Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

James J. Gilmore, Jr. (NY), Chair *Patrick C. Keliher (ME), Vice-Chair* *Robert E. Beal, Executive Director*

Vision: Sustainably Managing Atlantic Coastal Fisheries

MEMORANDUM

April 17, 2019

TO: Commissioners; Proxies; American Lobster Management Board; Atlantic Coastal Cooperative Statistics Program Coordinating Council; Atlantic Herring Management Board; Atlantic Striped Bass Management Board; Coastal Sharks Management Board; Executive Committee; Horseshoe Crab Management Board; ISFMP Policy Board; Law Enforcement Committee; South Atlantic State/Federal Fisheries Management Board; Summer Flounder, Scup, and Black Sea Bass Management Board

FROM: Robert E. Beal REB
Executive Director

RE: ASMFC Spring Meeting: April 29 – May 2, 2019 (TA 19-036)

The Atlantic States Marine Fisheries Commission's Spring Meeting will be held April 29 – May 2, 2019 at **The Westin Crystal City** (Telephone: 703.486.1111), located at 1800 South Eads Street, Arlington, VA. Meeting materials are available on the Commission website at http://www.asmfc.org/home/2019-spring-meeting. Supplemental materials will be posted to the website on Wednesday, April 24, 2019.

The agenda is subject to change. The agenda reflects the current estimate of time required for scheduled Board meetings. The Commission may adjust this agenda in accordance with the actual duration of Board meetings. Interested parties should anticipate Boards starting earlier or later than indicated herein.

As a reminder for those submitting travel vouchers, please note the travel voucher has been revised to reflect the change in the mileage rate for privately owned vehicles to 58 cents/mile. The new voucher can be obtained at http://www.asmfc.org/files/Meetings/ASMFCElectronicTravelVoucher_Jan19.xlsx.

Board meeting proceedings will be broadcast daily via webinar beginning April 29th at 1:00 p.m. and continuing daily until the conclusion of the meeting (expected to be 12:15 p.m.) on Thursday, May 2nd. The webinar will allow registrants to listen to board deliberations and view presentations and motions as they occur. No comments or questions will be accepted via the webinar. Should technical difficulties arise while streaming the broadcast, the boards will continue their deliberations without interruption. We will attempt to resume the broadcast as soon as possible. To register, please go to https://attendee.gotowebinar.com/register/1041506190356646145.

We look forward to seeing you at the Spring Meeting. If the staff or I can provide any further assistance to you, please call us at 703.842.0740.

Enclosures: Final Agenda, Hotel Directions, TA 19-036, and Travel Reimbursement Guidelines

Atlantic States Marine Fisheries Commission

Spring Meeting

April 29 – May 2, 2019

The Westin Crystal City

Arlington, Virginia

Public Comment Guidelines

With the intent of developing policies in the Commission's procedures for public participation that result in a fair opportunity for public input, the ISFMP Policy Board has approved the following guidelines for use at management board meetings:

For issues that are not on the agenda, management boards will continue to provide opportunity to the public to bring matters of concern to the board's attention at the start of each board meeting. Board chairs will use a speaker sign-up list in deciding how to allocate the available time on the agenda (typically 10 minutes) to the number of people who want to speak.

For topics that are on the agenda, but have not gone out for public comment, board chairs will provide limited opportunity for comment, taking into account the time allotted on the agenda for the topic. Chairs will have flexibility in deciding how to allocate comment opportunities; this could include hearing one comment in favor and one in opposition until the chair is satisfied further comment will not provide additional insight to the board.

For agenda action items that have already gone out for public comment, it is the Policy Board's intent to end the occasional practice of allowing extensive and lengthy public comments. Currently, board chairs have the discretion to decide what public comment to allow in these circumstances.

In addition, the following timeline has been established for the **submission of written comment for issues for which the Commission has *NOT* established a specific public comment period** (i.e., in response to proposed management action).

1. Comments received 3 weeks prior to the start of a meeting week will be included in the briefing materials.
2. Comments received by 5:00 PM on the Tuesday immediately preceding the scheduled ASMFC Meeting (in this case, the Tuesday deadline will be ***April 23, 2019***) will be distributed electronically to Commissioners/Board members prior to the meeting and a limited number of copies will be provided at the meeting.
3. Following the Tuesday, ***April 23, 2019 5:00 PM deadline***, the commenter will be responsible for distributing the information to the management board prior to the board meeting or providing enough copies for the management board consideration at the meeting (a minimum of 50 copies).

The submitted comments must clearly indicate the commenter's expectation from the ASMFC staff regarding distribution. As with other public comment, it will be accepted via mail, fax, and email.

Final Agenda

The agenda is subject to change. The agenda reflects the current estimate of time required for scheduled Board meetings. The Commission may adjust this agenda in accordance with the actual duration of Board meetings. Interested parties should anticipate Boards starting earlier or later than indicated herein.

<u>Monday, April 29</u>

1:00 – 5:00 p.m. **American Lobster Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia
Other Members: NEFMC, NMFS
Chair: Train
Other Participants: Perry, Reardon, Carroll, Coogen
Staff: Kerns

1. Welcome/Call to Order *(S. Train)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment
4. Update on the Atlantic Large Whale Take Reduction Team Spring Meeting and Recommendations to NOAA Fisheries *(C. Coogen)*
5. Review Progress on American Lobster Draft Addendum XXVIII *(T. Kerns)*
6. Report from the American Lobster Bait Working Group *(M. Schmidtke)*
7. Review Implementation of the Jonah Crab Fishery Management Plan by Delaware and New York *(S. Train)* **Possible Action**
8. Progress Update on the 2020 American Lobster Benchmark Stock Assessment *(J. Kipp)*
9. Other Business/Adjourn

<u>Tuesday, April 30</u>

8:30 – 10:00 a.m. **Atlantic Herring Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey
Other Members: NEFMC, NMFS
Chair: Keliher
Other Participants: Zobel, Eastman, Kaelin
Staff: Rootes-Murdy

1. Welcome/Call to Order *(P. Keliher)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment
4. Consider Addendum II for Final Approval **Final Action**
   - Review Options and Public Comment Summary *(K. Rootes-Murdy)*
   - Advisory Panel Report *(J. Kaelin)*
   - Consider Final Approval of Addendum II

5. Update on 2020-2021 Fishery Specifications *(K. Rootes-Murdy)*
6. Progress Update on Draft Addendum III *(K. Rootes-Murdy)*
7. Review Management Tools Used for Setting Days Out Measures *(K. Rootes-Murdy*) **Possible Action**
8. Consider Approval of 2019 Fishery Management Plan Review and State Compliance Reports *(K. Rootes-Murdy*) **Action**
9. Other Business/Adjourn

10:15 a.m. – Noon **Atlantic Striped Bass Management Board**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina
Other Members: DC, NMFS, PRFC, USFWS
Chair: Armstrong
Other Participants: Lengyel, Blanchard, Celestino, Latour
Staff: Appelman

1. Welcome/Call to Order *(M. Armstrong)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment
4. 2018 Atlantic Striped Bass Benchmark Stock Assessment **Action**
   - Overview of Benchmark Stock Assessment *(M. Celestino*)
   - Presentation of Peer Review Report *(R. Latour)*
   - Consider Acceptance of 2018 Benchmark Stock Assessment and Peer Review Report for Management Use *(M. Armstrong)*
5. Consider Management Response to the 2018 Benchmark Stock Assessment *(M. Armstrong)* **Action**
   - Review Technical Committee Report on Reductions Needed to Achieve Fishing Mortality Reference Points in 2020 *(N. Lengyel)*
   - Review Adaptive Management Timeline *(M. Appelman)*
6. Recess

Noon – 1:00 p.m. **Lunch** *(On Your Own)*

1:00 – 2:30 p.m. **Atlantic Striped Bass Management Board (continued)**

7. Reconvene
8. Consider Management Response (continued) *(M. Armstrong)* **Action**
9. Consider Forwarding Comments to NOAA Fisheries Opposing Proposed Measures to Lift Ban on Recreational Striped Bass Fishing in Federal Block Island Sound Transit Zone *(M. Armstrong)* **Action**
10. Other Business/Adjourn

12:30 – 5:00 p.m. **Law Enforcement Committee**
(A portion of this meeting may be a closed session for the LEC Coordinator and Committee members only)
Members: Anthony, Blanchard, Carroll, Eastman, Furlong, Gadomski, Garner, Hettenbach, Hogan, Kersey, King, Lauderman, Lynn, Messeck, Moore, Moran, Noel, Pearce, Ray, Santiago, Snellbaker, Williams
Chair: Anthony
Staff: Robson

1. Call to Order/Roll Call of the LEC Representatives *(S. Anthony)*
2. Approval of Agenda and October 2018 Minutes **Action**
3. Public Comment
4. Presentation on Police-Assisted Addiction and Recovery Initiative (PAARI) and Use of NARCAN/NALAXONE
5. Review of 2019 Action Plan
6. Review Potential Atlantic Cobia Regulations in Federal Waters
7. Discuss Use of Drones and Other Technologies in Enforcement
8. Review and Discuss Ongoing Enforcement Activities **Closed Session**
9. State Agency Reports
10. Recess

2:45 – 3:15 p.m. **Coastal Sharks Management Board**
Member States: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: NMFS, USFWS
Chair: Miller
Other Participants: Frazier, Garner
Staff: Rootes-Murdy

1. Welcome/Call to Order *(R. Miller)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2018
3. Public Comment
4. Final Rule for Highly Migratory Species Amendment 11 (Shortfin Mako)
   - Review Final Rule and NOAA Fisheries Request for Complementary Measures *(K. Brewster-Geisz)*
   - Technical Committee Report *(K. Rootes-Murdy)*
   - Consider Complementary Management Measures *(R. Miller)* **Final Action**
5. Consider Approval of 2018 Fishery Management Plan Review and State Compliance Reports *(K. Rootes-Murdy)* **Action**
6. Other Business/Adjourn

3:30 – 5:00 p.m. **Atlantic Coastal Cooperative Statistics Program (ACCSP) Coordinating Council**
Partners: ASMFC, Connecticut, Delaware, District of Columbia, Florida, Georgia, MAFMC, Maine, Maryland, Massachusetts, NEFMC, New Hampshire, New Jersey, New York, NMFS, North Carolina, Pennsylvania, PRFC, Rhode Island, SAFMC, South Carolina, USFWS, Virginia
Chair: Fegley
Staff: Cahall

1. Welcome/Introductions *(L. Fegley)*
2. Council Consent
   - Approval of Agenda
   - Approval of Minutes from February 2019
3. Public Comment
4. Review Progress on Accountability/Validation *(J. Simpson)*
5. Program Updates
   - Administrative *(M. Cahall)*
   - SAFIS *(M. Cahall)*
   - Recreational *(APAIS Staff)*
6. Committee Updates
   - Commercial Technical
   - Information Systems
   - Joint Operations/Advisors
7. Review and Consider Approval of 2020 Request for Proposals *(L. Fegley)*
8. Other Business/Adjourn

5:30 – 7:00 p.m. **Annual Awards of Excellence Reception**

<u>Wednesday, May 1</u>

8:00 – 10:30 a.m. **Executive Committee**
Breakfast will be available at 7:30 a.m.
(A portion of this meeting may be a closed session for Committee members and Commissioners only)
Members: Abbott, Blazer, Bowman, Boyles, Jr., Cimino, Clark, Estes, Gilmore, Grout, Haymans, Keliher, McNamee, Miller, Miner, Murphey, Pierce, Shiels
Chair: Gilmore
Staff: Leach

1. Welcome/Call to Order *(J. Gilmore)*
2. Committee Consent
   - Approval of Agenda
   - Approval of Meeting Summary from February 2019
3. Public Comment
4. Report of the Administrative Oversight Committee
   - Presentation of the FY2020 Budget
5. Review Draft Standard Operating Procedures and Policies for Management Board Work Groups
6. Future Annual Meetings Update *(L. Leach)*
7. Executive Director Performance Review **(Closed Session)**
8. Other Business/Adjourn

8:00 a.m. – Noon **Law Enforcement Committee (continued)**

11. Reconvene/Social
12. Review and Discuss Mid-Atlantic Fishery Management Council Enforcement Workshop
13. Review and Discuss Offshore Enforcement Vessel Working Group
14. Review and Discuss ASMFC Species Issues, as Needed
15. Presentation on Electronic Reporting in the South Atlantic and Gulf of Mexico
16. Group Photograph
17. Discuss Criteria/Metrics for Evaluating Enforcement Effectiveness
18. Federal Agency Reports
19. Adjourn

10:45 a.m. – 12:15 p.m. **Summer Flounder, Scup, and Black Sea Bass Management Board**
Member States: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina
Other Members: NMFS, PRFC, USFWS
Chair: Ballou
Other Participants: Wojcik, Snellbaker
Staff: Starks, Rootes-Murdy

1. Welcome/Call to Order *(R. Ballou)*
2. Board Consent
   - Approval of Agenda
3. Public Comment
4. Review Plan Development Team Analysis of Black Sea Bass Commercial Management Strategies to Address Fishery Shifts *(C. Starks)* **Possible Action**
   - Advisory Panel Report
5. Review and Populate Advisory Panel Membership *(T. Berger)* **Action**
6. Other Business/Adjourn

12:15 – 1:15 p.m. **Lunch** *(On Your Own)*

1:15 – 2:30 p.m. **Business Session**
Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Chair: Gilmore
Staff: Beal

1. Welcome/Call to Order *(J. Gilmore)*
2. Committee Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2018
3. Public Comment
4. Review and Consider Approval of 2019-2023 Strategic Plan **Final Action**
5. Consider Approval of the Summer Flounder Commercial Issues Amendment **Final Action**
6. Recess

2:45 – 5:15 p.m. **Horseshoe Crab Management Board**

Member States: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: PRFC, NMFS, USFWS
Chair: Rhodes; Cimino (Vice-Chair) serving as chair for this meeting
Other Participants: Brunson, Messeck, Jacobson, Sweka
Staff: Schmidtke

1. Welcome/Call to Order *(J. Cimino)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from October 2018
3. Public Comment
4. 2019 Horseshoe Crab Benchmark Stock Assessment **Action**
   - Presentation of Stock Assessment Report *(J. Sweka*)
   - Presentation of Peer Review Panel Report *(L. Jacobson*)
   - Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use *(J. Cimino)*
5. Consider Management Response to the 2019 Horseshoe Crab Benchmark Stock Assessment *(J. Cimino)* **Possible Action**
6. Review and Populate Advisory Panel Membership *(T. Berger*) **Action**
7. Other Business/Adjourn

Thursday, May 2

8:00 – 9:45 a.m. **Interstate Fisheries Management Program Policy Board**

Member States: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: DC, NMFS, PRFC, USFWS
Chair: Gilmore
Staff: Kerns

1. Welcome/Call to Order *(J. Gilmore)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment
4. Update from Executive Committee *(J. Gilmore)*
5. Update from the Risk Policy Work Group *(J. McNamee)*
6. Committee Reports
   Law Enforcement *(M. Robson)*
   Artificial Reef *(L. Havel)*
7. Review Noncompliance Findings (If Necessary) **Action**
8. Other Business/Adjourn

9:45 – 10:00 a.m. **Business Session (continued)**

7. Reconvene
8. Consider Noncompliance Recommendations (If Necessary) **Final Action**
9. Other Business/Adjourn

10:15 a.m. – 12:15 p.m. **South Atlantic State/Federal Fisheries Management Board**
Member States: New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Other Members: DC, NMFS, PRFC, SAFMC, USFWS
Chair: Geer
Other Participants: McDonough, Rickabaugh, Lynn
Staff: Schmidtke

1. Welcome/Call to Order *(P. Geer)*
2. Board Consent
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment
4. Review and Consider Draft Amendment 1 to the Cobia Fishery Management Plan for Public Comment *(M. Schmidtke*) **Action**
5. Review State-Gathered Public Input and Consider Management Action for Atlantic Croaker and Spot *(P. Geer)* **Possible Action**
6. Other Business/Adjourn

Atlantic States Marine Fisheries Commission

American Lobster Management Board

April 29, 2019
1:00 – 5:00 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(S. Train)* — 1:00 p.m.
2. Board Consent — 1:00 p.m.
   - Approval of Agenda
   - Approval of Proceedings from February 2019
3. Public Comment — 1:05 p.m.
4. Update on the Atlantic Large Whale Take Reduction Team Spring Meeting and Recommendations to NOAA Fisheries *(C. Coogen)* — 1:15 p.m.
5. Review Progress on Draft Addendum XXVIII (*T. Kerns*) — 2:30 p.m.
6. Report from the Lobster Bait Working Group (*M. Schmidtke*) — 4:00 p.m.
7. Review Implementation of the Jonah Crab Fishery Management Plan for Delaware and New York *(S. Train)* **Possible Action** — 4:15 p.m.
8. Progress Update on the 2020 American Lobster Benchmark Stock Assessment *(J. Kipp)* — 4:30 p.m.
9. Other Business/Adjourn — 4:45-5:00 p.m.

The meeting will be held at The Westin Crystal City, 1800 S. Eads Street, Arlington, VA; 703.486.1111

MEETING OVERVIEW

American Lobster Management Board Meeting
April 29, 2019
1:00 – 5:00 p.m.
Arlington, Virginia

Chair: Stephen Train (ME) Assumed Chairmanship: 02/18	Technical Committee Chair: Kathleen Reardon (ME)	Law Enforcement Committee Representative: Col. Jay Carroll
Vice Chair: Dan McKiernan (MA)	Advisory Panel Chair: Grant Moore (MA)	Previous Board Meeting: February 5, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, DE, MD, VA, NMFS, NEFMC (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 5 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Update on the ALWTRT Meeting and Recommendations to NOAA Fisheries (1:15 – 2:30 p.m.)
Background • The Atlantic Large Whale Take Reduction Team will meet April 23-26 to deliberate on recommended measures to NOAA Fisheries to reduce the effects of US fisheries on the right whale population. The ALWTRT was tasked with reducing serious injury and mortality on N. Atl. Right Whales by 60-80% • It is expected a series of recommendations for the American lobster fishery with will forward to NOAA Fisheries.
Presentations • Report on the ALWTRT Meeting by C. Coogen
Board Actions for Consideration at the Meeting • Consider any management responses to the ALWTRT recommendations (Possible impacts to PDT direction on Draft Addendum XXVIII)

5. Review Progress on Draft Addendum XXVIII (2:30-4:00 p.m.)
Background • In October 2018, the Board established a Working Group to discuss the intersection of lobster management and right whales. • The Working Group met on November 29th (in-person) and January 11th (conference call) to develop a series of recommendations to the Board • The Board initiated Draft Addendum XXVIII to reduce the number of end lines in the lobster fishery. • The PDT has held weekly meetings to address issues and draft management options for the draft addendum
Presentations • Review PDT progress on the development of the draft Addendum T. Kerns (**Supplemental Materials**)
Board actions for consideration at this meeting • None

6. Report from the Lobster Bait Working Group (4:00– 4:15 a.m.)
Background • Given the results of the 2018 Atlantic Herring Stock Assessment, it is expected that there will be reductions in the Atlantic herring ABCs for 2019 through 2021. This could have impacts on the lobster fishery given herring is a preferred bait source. The Board established a Bait Working Group (WG) to draft a resolution regarding bait use in the lobster fishery. • The WG reviewed Maine's protocol for identifying alternative bait sources and classifying potential bio-hazards as well as explored other state/agency work on the issue to draft a resolution and flow chart to establish new bait sources.
Presentations • Progress report from the Bait Working Group M. Schmidtke
Board Actions for Consideration at this Meeting • None

7. Implementation of Jonah Crab Fishery Management Plan (4:15 – 4:30 p.m.) Possible Action
Background • In October 2018, the Board reviewed the Jonah Crab FMP Review which found that the states of Delaware and New York had not implemented the full suite of provisions in the FMP and associated addenda. • In response, the Board agreed to write letters to the two states requesting they come back into compliance with the Jonah Crab FMP. The Board also agreed to revisit this issue at the May 2019 meeting.
Presentations • Update on implementation of Jonah Crab FMP by T. Kerns
Board actions for consideration at this meeting • Consider Board action regarding compliance with the Jonah Crab FMP.

8. 2020 American Lobster Benchmark Stock Assessment Update (4:30 – 4:45 p.m.)
Background • Work on the 2020 American Lobster Benchmark Stock Assessment began last year and a Data Workshop was held in May 2018. • The first Assessment Workshop was held in New Bedford, MA on January 28-31, 2019. The second Assessment Workshop is tentatively scheduled for September 2019.
Presentations • Stock assessment update by J. Kipp

9. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

AMERICAN LOBSTER MANAGEMENT BOARD

The Westin Crystal City
Arlington, Virginia
February 5, 2019

These minutes are draft and subject to approval by the American Lobster Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).

2. **Approval of Proceedings of October 2018** by Consent (Page 1).

3. **Move to initiate an addendum to reduce the number of vertical lines in the water. The PDT should consider the following as specified in the Lobster-Whale Work Group Memo. The PDT may need to consider the ongoing activities of the ALWTRT when drafting this document:**

   - **Reduction of vertical lines by 20% to 40% for each LCMA (exclusive of LCMA 6). Percent reductions by LCMA may differ given ongoing and future trap reductions as well as newly proposed or implemented area closures in state and federal waters.**
   - **In LCMAs 1, 4, 5, and OCC: reductions can be achieved by trap limits, gear configurations, season closures, or other measures.**
   - **In LCMAs 2 and 3: reductions can be achieved by gear configurations, seasonal closures, acceleration of current planned trap reduction, or other measures.**
   - **Elimination of the 10% replacement trap tag provision.**
   - **Developing a method for reporting vertical line and trap use by individuals in each jurisdiction until 100% harvester reporting is implemented in state and federal waters.**

   (Page 6). Motion made by Mr. Borden and seconded by Mr. Grout. Motion carried (Page 11).

4. **Move that the Lobster Board recommend to the Policy Board that a letter be sent to NOAA Fisheries for consideration by the Atlantic Large Whale Take Reduction Team to develop and support a suite of options for electronic vessel monitoring for federally permitted vessels** (Page 17). Motion by Pat Keliher; second by Dennis Abbott. Motion carried (Page 19).

5. **Motion to adjourn by Consent** (Page 21).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Steve Train, ME (GA)
Douglas Grout, NH (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
G. Ritchie White, NH (GA)
Raymond Kane, MA (GA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Rep. Sarah Peake, MA (LA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Jay McNamee, RI (AA)
David Borden, RI (GA)
Sen. Craig Miner, CT (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Joe Cimino, NJ, proxy for L. Herrighty (AA)
Russ Allen, NJ, proxy for T. Fote (GA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Russell Dize, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Mike Luisi, MD, proxy for D. Blazer (AA)
Pat Geer, VA, proxy for S. Bowman (AA)
Peter Burns, NMFS
Allison Murphy, NMFS

AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Kathleen Reardon, Technical Committee Chair
Rene Cloutier, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Megan Ware
Jessica Kuesel
Katie Drew

Guests

Gib Brogan, Oceana
Heather Corbett, NJ DFW
Jane Davenport, Defenders of Wildlife
Emily Gilbert, NMFS
Zach Greenberg, PEW Trusts
Marin Hawk, MSC
Arnold Leo, E. Hampton, NY
Chip Lynch, NOAA
Patrice McCarron, MLA
Purcie Bennett-Nickerson, PEW Trusts
Mariah Pfleger, Oceana
Sam Rauch, NOAA
Mike Thalhauser, MCCF
Marek Topolski, MD DNR
Mike Waine, ASA
Danny White, ME Marine Patrol

These minutes are draft and subject to approval by the American Lobster Management Board.
The Board will review the minutes during its next meeting.

The American Lobster Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Tuesday, February 5, 2018, and was called to order at 2:55 o'clock p.m. by Chairman Stephen Train.

CALL TO ORDER

CHAIRMAN STEPHEN TRAIN: Okay we'll get this meeting started. My name is Steve Train; I'm the Chair of the American Lobster Management Board. Apparently we've got a bigger audience now than some of the other meetings earlier today; because they will be able to listen to our podcast, now that the parade is over and they've been able to go home.

APPROVAL OF AGENDA

CHAIRMAN TRAIN: I'm assuming everybody had the paperwork, has had a copy, had it e-mailed to them. By consent can we get an approval of the agenda; anyone opposed? Okay the agenda is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN TRAIN: Is there anyone opposed to approving the proceedings of the previous meeting from October? If not, I'll consider that approved by consent; okay, seeing none.

PUBLIC COMMENT

CHAIRMAN TRAIN: This is our public comment period. I only have three people currently signed up for public comment. I need to remind you public comment is for something that is not on the agenda. If you would like to come up to speak, currently I have, I've got to try to read these names, Gib Brogan is first.

MR. GIB BROGAN: My name is Gib Brogan; I'm with the Oceana. We've been following the Commission's work on the lobster FMP and looking at the addendum process, and following the TRT and the biological opinion processes. Looking at these, I think that as you discuss this today and look at the issues that are facing the lobster fishery with right whales and other large whales.

I think it's important that the Commission come away from today's meeting with some clarity on the interaction between these processes. Right now there is the Take Reduction Team, the Take Reduction Plan that's working on their work. There is a biological opinion that is ongoing, and there is potentially an addendum.

The interplay between these three moving pieces is really important; and having clarity on what these mean, how these are going to proceed in the coming months will be very important to get a good outcome for this fishery. We hope that coming out of today we have a clear idea of what's happening there.

An overarching issue with this addendum as we see it is the need for a clear statement of a purpose and need for this action. The various documents that are out there right now, the Working Group's work that has been done through their meetings, and the documents that are available right now, make some passing reference to why this addendum is happening. Strong fisheries management, strong outcomes come out of clear purpose and need. Another suggestion that we have for this meeting today is to come up with a clear statement of why you're doing this addendum.

CHAIRMAN TRAIN: If you don't mind, you're speaking on an agenda item now.

MR. BROGAN: I'm sorry, I was looking at things that weren't in the available documents related to the addendum; I apologize. Thank you very much.

CHAIRMAN TRAIN: Jane Davenport, you're next.

MS. JANE DAVENPORT: My name is Jane Davenport; and I'm with Defenders of Wildlife, and I and some of my other colleagues are members of the TRT representing the conservation community. I'm certainly aware that this public comment opportunity is not meant to be on agenda items.

But I would also like to ask that you indulge, as per the statement in the meeting overview that there be limited opportunity for comment on agenda items that the public has not had opportunity for comment on. If I may, I would just like to make a brief comment on that; because we haven't had that opportunity before.

CHAIRMAN TRAIN: Brief.

MS. DAVENPORT: Yes thank you. We're certainly encouraged that the Commission is being proactive in putting together this American Lobster and Whale Workgroup to move forward with an addendum; to try to solve the problem. The environmental NGOs that I work with have been very skeptical of whether effort reduction is going to get this fishery where it needs to go; and enable the National Marine Fisheries Service to get where it needs to go in respect to complying with the Endangered Species Act and the Marine Mammal Protection Act.

While we are very encouraged that the addendum is speaking in terms of reducing vertical line rules, we want to encourage the Commission and its work to be really clear on the data that's being used about the effort and the locations of various fisheries, to really prove that whatever vertical line reduction measures are being considered and eventually passed in an addendum, will truly be effective at reducing the risk to North Atlantic right whales and other large whales from vertical lines in the water column.

CHAIRMAN TRAIN: If you don't mind, you may want to make this comment after we get to the next agenda item, when we're actually discussing the addendum.

MS. DAVENPORT: Will there be an opportunity for public comment then?

CHAIRMAN TRAIN: I will make an opportunity then.

MS. DAVENPORT: Thank you that would be very much appreciated.

CHAIRMAN TRAIN: We have Purcie Bennett-Nickerson. Did I say the first name right?

MS. PURCIE BENNETT-NICKERSON: Hello, Purcie Bennett-Nickerson, and I work for the Pew Charitable Trust. My comments are sort of a mixed bag as to whether or not it's about this agenda item or about Addendum XXVI. We commented on Addendum XXVI when it was in the scoping phase, and we would like to reiterate some of those comments now.

We are encouraged that in this particular action the Board is recommending that VTR and VMS or something along those lines would be implemented within one year. That would be in line with our comments on Addendum XXVI. I haven't heard, or we haven't heard any updates on where that is in the process.

I'm guessing that it's possible that some of the actions that are done by this Board would change some of the outcomes of that. I'm not 100 percent sure, just hoping that we can get an update on that. But specifically our request and recommendations would be that there would be 100 percent catch reporting requirement at the trip level for all permit holders; that they require additional reporting requirements, including a lost gear reporting requirement.

Require harvesters to report all data; including fishing locations by ten minute squares or a finer spatial scale if available. Require harvesters to report all data electronically. Require electronic monitoring. Require regional-specific gear markings at least every 40 feet of line, and implement trip caps and ownership limits in the lobster fishery to eliminate latent trip allocation, and reduce any number of traps that are actually fished. I don't know whether that's related to XXVI or to what's happening now, but sort of a mixed bag, thank you.

CHAIRMAN TRAIN: Is there anybody who has not signed up for public comment that would like to speak?

REPORT FROM THE LOBSTER-WHALE WORKING GROUP

CHAIRMAN TRAIN: Our next agenda item is the report from the Lobster-Whale Working Group; Megan is going to give that.

MS. MEGAN WARE: I'm giving the Report on the Recommendations from the Lobster-Whale Workgroup. Just as a reminder; at annual meeting the Board reviewed ongoing discussions related to right whale conservation and fisheries management. That included a review of the Technical Memo by the Science Center on factors contributing to right whale population declines; as well as the recent discussions of the Take Reduction Team.

Given the potential for impacts to the lobster fishery; the Board created this workgroup to discuss the measures being considered, and provide recommendations to the Board. Workgroup members included state agency staff; including some of the Commissioners on the Lobster Board, federal partners, and ASMFC staff.

Before going into the discussion of the Workgroup, I wanted to provide an overview of the ongoing processes related to right whale conservation, because I think it is important context for the Workgroup's discussion. As you all know, Atlantic right whale populations have been in decline since 2010. As a result there are kind of two processes that are ongoing. The first is under the Marine Mammal Protection Act; and that is the work of the Take Reduction Team. That team is charged with reducing serious injury and mortality of right whales. At their upcoming spring meeting they are expected to finalize recommendations to NMFS. At this point I think it's unclear what that Take Reduction Team will recommend.

But certainly some of the discussions have included season closures, ropeless testing, weak rope, and gear markings. We also have under the Endangered Species Act the preparation of the Biological Opinion. A biological opinion provides a determination of jeopardy. I wanted to provide that definition of jeopardy to the Board; it is when an action is reasonably expected to directly or indirectly diminish a species numbers, reproduction, or distribution so that the likelihood of survival and recovery is appreciably reduced.

I've kind of underlined some of the important statements for both the Marine Mammal Protection Act and the Endangered Species Act; to show that that definition of jeopardy is a bit broader than what the Take Reduction Team discusses. Just a little bit more on the Biological Opinion, again it provides a conclusion on whether an action is likely to jeopardize the continued existence of an ESA species.

Again, that definition of jeopardy is broader; so it includes things like their reproduction, their distribution. The Biological Opinion consults on fisheries as they're currently operating, or as modified by rulemaking. That can include things like the TRT recommendations in subsequent rulemaking; but it also can include Commission action.

It means that actions taken by this Lobster Board can be taken into account in a biological opinion. If there is a jeopardy finding; so that is one of the potential results of a biological opinion, it results in reasonable and prudent alternatives. Those alternatives must relieve jeopardy.

Those come as a component of the Biological Opinion, and those alternatives are developed outside of the typical Commission process.

With that background information, the Workgroup did note the several ongoing processes associated with right whale conservation; which could substantially impact the economic and cultural future of the lobster fishery.

Given the high economic value of the lobster fishery and its social significance, the Workgroup agreed that it is important to ensure that the implementation of right whale conservation measures takes place in ways that maintain the viability of the lobster fishery. You all know as members of the Commission that Commission is the managing authority for the lobster FMP.

Some of the goals of the FMP include promoting economic efficiency, maintaining opportunities for participation, preserving cultural features of the industry; and given this the Workgroup concluded that action by the Board to consider modifications to measures in the lobster FMP is warranted at this time.

By the Commission taking actions, states can continue to cooperatively participate in the management of the species. In addition, those who are most familiar with lobster management and the fishery can provide input on those future regulations. The Workgroup did recognize that other regulatory changes may occur in the fishery; but noted the need to proactively respond to these growing challenges that are facing the lobster fishery. The recommendation from the Workgroup is that this Board initiates an addendum to consider reducing the number of traps and/or vertical lines in the water, and require vessel tracking systems for federal permit holders.

There were four components of that recommendation; which I will go through, but it was also included in your supplemental meeting materials. Part 1, management tools that the Plan Development Team should evaluate are reductions of vertical lines using trap limits, gear configurations, seasonal closures, and/or other measures to achieve a rate of 20 percent and 40 percent by LCMA, exclusive of LCMA 6.

There was a note that trap reductions should consider ongoing state and federal management actions by LCMA; as well as future trap reductions that are already set in rule. There was also a recommendation that the PDT evaluate the elimination of the 10 percent replacement trap tag provision.

Right now some states issue additional 10 percent annual allotments automatically; while other states issue this when it's requested. There is a potential for some fishermen to fish above what is their trap limit. There was also a recommendation that the Plan Development Team evaluate the acceleration of planned trap reductions.

Number 2 was vessel tracking; so a vessel tracking system that would be required for federal-lobster-permit holders and that this be an advanced monitoring or tracking system. It not only tracked the movement, but also identifies where gear is hauled or how many traps are fished. Number 3 was reporting. The PDT should develop a method for reporting vertical line and trap use by individual in each jurisdiction; until 100 percent harvester reporting is implemented in state and federal waters.

Number 4, in addition the Plan Development Team may want to consider the list of management tools below if they're not included in the final Take Reduction Team recommendations; that included weak-link placement on rope, other innovations to break rope, and reduced rope strength on one or both ends. Kind of the whole compilation of those recommendations again is included in your supplemental materials. With that I will take any questions.

CHAIRMAN TRAIN: Do we have questions for Megan? Wow, you crushed it. Pat.

MR. PATRICK C. KELIHER: Thanks Megan for that summary. A lot of work, a lot of conversations have gone into this; to try to make determinations how and if the Commission should be involved. I know many people around this table have a lot of concerns about the Commission taking actions as it regards to the protection of whales.

However, I think we need to act. I think the goals stated within the Working Paper, as far as what the FMP should include, including promoting economic efficiency and maintaining opportunities for participation, as well as preserving the cultural features of the industry are important to recognize. I frankly, with due respect to my friends at NOAA, don't want NOAA making decisions on what this lobster fishery should look like in the future. I'm not sure what the process should be yet; and how we should begin developing a motion. But I do believe that we need to take action. There were several comments from the public in regards to having a clear direction from the Commission and the commission process. I think that is imperative that we understand what our role is versus the TRT. In my mind, and people can correct me if they feel differently.

In my mind the TRT is dealing with serious injury and mortality associated with right whales. Our role as a Board should be; how can we as a Board and as a management body, and as individual jurisdictions, reduce risk to the right whales? To me this is risk associated with the Biological Opinion; as Megan stated earlier.

I want to make sure that we don't start doing TRT work here. I'm working on a motion in my mind dealing with the electronic monitoring part; to try to separate that. But I'll ask to reserve some time for later; so I can think about what that should be. With that I'll stop rambling.

CHAIRMAN TRAIN: David Borden.

MR. DAVID V. BORDEN: As a member of the Working Group, I just thought I would comment from the perspective. I have a lot of personal reservation about the motion. I think as everyone knows, I represent the offshore lobster industry. I have a lot of reservations about what the motion says, how it says it, what the process is that would be followed, and where we'll end up in the final analysis.

But having said that and having those concerns about the motion, I think Pat's comment is dead on that if we want to control our own future on this. I would point out we have to get ahead of the issue instead of responding to the issue, and that carries a lot of uncertainty; because our normal way of doing business is we ask a bunch of technical people to say how much of a cut do we need, or how much of a restriction should we put on our industry?

They come back with a number and then we work on it, and that's all a fairly logical process; that process is not being followed. We're not going to know what the cut is until the end; when the Agency basically comes out with its jeopardy finding. What we do here is a step; and then regardless of what we do, it's a step in the right direction.

Then the TRT process basically follow on and take additional action on the issue; and then when NOAA makes its determination, if it requires additional action then there is going to be additional action that the Agency is going to take. This is kind of a hybrid; but I would emphasize the fact that every jurisdiction around this table has fixed-gear fishermen.

The primary focus of this motion is on the lobster fishery; but in the final analysis, every one of the fixed-gear fisheries may be affected by this issue. In my view where I come down on this, all of this uncertainty, although I have personal reservations, I support moving forward. I've got a motion that Megan has at the appropriate time.

CHAIRMAN TRAIN: Any other questions? John Clark, go ahead.

MR. JOHN CLARK: I just wanted a clarification on this first recommendation; it says to achieve a rate of 20 and 40 percent by each LCMA. What does that mean?

MS. WARE: The range of reductions that would be in the addenda.

MR. CLARK: It should be 20 to 40 percent?

MS. WARE: I think the idea was that the two options would be 20 and 40 percent; but the range in between is still okay, because it's within the range of options in the document.

CHAIRMAN TRAIN: I'm looking for other hands that want to comment. Not seeing any, David, did you say had a motion, David Borden?

MR. BORDEN: Yes, Megan has it. I'll read it. Ah oh, she added 10,000 words to it. This I would point out. Before I even open my mouth, I have to get my glasses out and Number 2 I would point out. This is what the New England Council calls a Dr. Pierce motion. **I would move to initiate an addendum to reduce the number of vertical lines in the water; and require vessel tracking systems for federal permit holders.**

The PDT should consider the following as specified in the Lobster-Whale Workgroup Memo. The PDT may need to consider the ongoing activities of the ALWTRT when drafting the document. That first bullet: Reduction of vertical lines by 20 to 40 percent for each LCMA (exclusive of Area 6). Percent reductions by LCMA may differ given the ongoing and future trap reductions, as well as newly proposed or implemented area closures in state and federal waters.

- **In LCMAs 1, 4, 5, and the Outer Cape, reductions can be achieved by trap limits, gear configurations, season closures, or other measures.**

- **In LCMAs 2 and 3, reductions can be achieved by gear configurations, seasonal closures, acceleration of current or planned trapped reduction, or other measures. Next bullet: Elimination of the 10 percent replacement trap tag provision.**

- **Requiring 10 percent of federal lobster permit holders have advanced a 100 percent, excuse me, 100 percent of federal lobster permit holders to have advance vessel monitoring/tracking systems that could not only track movement but also identify where gear is hauled or how many traps are fished. Last bullet: Developing a method for reporting vertical lines in trap use by individuals in each jurisdiction until 100 percent harvester reporting is implemented in state and federal waters, so I move that Mr. Chairman.**

CHAIRMAN TRAIN: Take a breath, David. Do we have a second? Doug Grout, second. David, would you like to speak to the motion?

MR. BORDEN: Yes, I already made my point; but I would note for the record that is the longest motion I've ever made in my life.

CHAIRMAN TRAIN: Doug, as a seconder would you like a chance to speak, Doug Grout?

MR. DOUGLAS E. GROUT: Yes, I almost wasn't going to second it; because it does violate the Pierce rule, because they did shrink the fonts up there to get it on one page. But I decided to move forward. I agree that the main purpose of this, at least from my standpoint is that the Commission and the Industry have some input into trying to avoid a jeopardy finding.

I would hope that somewhere in our process, our federal partners might give us an indication of what the percentage cuts that we might have to take here to avoid a jeopardy finding. It makes our decisions a lot easier; instead of just guessing. But I think it's important we start today, and take a look at this and try and come up with this kind of an outline, some options. We also need to come up with a good problem statement too.

CHAIRMAN TRAIN: Are there any other comments on the motion, questions, Pat Keliher?

MR. KELIHER: Mr. Chairman, if I could direct this question through you to the maker of the motion. David, requiring 100 percent of federal lobster permit holders, I get it. I understand why we need to do it. But I'm going to go back to the comment that I made earlier in regards to kind of a clear line between what the Commission is going to be doing, and what the TRT is going to be doing. To me that gets to the issues around serious injury and mortality, and monitoring those issues. Do you think that that would be better dealt with separately by a recommendation from this Board to the Agency to address through the TRT process?

MR. BORDEN: Pat, I'm not exactly sure what you're asking. I mean the Commission already has a number of requests on the reporting issue in the system. Are you suggesting something other than those items? If you are, please be a little bit clearer, more explicit.

MR. KELIHER: Just the second to the last bullet, David, instead of making it a part of this motion, I guess we can't remand anything to the TRT. But if we could, to me this seems like an issues better dealt with by the TRT; and it is something that the Agency could put into place much quicker through their rulemaking under MMA, versus going through this process and then advancing it to the Agency.

CHAIRMAN TRAIN: David.

MR. BORDEN: I guess my answer is I'm not sure of how fast the rules are going to get implemented. If we were to adopt the whole series of provisions that are consistent with the motion, my assumption is we wouldn't do it until the summer; Megan is that the timeline we're on, or fall?

MS. WARE: In terms of when you would see a document for public comment or final action?
MR. BORDEN: The comment.

MS. WARE: I think some of that will depend honestly on the on goings of the Take Reduction Team, and monitoring what they're doing with that group. I think it would be either May or August Board meeting.

MR. BORDEN: I guess going back to Pat's question. If we were to pull that out, we could for instance make that a recommendation that the Commission submits to the TRT and asks them to consider it, and I would have no objection to that.

CHAIRMAN TRAIN: Go ahead, Pat, and then we need to get to some other people.

MR. KELIHER: That's where I'm going, David. I'm just wondering; we have a lot of work to do, well we, the PDT. Our staff has a lot of work to do between now and May; if this motion passes. I'm just trying to figure out if there are ways to streamline the work. I know that the TRT did have some preliminary discussions in regards to this; and maybe it's best left there for now.

MR. BORDEN: I would ask, Mr. Chairman, whether or not Mr. Grout has any objection to removing that bullet from the motion and then taking it up subsequently.

MR. GROUT: I have no objection with that process.

MR. BORDEN: Steve, I think you have a perfected motion.

CHAIRMAN TRAIN: Okay, now I'm wondering do we need to read what we're removing, because the motion has changed, Bob.

MS. TONI KERNS: Steve, we'll need to reread it into the record when it gets time to vote on it.

CHAIRMAN TRAIN: Okay, thank you, we'll let Dave do that. Dan McKiernan, you are next.

MR. DANIEL McKIERNAN: I'm concerned about one aspect of the motion; when it talks specifically about percent reductions by LCMA may differ given ongoing and future trap reductions, because in Massachusetts portion of Outer Cape and Area 2, we have a documented decline in vertical lines over the last seven years.

We instituted a mandatory reporting form to all of our fishermen at the end of the year to ask them, how many vertical lines are you fishing? I was challenged by the industry saying why are you asking this? I said, because you're going to get credit when your vertical lines go down. I guess it's implied what the starting point is.

But I guess I'm forecasting to you all now that we're not going to tolerate a lack of recognition of reductions in vertical lines that have taken place; including those that aren't being brought about by trap reductions, by simply changing fishing strategies. Some of the Outer Cape fishermen are going from 800 single traps to 800 traps fished as 20 pot trawls.

That's going to have a huge decline in the number of vertical lines. We need not apply these formulas to each LMA the same. Because Massachusetts instituted this very unique reporting form that puts us, you could either say in the catbird seat, or on the firing line. I'm just letting you all know that this is really going to be important to us that we not start this process or this reference point of either last year or the year before; because right whales started to go downhill a decade ago, and the fishermen in those two areas have suffered a lot of trap cuts, but also documented reductions in vertical lines.

CHAIRMAN TRAIN: Sarah Peake.

REPRESENTATIVE SARAH PEAKE: I share the concerns of our Deputy Director; and my questions were going to be targeted in the same way, so I won't take up the group's time to just restate what was just stated by him. I will take a moment of personal privilege to come to the defense of our Director of DMF that sometimes details matter, and facts matter. I appreciate his detailed approach, so thank you, and the gentleman to my right as well.

CHAIRMAN TRAIN: Ritchie White.

MR. G. RITCHIE WHITE: I would like to ask the Service, I guess Peter. The difference between having the VMS language go in to this document, as opposed to us separately writing a letter to the Service asking them to implement it, if there is any difference in the timing or how they would view that.

CHAIRMAN TRAIN: Peter, you were next on my checklist anyway. Peter Burns.

MR. PETER BURNS: Yes my comment was going to be related to the same question that Ritchie had. I think that certainly we understand that there are two memos in the file right now that have recommendations for VMS for all federal vessels. I know that in Addendum XXVI we had a pilot program that was approved; that would look at VMS across the different types of vessels and different areas in the offshore fishery.

My thinking was that it would be more of a sort of collaborative approach at the Lobster Board level; using a working group or this pilot program to really try to groundtruth what the best way to implement VMS would be. I don't know if we've moved forward at all with that working group or not; but certainly if there is something that moves forward in that direction, we would want to be informed by that.

In the meantime I think that for the purposes of this motion, I mean I think we could go either way. I think if it's included in here I don't think it hurts. I like the fact that it is included in here; because I think with our Law Enforcement Committee, with the state and industry people that are on the Lobster Board that we could probably have a more informed conversation about how to best implement VMS.

The alternative I guess would be to write a letter to us and ask us to implement 100 percent mandatory VMS for all federal lobster vessels; but that leaves a lot to the Service to try to understand the best way to do that. I think that we would be better served, and the industry would be better served by having the input of the Board.

I don't know if I'm being very definitive one way or the other; but I don't think it hurts having it in here, and I'm not sure if having it go to the TRT for consideration would necessarily be the best way for us to move forward with the right information to be able to decide how to do that.

CHAIRMAN TRAIN: Ritchie, are you satisfied? Okay David Borden again.

MR. BORDEN: As far as the motion itself. The reason I withdrew that. I wanted to have a separate discussion on it. My view is that would follow. I'm not going to go back and answer all of Peter's questions in the interest of time. I would like to go back to the point that Dan made. I have exactly the same. When I was attempting to be brief, when I talked about my reservations, and I'm going to still be brief.

But I have all the same reservations he has on this issue of the percent reductions. If you look at the allocations, Area 4 and 5, these are Mid-Atlantic lobster management areas. Areas 3 and 2 in the Outer Cape have all had very extensive trap allocation programs that were based on history; that eliminated and have subsequently consolidated the industry in a lot of those areas. That sentence that second sentence is designed to basically say to those areas that you're efforts in the past are going to be recognized as part of the process.

I agree with what Dan said; and I think we have to just recognize that vertical line cuts in the areas are going to be different in different areas, depending on the density of the traps, and how they relate to a whole host of variables like exempted areas. There are going to be exempted areas; where we may have a different set of rules. That is what the intent of that sentence is.

CHAIRMAN TRAIN: I haven't seen any more hands; so this is where I'm going to go back to the public and see if there is any comment on the Addendum. Please step, oh Peter Burns, and then I'll go to the public. When the public comes up, please come up and say your name at the microphone.

MR. BURNS: Sorry to jump in; but I just think it's important after David's comment. First of all I'm pleased with the motion; and I'm pleased that there is some interest on behalf of the Board here to move forward. I think it's really important, and I think that timing is of the essence here.

I think as soon as the Commission can start to develop these addenda, I think that is really going to be a great way so that we can try to complement whatever comes out of the TRT to try to avoid a jeopardy finding with the Biological Opinion. I think now is the time to start doing that. It's a lot of work moving forward. But I think we're heading in the right direction here; at least we have something in the pipeline now.

As far as the fine print in the motion. I think that to understand really where the ESA is coming from. I'm not really sure how anything in the past may or may not be able to be credited. I don't want to put the cart before the horse here; because I think everything should go on the table, and we should have some clear expectations on how we want to move forward.

I think the ESA and the Biological Opinion are going to be looking at the best available information. We've seen reductions in the population of whales going down since 2010. I think that the ESA and the Biological Opinion, we're going to want to look at the most recent information available to base the reductions on. I think that there clearly could be some credit for the Area 3 trap caps that NMFS hasn't implemented yet that we're looking at. There is also some Area 2 trap reductions that have not come to pass yet; but that are on the books, so that could certainly happen. I'm not saying that definitively we couldn't get credit for something in the past. But I'm just trying to let folks know that the ESA and the Biological Opinion may have a different way of calculating these reductions moving forward.

CHAIRMAN TRAIN: Now once again back to the public. If you would like to speak, please state your name when you come up.

MS. DAVENPORT: Thank you, Mr. Chairman. I really appreciate the opportunity. I am Jane Davenport with Defenders of Wildlife. Before the Commission votes, I would really like to urge you to consider a larger range of reductions than the 20 to 40 percent that is currently on the table. My understanding from the October Working Group meeting is that at that point the range of alternatives included up to 50 percent reduction.

But amplifying what Peter Burns just said. It's critical to understand that as the Agencies Tech Memo demonstrated in the fall; a female right whale has only a 5 percent chance of avoiding entanglement in a vertical line in the ten-year-calving interval. Of course that ten year interval is because of chronic entanglements in fishing lines.

The normal calving interval for a right whale is three to four years. As a matter of biology, not as a matter of what the Agency has found in a biological opinion, but as a matter of what the best available scientific data has shown. Entanglements are already causing jeopardy to the North Atlantic right whale; in terms of both lethal and the sub-lethal effects of effecting reproduction.

I commend your Commission for being proactive on this. But please understand that this is a time for bold action; not conservative action, and considering a larger percentage reduction, considering more innovative methods of getting rid of end lines, such as for example having a ropeless mechanism on one end, and a rope on the other. That would achieve a 50 percent reduction right there.

Understanding that that technology is not ready to come off the shelf yet, the Commission could play a really important role in facilitating and incentivizing the development of those technologies. Again, I just respectfully ask that you consider even bolder action than what you've got in the motion before the Commission.

CHAIRMAN TRAIN: Thank you for your comments, is there anybody else in the public? Come up and state your name, please.

MS. PATRICE McCARRON: Good afternoon, Patrice McCarron with the Maine Lobstermen's Association. I want to thank the Commission for forming this group and putting this motion forward. The Maine Lobstermen's Association does support the motion. This is really tough business for the lobster industry.

I don't think our association or our industry exactly shares Ms. Davenport's view of our role in the entanglement. But we do acknowledge that we play a role; and our fishery needs to change. This Biological Opinion is scary, and when I think about the courts deciding things or the Service deciding things, I know that they

don't understand the fishery and they don't adequately understand how these actions might affect our livelihoods and our ability to continue to make a living. I think the Commission is uniquely qualified to do this work. I think the close involvement of the states who understand the fishery.
You know I certainly hear Mr. McKiernan's concerns. These fisheries are diverse. You know you think vertical line reduction 50 percent, no problem. But you start to talk this through with guys, and you guys who fish singles, you have guys who fish pairs up to 20 trap trawls, and it's quickly a mess.

It's not a one-size-fits-all; it's probably multiple approaches that would allow different areas of our fishery to achieve any of these measures. I think this is great. This allows the discussion to happen. I don't know where the industry will fall on the various options; but I think this is the vehicle to move it forward. You guys are most capable of bringing the best information to the table; and giving our industries a really strong voice in trying to map this future and keep our fishery out of jeopardy. Thank you.

CHAIRMAN TRAIN: Thank you for your comment, do we have any more hands in the audience that would like to come up and speak? Seeing none; any more comments from the table? Okay we have a motion and it's been seconded, and all comments are over. I guess it's time to vote. I think you need to reread the motion now, David.

MR. BORDEN: Do I have to do this? Move to initiate an addendum to reduce the number of vertical lines in the water. The PDT should consider the following as specified in the Lobster-Whale Workgroup Memo. The PDT may need to consider the ongoing activities of the ALWTRT when drafting this document.

- Reduction of vertical lines by 20 percent to 40 percent for each LCMA (exclusive of Area 6).
- Percent reductions by LCMA may differ given ongoing and future trap reductions as well as newly proposed or implemented area closures in state and federal waters. In LCMA 1, 4, 5, and the Outer Cape, reductions may be achieved by trap limits, gear configurations, season closures, or other measures. In LCMA 2 and 3: reductions can be achieved by gear configurations, seasonal closures, acceleration of current planned trap reduction, or other measures.

- Elimination of the 10 percent replacement tag provision. Developing a method for reporting vertical lines and trap use by individuals in each jurisdiction until 100 percent harvester reporting is implemented in state and federal waters.

CHAIRMAN TRAIN: Do we need time to caucus? Okay, all in favor of the motion on the table raise your right hand, please. I don't think I need to do this; but we'll do this, opposition, abstention, null votes, 11, no, no, no. **The motion passes; and David, did you have a follow up from what you removed?**

MR. BORDEN: I would defer to Pat Keliher. I think he was going to make a suggestion.

CHAIRMAN TRAIN: Pat Keliher.

MR. KELIHER: I appreciate that Mr. Chairman. I do have a motion that was prepared. I don't know if it was.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Do you want me to do the Working Group Report first, and follow up with your motion?

MR. KELIHER: Yes, why don't we do that? Let's do that.

EXECUTIVE DIRECTOR BEAL: The Lobster Enforcement Vessel Working Group, it might be good to do that report out and then come back to this electronic monitoring issue; because there is a recommendation that came out of that Working Group relative to this issue.

CHAIRMAN TRAIN: Now before we go on to that item, Megan does have a question.

MS. WARE: I was just going to ask. This is a pretty hefty document for the PDT. I'm going to ask that all states review their PDT membership; and make sure that the person who is most qualified to work on this is a member of the PDT, and that they also have time to write part of this document, so if states could review that that would be a big help.

CHAIRMAN TRAIN: Pat Keliher:

MR. KELIHER: Megan, will the PDT be relying on the IEC data and model in doing any of this work?

MS. WARE: I think that will be one of the first discussions of that group. I don't have an answer for that.

MR. KELIHER: We have a Technical Committee that is fairly well tasked right now; in regards to the current assessment work that is ongoing. We've already tabled the Resiliency Addendum. I'm hesitant to put this on the table; but knowing that the individual states when they have talked to IEC in regards to datasets have identified some problems. Is it worthwhile having the TC take a look at this data; to ensure the TCs comfort level? Again, knowing full well that they are very well fully tasked at this moment?

MS. WARE: I think that's a question for the Board. I think you're correct in saying that the TC has got their hands full right now with the assessment. I just want to say that if we do task the TC with something, there may be delays down the road for the assessment; but that's the Board's decision on how you would like to move forward with that.

CHAIRMAN TRAIN: Go ahead, Pat.

MR. KELIHER: Knowing full well that workload; and knowing that we might initiate delays, I also would echo some of the environmental group comments in regards to data and ensuring that we are utilizing the best available data with the work that we're doing. As such, I would move that we task the Technical Committee to review the IEC data to ensure that we have a reliable comfort with its use.

CHAIRMAN TRAIN: Okay Pat has moved for that. Toni, did you have something on that Toni Kerns?

MS. KERNS: I just have a question for each of the states to confirm that the Technical Committee is actually the right group to review that; because in every state the Technical Committee person isn't necessarily their data guru. I think in some states it might be a different person.

That's why when Megan and I have communicated with the states and IEC, we have asked the state to make sure that they are providing the right contact to IEC, and then each individual state sign off on their data and how IEC is using that data before they allow or communicate with NOAA that that data has been approved, and that they also cc Colleen.

Colleen is the NOAA person working on the whale group; for those that don't know, to confirm either that Colleen knows that the state has a concern and that then Colleen also knows that that concern has been signed off and addressed, so that NOAA knows when concerns are there. I just don't know if the TC is going to have all the right people to do that or not. It's a question to the states.

CHAIRMAN TRAIN: We have a motion on the table, Dan. It needs to be seconded. Is there a second for Pat's motion? Ritchie White, are you seconding, discussion on the motion, now Dan McKiernan.

MR. McKIERNAN: To Toni's point. The person at Mass DMF who is on the TC is different than the person who is our data guru. I don't think we would support this.

CHAIRMAN TRAIN: For some reason I'm not seeing your last name, I want to pronounce it right because people are listening. Jay McNamee.

DR. JASON McNAMEE: I'm in agreement with Mr. McKiernan. I am opposed to this motion. I think it is incumbent on the states to have taken a look at this data. The Technical Committee has a tremendous amount of work to get done with the assessment. I don't think we need to task them. I think there are other ways of getting at what you're trying to get at, Pat that we can do external to the Technical Committee.

CHAIRMAN TRAIN: Emerson Hasbrouck.

MR. EMERSON C. HASBROUCK: I have two questions. The first is what is the IEC data; and secondly, why are we asking the Technical Committee to review that data?

MS. WARE: One of the things that have been used in the past for the TRT is a model. We call it the IEC model; it's the group that makes it. Fisheries data that goes into that was originally used for a co-occurrence model. It mapped where fisheries were versus where whales were. That's not really its use at this point; but it is looking like it might be the best available data for things like number of vertical lines, or information on gear in different fisheries.

The data is collected from all of the Atlantic Coast states, so it has a pretty large geographic span. Since this is the data that may be used in the Biological Opinion, I think there was an interest to make sure that that data really reflects what's actually happening, and for the states to review it. Does that help, Emerson?

MR. HASBROUCK: Yes, thank you.

CHAIRMAN TRAIN: David Borden and then Doug Grout.

MR. BORDEN: I was just going to suggest a simpler way. Rather than deal with the motion, simply to ask every State Director sitting around the table to go home, talk to the appropriate staff in their agency, have them review this data. Then have the State Director send an e-mail in to our staff, basically saying that they either approve or disapprove, and if they disapprove then follow the directions that Toni specified.

CHAIRMAN TRAIN: Doug, and then Dennis Abbott.

MR. GROUT: The person that deals with our landings data is different than our Technical Committee member. We have been already, at the instruction of the Commission staff, reviewing the IEC data compared to our state, which actually has end line numbers. We've been requiring that number in our lobster reporting for a number of years. At least from our particular small state, the numbers are very different than what's in the IEC model.

We are planning to; this is something that I thought was already a task that states were undertaking. But if we want to send a formal response to the Commission staff about this, we can do that. At least from my standpoint the Technical Committee wouldn't be the most appropriate entity to look at this.

CHAIRMAN TRAIN: Dennis has deferred, Pat Keliher.

MR. KELIHER: I appreciate those comments; and that is why I was hesitant to make the motion in the first place, more because of the workload, but I think the points on are they right entity to review I take to heart. But like Doug, when our staff looked at the IEC data in regards to Maine, we had a lot of concerns.

IEC was very quick to help address those. If in fact all jurisdictions are moving forward, and having those conversations then I'm comfortable; because the PDT is not, as Toni just reminded me the PDT is not going to utilize datasets that are not going to be accurate. If jurisdictions sitting around this table are comfortable, and they are interacting with IEC with their datasets, then I'm much more comfortable. If they're not then I remain concerned that the data that's going to drive the Biological Opinion, and the data that would help would also be used to drive any development of any addendum, is potentially going to be flawed. I want to ensure that that is not the case.

CHAIRMAN TRAIN: Peter Burns.

MR. BURNS: Yes, I think this is a good discussion, and I think it's really important. Certainly the Fisheries Service believes that we have to use the best data, and that it's important for everyone to be on the same page with what we began with and what we use. I think IEC could be available to do a webinar or some type of a seminar to go through the data that they have.

We could have the appropriate people sit in on the webinar from the different states; and then there could be some interaction between them, and the caveats on the data and where the gaps are, and where the questions are. That might be a good way to really get everybody altogether; and kind of take a look at the information there and make any corrections as needed.

CHAIRMAN TRAIN: One more time Pat Keliher.

MR. KELIHER: I appreciate that Peter. I think that is a fantastic suggestion. It allows us to have the right people interact with them, and ensure that that conversation happens. With that in mind, if the seconder of the motion agrees, I would be happy to withdraw.

CHAIRMAN TRAIN: Doug that was you I believe, no it was Ritchie, I'm sorry.

MR. WHITE: Agree.

CHAIRMAN TRAIN: Okay that motion is withdrawn. Dan McKiernan.

MR. McKIERNAN: The elephant in the room on all of this forward management of the lobster fishery is the role of the exempted areas; and to what degree the exempted areas will continue to be exempted. I only bring this up, because one of my best staff is going to be saddled with serving on this PDT; and he's going to ask me Friday morning that question.

I don't know how we come away from this meeting without sending that signal to the PDT. Maine has the historic exemption line that encompasses a lot of their state waters. New Hampshire exemption line includes all of the Great Bay. Massachusetts has a 0-3 mile exemption for single traps. The Nantucket Sound fishery at this point is not included, because of the lack of whale sightings down there.

I hope that we can send a signal to them. I don't know if they're listening in, but I'm really concerned that there is no message being sent there. That's going to be a huge issue for NMFS when they do their Biological Opinion. I know we're hoping the PDT delivers the goods, you know a definitive, verifiable management scheme. But that's a big question; and I didn't see that noted in the motion. I hate to bring it up after the motion, but I would like to have a discussion on that.

CHAIRMAN TRAIN: I'm looking around Dan, to see if somebody would like to discuss it. Does anybody want to talk, no, I guess not today?

REPORT FROM THE LOBSTER ENFORCEMENT VESSEL WORKING GROUP

CHAIRMAN TRAIN: Okay, we are going to move to Item Number 5, Report from the Lobster Enforcement Vessel Working Group, Bob Beal.

EXECUTIVE DIRECTOR BEAL: I'll make this fairly brief; but happy to answer any questions at the end. I don't have slides; but there is the draft meeting summary in the supplemental material that was supplied to the Board. This Board has talked about offshore lobster enforcement a number of times; and expressed concerns over the difficulty of enforcing the regulations out in the offshore areas, different gear, far from shore, heavy gear and those sorts of things.

There has also been some discussions with NOAA Fisheries about ways that we could possibly build a vessel, fund a vessel that is capable of going offshore hauling gear, and enforcing the provisions in the offshore area. NOAA Fisheries has identified some opportunities possibly for funding a vessel and building a vessel; and with hopes that that actually is able to move forward.

This Board formed a working group to talk about the offshore area; and how we would staff an enforcement vessel, and where the vessel would be located, who would own the vessel, all the other logistics associated with the vessel operating in the offshore area. That group was formed at the annual meeting.

The group got together December 20, this year, right before the Christmas holidays. The current makeup of the group has representatives from Maine, New Hampshire, Rhode Island, NOAA Office of Law Enforcement, and the U.S. Coastguard. If any other states want to be involved they are more than welcome to become part of the working group.

The meeting started out with kind of a background conversation about offshore enforcement and the difficulties associated with it, and the limitations of the current vessels that the states operate. There was a note that the U.S. Coastguard doesn't pull lobster gear; they don't have the ability to haul gear and look at it.

The reality is most enforcement in lobster gear right now is limited to about 20, 25 miles offshore. There are some trips that go farther than that; but they are not very common. There was some conversation about some examples of when the enforcement vessels do wander farther offshore to enforce the provisions.

There is some pretty high noncompliance rate up to 80 percent in some areas on one trip that was made. The enforcement folks knew of some folks that weren't playing by the rules. They went out to those areas, and they found a lot of illegal gear. That just reinforced the concern of the group that there needed to be increased offshore lobster enforcement.

The first subject that the group talked about gets to this electronic monitoring conversation that the Board had earlier today. The group quickly came to the point where just building a new shiny vessel and saying go offshore and enforce lobster rules; really doesn't work all by itself. That vessel and the enforcement folks would need to be able to narrow down the part of the ocean that they're going to travel in and enforce the regulations in. Step one, the group agreed would be electronic monitoring, VMS type monitoring on all the federally permitted vessels, to be able to identify where the vessels are going. It would be a little bit more complex than just standard VMS. It would be monitoring gear that anytime the hydraulics or the winch are engaged, there would be a ping sent back to shore or recorded, the vessel location and the fact that the hydraulics have been engaged and they're hauling gear offshore, so they would know when that vessel is hauling gear and where they're located any time.

Once you build a record of this, the offshore vessel would know where to go and where to look at gear and where to haul gear, and make sure it's all compliant with the current provision. There is a recommendation that came out of the group that I think Pat is going to talk to a little bit later.

But the bottom line is that the group recommends an accelerated approach to implementing a VMS type system in all offshore area, or all federally permitted vessels fishing in the offshore areas. This as I said, would be more complex than just some of the VMS systems just monitor vessel location every half an hour or fairly infrequently.

It would be linked to the hydraulics and a frequent ping rate, so they have a good track of where that vessel is going and where that vessel is fishing. The other provision there is this technology could be linked to cameras, so that any time the trap hauler is engaged the camera would start recording all the activity on the deck, and they could count traps and monitor the other parts of the fishery as well.

That is a recommendation that is to this management board for consideration during this meeting. The group talked a lot obviously about what would this offshore vessel look like. How big is it? What is the capacity? How long would it need to be able to stay offshore and those type of details? They really after a fair amount of discussion they came up with two scenarios. The first scenario is a 70-ish foot steel hold vessel that could operate offshore for fairly long periods of time, haul a lot of gear, and look at a lot of areas.

It would be fairly independent offshore, and it could operate on its own without support of the Coastguard or anyone else. But as that conversation kind of matured during this meeting, it became clear that this vessel would probably need to be owned by the federal government; either the U.S. Coastguard or NOAA Office of Law Enforcement.

Given the complexities of adding another vessel to the federal fleet, they came up with Option B as well, which would be a vessel in the mid 50 foot range, 55 foot, but it would be a fiberglass vessel, a little bit less expensive to build, a little bit less endurance offshore and a little bit more restricted by weather. But the U.S. Coastguard representatives said they would be willing to partner with this vessel and do offshore enforcement.

One of the ideas is that boat would be owned by the state of Maine. Maine would ensure the boat, self-insure the boat, and it would be staffed primarily by Maine enforcement folks, but it would be also available to travel south down to some of the other more southern offshore areas, and engage in enforcement activities in those areas as well. Those sorts of Option A and Option B need to be fleshed out a little bit better. One of the other areas that were talked about toward the end of the meeting was the schedule and the penalties for violations. What a number of the states are doing is much faster and much more severe than what happens sometimes in the federal system. Now the federal system does take a long time and multiple years to fully prosecute a case that is made; and state systems take two months, four months, six months, something along those lines.

There is a disconnect there, and states frequently suspend or revoke fishing permits, and the federal government doesn't do that very frequently. There is conversation that we should have some more discussion about making the federal and state penalties more consistent; and try to streamline. I don't know if we can necessarily speed up the federal enforcement process; but at least have that conversation and decide if we can make the penalties and some of the processes more consistent between state and federal government.

Mr. Chairman, that's a quick summary, there are a number of follow up activities at the end of the meeting summary. But all in all I think it's a good group. They clearly understand all the ins and outs of this. They've moved forward quite a bit on how to staff this vessel and own this vessel and operate this vessel; but there are details still that need to be fleshed out some more.

But the primary short term outcome is this notion of electronic monitoring of the federally permitted vessels; and that working group made that recommendation to this Board for consideration today. Happy to answer any questions, and there is a number of folks obviously around the table that are part of that working group and can chime in if they want to provide more details.

CHAIRMAN TRAIN: Questions or comments? David Borden.

MR. BORDEN: Just a quick comment. When we talk about tracking we're not talking about VMS; we're talking about a tracking system that's probably about the size of your cell phone that would record every five minutes. Therefore, you would have an actual location where the gear is being hauled; as opposed to a VMS system.

One of the big differences, cost of tracking system is about a $350.00 item and then you get a service program that goes with it. A VMS system can cost thousands of dollars. One of the biggest issues is the electrical draw on the boat. A lot of the fleet that would be covered by this are on moorings, don't have access to electrical outlets, so you've got to get something with a low draw, otherwise they simply burn out the batteries.

CHAIRMA TRAIN: Pat Keliher.

MR. KELIHER: I can't emphasize more the importance of being able to haul gear in Area 3; from an enforcement perspective. The goal in the state of Maine is voluntary compliance. That is the end goal with everything that we put in place; and we maintain voluntary compliance in two different ways.

One, the fleet knows that the Maine Marine Patrol is hauling lobster gear up and down the coast, 20 to 30,000 traps a year. I mean it's a small percentage of what you, Mr. Chairman as a fisherman would haul yourself. But the fact that we're hauling gear, confiscating gear, and writing tickets based on that ensures voluntary compliance. We've just received not too long ago some Intel in regards to a fisherman in Area 3; and after going out and hauling that individual's gear, we discovered that 80 percent of that gear was in violation, 80 percent. Hauling some other gear in the area we ended up ticketing another person for having untagged gear.

That's the snapshot; and I don't mean to say that 80 percent of the gear in Area 3 is noncompliant. This was obviously based on good intelligence for the time. But if we're not hauling gear, and didn't have the ability to haul gear, we wouldn't have found it. We wouldn't have found those violations.

It's something that this Board needs to keep in mind. I think we need to find a way to get a big boat into the fleet. I am willing to redirect some of the assets within the state of Maine to try to do this; even though we have the fewest amounts of permit holders in Area 3. This is one lobster management unit.

Now we are managing the Gulf of Maine and Georges Bank, so it is as resource issue as well as compliance issue with our FMPs, and an issue for marine mammals. We need to find a way to solve this problem. The electronic monitoring is a big part of this; and frankly it is the first step that needs to be taken. With that in mind, Mr. Chairman, I have a motion in the queue ready to go up to start a discussion on that component.

CHAIRMAN TRAIN: Well let's get the motion up.

MR. KELIHER: My motion is not a Dr. Pierce motion. That is not it either, I don't think is it?

Unless you. Yes it is, no it's not, and no there it is, no that's not it that's definitely not it. You don't have it? You didn't get it? It's short. I'll read it and you type, how's that? You ready? **Move that the Lobster Board recommend to the Policy Board that a letter be sent to NOAA Fisheries for consideration by the TRT to develop and support a suite of options for electronic vessel monitoring for federally permitted vessels.** If I get a second I'll –

CHAIRMAN TRAIN: Seconded by Dennis Abbott. Go ahead, Pat.

MR. KELIHER: I want to reiterate some points that David Borden made; and I didn't feel like I needed to put it in a motion. But we're not talking about VMS here. We're talking about a very simple system that has been tried and tested on offshore vessels. You could create geo fencing with it; you can ensure that we would know when they leave the dock. But based on Bluetooth technology you would know when the hauler is engaged, so you would know where the gear is.

That is very, very important to have that information as it relates to a large offshore vessel; because the density of gear in Area 3 is nothing like we have inside. Having that knowledge of where that gear is to then haul is critical. I think beyond that the idea of it, as our Executive Director said, the idea of potential video use within this type of system is also very important.

CHAIRMAN TRAIN: Dennis as a seconder would you like to speak? No, okay. Eric Reid, no go ahead Dan McKiernan.

MR. McKIERNAN: Pat, could you explain the role of the Large Whale Take Reduction Team as the recipient of this?

MR. KELIHER: As I said earlier, and maybe I shouldn't make such a hard black and white line here. But to me this type of technology really gets to serious injury and mortality. It's a way for us to monitor gear as it relates to current and future regulations; rope size diameters, traps, number of traps on a trawl, information in regards to issues that again relate to not necessarily as much risk, but as it does to serious injury and mortality. I think that belongs in their wheelhouse. It doesn't mean we can't assist. I think we all have representatives on the TRT that can help with that; as well as the Commission's representative on the TRT.

CHAIRMAN TRAIN: Peter Burns.

MR. BURNS: I think that if the Policy Board or the Board approves this and the Policy Board sends a letter, I think it would be good and helpful to have as much technical information in there as possible to provide the TRT with some different types of technologies, and the type that the Board might be looking for to look at so that it can sort of give a little bit more detail on the scope and the intent of what's happening here. If there is any information either from a working group or from the Law Enforcement Committee that can help inform that I think that information would be helpful.

CHAIRAN TRAIN: Dennis Abbott.

MR. ABBOTT: Having been at that meeting; it seemed very clear that if you didn't have this there would really not be a lot of sense in having an offshore vessel, because Maine Law Enforcement at that meeting talked about the difficulty in even locating any gear. You could spend inordinate amounts of time looking for gear and not finding it. These two things, getting a craft and having this monitoring goes hand in hand, and they both have to be there.

CHAIRMAN TRAIN: Bob.

EXECUTIVE DIRECTOR BEAL: Not knowing the membership and expertise of all the individuals on the TRT right off the top of my head. I take Peter's point that the TRT may not have all the expertise they need to dig into all the options, and different hardware and software and other things that are available to monitor vessels and cameras.

There are electronic monitoring experts out there. We'll try to do the best we can in providing them some information in that letter or get it working with our Law Enforcement Committee or something else to help that group out; and at least understand what the goals and what we're trying to achieve through this electronic monitoring. It's a fair point. They're individuals that weren't put together to be electronic monitoring experts.

CHAIRMAN TRAIN: Are there any other comments on the motion? **Do we need time to caucus? Okay, everyone in favor of the motion raise your right hand; opposed, null votes, abstentions, one abstention. Motion carries 10, 0, 0, and 1.** Ray Kane.

MR. RAYMOND W. KANE: I just heard Dennis' rationale. I know years ago offshore lobstering for Bobby Brown, has anybody contemplated aerial surveys to find illegal gear? I mean it's a lot quicker way, just a thought. Put a plane up, go offshore, and you'll have tracking on legal gear, you'll know where that is. But the illegal gear so you can send the enforcement boat directly to the illegal gear, just a question.

CHAIRMAN TRAIN: Pat Keliher.

MR. KELIHER: I'm glad you finished that because the Maine Marine Patrol has a plane; and I can tell you we haven't written any lobster violations with it, but if you had that sort of ability that would be great. However, we're flying a Cessna on floats; so to go that far out I can tell you, and the Major can tell you better that our pilot would not be thrilled about being sent 75 or 80 miles offshore, even with floats. You would have to have an aircraft with a little bit longer range I think, to do that type of work. It might be even more cost prohibitive.

CHAIRMAN TRAIN: Go ahead, Ray.

MR. KANE: Just a thank you, another suggestion, blue fin tuna observer pilots. You know you can pick them up cheap. They are no longer observing for seiners, and they fly that distance, single engines without floats.

REVIEW IMPLEMENTATION OF THE JONAH CRAB FISHERY MANAGEMENT PLAN FOR DELAWARE AND NEW YORK

CHAIRMAN TRAIN: Okay we're going to go on to our next agenda item. Review Implementation of the Jonah Crab Fishery Management Plan for Delaware and New York; and I'll take it in the way that it is presented. Delaware, do you have anything to tell me?

MR. CLARK: I do indeed. I apologize for the first state's tardiness in getting this compliance here. But we have started the regulatory process. The first step has been completed; and within four to six months we should be in full compliance for our little harvest of Jonah crab claws.

CHAIRMAN TRAIN: That was John Clark by the way. Thank you very much, and New York.

MR. JAMES J. GILMORE: I'll start by apologizing too; just because John said those things. Ours is a little bit more complicated. I think we put it context. We have a rulemaking in place. We're ready with all the limits to file them. Unfortunately the statute that we have for this expired on December 31, so currently I have a rulemaking that I can't file.

However, the Legislature, both the Assembly and the Senate, have put bills in to restore that statute. The minute I have that we'll be able to file the rules; which should be pretty soon. Hopefully we're looking at by March. We're working with the Legislature. They know that we're out of compliance right now; so they understand the priority of it.

The one hiccup we have is just to give you some stats is that well first off, like most states, this is a federal fishery for the most part. The FMP requires that you essentially have a lobster license to prosecute this fishery. In New York we have a total of 12 permit holders in 2018. Ten of them have lobster licenses; so they're fine. The one issue we've got is that in New York you can also harvest if you have a crab permit. There are two individuals, and I think they're related that have crab permits that fish in state waters, but don't have a lobster license. If we cannot figure out a way to accommodate these guys, these guys will be out of the fishery, and I've actually met this guy and he's actually pretty reasonable. We've got two options on that.

I can try to convince the Legislature to do additional legislation for two fishermen that have gotten caught up in this little technicality, for lack of a better term, or is there some way through the Board we could do a technical fix for this, for these two guys that are essentially caught in what came from the FMP?

That is the sticking point. I have two fishermen, and I'm not sure how we cover in this. That is assuming we do all of, you know everything else should be going forward, in terms of implementing the management requirements. But I have two that I'm trying to keep in the fishery that has been doing this for a long time. That's where we are, Mr. Chairman.

CHAIRMAN TRAIN: My question is if you follow through with everything else and the legislative process, if you don't get something resolved through the Legislature for these two, you'll have something back here at our next meeting or the following meeting for us to resolve it?

MR. GILMORE: Yes. We're looking at; the other thing is the Legislature the whole thing changed over the last election, so a lot of new people trying to get up to speed on this. We're hoping to solve this through the Legislature, but that would probably be where we would get to that if we cannot fix it in New York, we would come back to the Board in the May meeting and try to come up with some other solution for the two fishermen.

CHAIRMAN TRAIN: Is there any other discussion on this topic? This is a possible action item. I don't see a need for action at this time. We're without a motion as such, I think we move on, Progress Update on the 2020 American Lobster Benchmark Stock Assessment.

PROGRESS UPDATE ON THE 2020 AMERICAN LOBSTER BENCHMARK STOCK ASSESSMENT

MR. JEFF J. KIPP: The Lobster Stock Assessment Subcommittee actually met last week at our second in-person meeting. It was an assessment workshop in New Bedford, Massachusetts; from Monday to Thursday. We reviewed the assessments models, the length-based assessment models with data updated through 2017, and also covered our non-model dependent terms of reference at that workshop.

Just as a reminder, the big milestones moving forward. We will have our last in-person workshop with the Stock Assessment Subcommittee tentatively scheduled for September of this year. At that meeting we'll be reviewing what we hope will be our final base models for this current assessment.

Tentatively we are scheduled for a peer review in May of 2020; and then we'll be coming to this Board to present the results of the assessment and that peer review at the August ASMFC meeting in 2020. If there are any questions on the assessment progress, I can take those now.

CHAIRMAN TRAIN: Do we have any questions for Jeff? You nailed it, I guess. David Borden.

MR. BORDEN: Not a question, but I had the good fortune of sitting through a day and a half of the discussions. I would just complement Jeff; I thought he ran a good meeting. I thought the Committee was very focused, and challenging of each other. When someone makes a statement they are right after each other; and that's what we need to get a good product out of it in the end, so keep up the good work.

CHAIRMAN TRAIN: Okay, do we have any other business? Go ahead, Pat Keliher.

MR. KELIHER: I'm going to bring it back to whales one last time. We have spent a lot of time as a body to speaking about the interactions and risks associated with lobster fisheries and right whales; but we are not having any conversation about every other fishery from Maine to Florida. I'm not asking for any specific information from NOAA Fisheries.

But you know there is other risk out there besides the lobster fishery. I know NOAA has not lost sight of that issue; but I just want to make sure that is on the record to express the state of Maine's concerns that other work needs to be done here, besides what's being done with this management board.

CHAIRMAN TRAIN: Anybody else? Seeing nothing, I'll entertain a final motion. Peter Burns.

MR. BURNS: Just a follow up to Mr. Keliher's comment. I think that in the process of the IEC webinar, maybe we could address that issue; because I believe that when that data was initially put together that was to look at the co-occurrence model of where fixed-gear fisheries and whales were interacting. There may be some of that data that is still available there, and something we could take advantage of that opportunity at that time, possibly.

CHAIRMAN TRAIN: Would you like to follow that up with a final motion?

ADJOURNMENT

MR. BURNS: Motion to adjourn, Mr. Chairman.

CHAIRMAN TRAIN: Any opposition? We're all done.

(Whereupon the meeting adjourned at 4:25 o'clock p.m. on February 5, 2019)

Atlantic States Marine Fisheries Commission

Atlantic Herring Management Board

April 30, 2019
8:30 – 10:00 a.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(P. Keliher)*	8:30 a.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from February 2019	8:30 a.m.
3.	Public Comment	8:35 a.m.
4.	Consider Addendum II for Final Approval **Final Action** • Review Options and Public Comment Summary (*K. Rootes-Murdy*) • Advisory Panel Report (*J. Kaelin*) • Consider Final Approval of Addendum II	8:45 a.m.
5.	Update on 2020-2021 Fishery Specifications *(K. Rootes-Murdy)*	9:15 a.m.
6.	Progress Update on Draft Addendum III (*K. Rootes-Murdy*)	9:30 a.m.
7.	Review the Management Tools Used for Setting Days Out Measures (*K. Rootes-Murdy*) **Possible Action**	9:40 a.m.
8.	Consider Approval of 2019 FMP Review and State Compliance Reports (*K. Rootes-Murdy*) **Action**	9:50 a.m.
9.	Other Business/Adjourn	10:00 a.m.

The meeting will be held at The Westin Crystal City, 1800 Eads Street, Arlington, VA; 703.486.1111

MEETING OVERVIEW

Atlantic Herring Management Board
Tuesday, April 30, 2019
8:30 – 10:00 a.m.
Arlington, Virginia

Chair: Pat Keliher (ME) Assumed Chairmanship: 02/18	Technical Committee Chair: Renee Zobel (NH)	Law Enforcement Committee: Michael Eastman (NH)
Vice Chair: Dr. David Pierce (MA)	Advisory Panel Chair: Jeff Kaelin (NJ)	Previous Board Meeting: February 5, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, NMFS, NEFMC (9 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Consider Draft Addendum II for Final Approval (8:45 – 9:15 a.m.) Final Action
Background • In October 2018, the Board moved to initiate initiated development of draft Addendum II to consider strengthening the protections provided to spawning herring in Area 1A. • In February, the Board approved the draft addendum for public comment. (**Briefing Materials**) • The public comment period was open from February to April 4. Public Hearings were held in ME, NH, MA, and via webinar.(**Briefing Materials**) • The Advisory Panel met via conference call on April 16 to review the draft addendum (**Supplemental Materials**)
Presentations • Review Options and Public Comment Summary by K. Rootes-Murdy • Advisory Panel Report by J. Kaelin
Board actions for consideration at this meeting • Select management options • Approve final document

5. Update on 2020-2021 Fishery Specifications (9:15 – 9:30 a.m.)

Background

- In April, the NEFMC met to approve the 2019-2021 Overfishing Limit (OFL) and Acceptable Biological Catch (ABC) as well as a range of alternatives for setting the Annual Catch Limits (ACLs) based on recommendations from the Herring Committee. (**Supplemental Materials**)

Presentations

- Update on 2020-2021 Fishery Specifications by K. Rootes-Murdy

6. Progress Update on Draft Addendum III (9:30 – 9:40 a.m.)

Background

- In October, the Board initiated Draft Addendum III to establish spawning protections in Area 3. The Board also sent a letter requesting the NEFMC add herring spawning protections to their 2019 priorities. At their December meeting, the NEFMC added consideration of spawning closures on Georges Bank as a 2019 priority.
- The NEFMC is seeking to hire a contractor to prepare an offshore spawning discussion document that could inform further development of Draft Addendum III.

Presentations

- Progress Update on Draft Addendum III by K. Rootes-Murdy

7. Review the Management Tools Used for Setting Days Out Measures (9:40 – 9:50 a.m.) Possible Action

Background

- Addendum I (2017) established management tools for the Area 1A fishery. The management tools were designed to meet the needs of the fishery by allocating the resource when the demand for bait is highest. (**Supplemental Materials**)
- In response to the 2018 stock assessment the 2019 ACL for Area 1A was reduced significantly. In April, the states of Maine through Massachusetts set effort controls that included no landings days during Quota Period 1 (June) in order to allocate quota efficiently throughout the remainder of the fishing season.

Presentations

- Review Management Tools for Setting Days Out Measures by K. Rootes-Murdy

Board actions for consideration at this meeting

- Initiate addendum to consider changes to management tools for the Area 1A fishery

8. Consider Approval of 2019 FMP Review and State Compliance (9:50 – 10:00 a.m.) Action

Background

- State compliance reports are due February 1.
- The Plan Review Team reviewed each state report and drafted the 2019 FMP Review. (**Briefing Materials**)

Presentations

- Overview of the 2019 Fishery Management Plan Review by K. Rootes-Murdy

Board Actions for Consideration at this Meeting

- Accept the 2019 Fishery Management Plan Review and approve *de minimis* requests

9. Other Business/Adjourn

Atlantic Herring Technical Committee Task List

Activity Level: Medium

Committee Overlap Score: Medium

Committee Task List
While there are no Board tasks for the TC at present, there are several annual activities in which TC members participate, both through the Commission and NEFMC • Participation on ASMFC PDT (currently working on Draft Addendum III) • Participation on NEFMC PDT (will be working to recommend specifications for the 2020-2021 fishing years) • Summer/fall collection of spawning samples per the spawning closure protocol • Annual state compliance reports are due February 1

TC Members
Renee Zobel (NHFG – Chair), Kurt Gottschall (CT DMF), Dr. Matt Cieri (ME DMR), Micah Dean (MA DMF), Corinne Truesdale (RI DFW), Deirdre Boelke (NEMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC HERRING BOARD

The Westin Crystal City
Arlington, Virginia
February 5, 2019

These minutes are draft and subject to approval by the Atlantic Herring Board
The Board will review the minutes during its next meeting

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Move to approve agenda** by Consent (Page 1).

2. **Move to approve proceedings of October, 2018** by Consent (Page 1).

3. **Move to approve Atlantic Herring Draft Addendum II for public comment** (Page 4). Motion by Doug Grout; second by Ray Kane. Motion carried (Page 4).

   Postponed Motion from October 2018:
   Move to initiate an Addendum which considers providing the Atlantic Herring Board greater flexibility to set annual quota period specifications for the Area 1A fishery. This issue can be included in the addendum initiated regarding the Gulf of Maine herring spawning protections, or it can be a separate document. Task the PDT to expand the quota period options to increase flexibility when distributing harvest during the months of July through September. However, in years of higher sub-ACLs, choose options that would allow for expansion of harvest to meet the needs of the market

4. **Move to table indefinitely** (Page 8). Motion by Ritchie White; second by Raymond Kane. Motion carried (Page 8).

5. **Move to postpone final action on Atlantic herring specifications until Policy Board on Thursday if NOAA Fisheries provides the final rule** (Page 8). Motion by Doug Grout; second by Steve Train. Motion carried (Page 10).

6. **Motion to adjourn** by Consent (Page 13).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Steve Train, ME (GA)
Doug Grout, NH (AA)
Cheri Patterson, NH, Administrative proxy
G. Ritchie White, NH (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Rep. Sarah Peake, MA (LA)
David Pierce, MA (AA)
Raymond Kane, MA (GA)
Jason McNamee, RI (AA)
Bob Ballou, RI, Administrative proxy
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Justin Davis, CT (AA)
Bill Hyatt, CT (GA)
Sen. Craig Miner, CT (LA)
Emerson Hasbrouck, NY (GA)
Jim Gilmore, NY (AA)
Maureen Davidson, NY, Administrative proxy (AA)
Russ Allen, NJ, proxy for T. Fote (GA)
Joe Cimino, NJ, proxy for L. Herrighty (AA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Terry Stockwell, proxy for T. Nies, NEFMC
Allison Murphy, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Jeff Kaelin, Advisory Panel Chair
Renee Zobel, Technical Committee Representative

Staff

Robert Beal
Toni Kerns
Megan Ware
Jessica Kuesel

Guests

Rodney Avila, Orsted US
Chris Batsavage, NC DMF
Peter Burns, NMFS
Joseph Gordon, PEW Trusts
Zach Greenberg, PEW Trusts
Arnold Leo, E. Hampton, NY
Patrice McCarron, MLA
Dan McKiernan, MA DMF
Derek Orner, NMFS
Kathleen Reardon, ME DMR
Melissa Smith, ME DMR
Mike Thalhauser, MCCF
Kevin Wark, Orsted, GSSA
Danny White, Maine Marine Police

The Atlantic Herring Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Tuesday, February 5, 2018, and was called to order at 9:00 o'clock a.m. by Chairman Patrick C. Keliher.

CALL TO ORDER

CHAIRMAN PATRICK C. KELIHER: I would like to welcome everybody to this morning's Atlantic Herring Management Board. It is a beautiful day; the sun is out. It's going to be almost 70. It is a great day for a parade; and here we are, exactly. Let's wrap this up so we can get back to Boston and join the parade.

APPROVAL OF AGENDA

CHAIRMAN KELIHER: I want to thank everybody for being here this morning. The first order of business is, actually I don't believe we have anybody signed up for public comment. Is there anybody that planned on speaking on any items that are not on the agenda? Seeing none; let's go right into Item Number 2, which is Board Consent, Approval of the Agenda. Is everybody all set on the agenda; any additions, any new business?

APPROVAL OF PROCEEDINGS

CHAIRMAN KELIHER: Seeing none; Approval of the Proceedings from the October, 2018 meeting. Has everybody had an opportunity to look at the minutes? I'm assuming everybody has. Is there any objection to those minutes? Seeing no objections they are accepted as written.

CONSIDER APPROVAL OF THE DRAFT ADDENDUM II FOR PUBLIC COMMENT

CHAIRMAN KELIHER: I went a little bit out of order, Item Number 4 is Consider Approval of the Draft Addendum II for public comment; and Megan is going to go over that document.

MS. MEGAN WARE: With some mood music.

CHAIRMAN KELIHER: I asked for that.

MS. WARE: Today I'm going to go through Herring Draft Addendum II. Just a reminder on our timeline, the Board initiated this at annual meeting and the PDT developed this document between November and January of this year. Today the Board is going to review this document and consider approving it for public comment.

If it is approved, our public comment period would be March through April of this year and the Board would return in May for reviewing that public comment and potentially taking final action. This addendum was largely in response to results of the 2018 stock assessment, which showed reduced levels of recruitment over the last five years.

While in the terminal year of that assessment the stock was not overfished and overfishing was not occurring. There were still serious concerns about the future health of this stock. As a result, the Board initiated this addendum to consider strengthening the existing spawning protections in Area 1A. In the motion for the addendum the Board recommended that the PDT consider measures, including the GSI trigger value, and the closure period length. Just to review our existing spawning program.

Right now we're focused on Area 1A and there are three closures: We have the Mass/New Hampshire Closure in green, the Western Maine Closure in yellow, and the Eastern Maine Closure in blue. We used samples to forecast the timing of spawning by modeling the relationship between GSI and date.

GSI as a reminder is a calculation of the gonad mass to total body mass. It's a tool that we use to measure herring maturity. The initiation of a spawning closure is determined by a trigger value; so that when GSI is projected to exceed the trigger value a spawning closure is implemented. If there are insufficient samples we use default closure dates.

Spawning closures last for four weeks; but they can be extended by two weeks if samples indicate a significant number of spawning herring. Before I get into a bit more details about the spawning program and TC analysis, I did want to preview the issues that are in this document. There are three issues that this document considers.

The first is the trigger value, so what is the trigger value that we use to initiate a closure. The second is the closure length, so how long do we close for? The third is the reclosure protocol, so do we need to reclose and if so what is the threshold we use to determine when that happens? I wanted to preview these issues for you, because they are all connected.

Depending on what trigger value you chose that may influence how long you have to close for. Depending on how long you close for that may determine whether you need to reclose and at what trigger. Kind of the overall message of this slide is, it's important to think holistically about this addendum and the options in it when the Board reviews the document.

Talking a little more specifically about the trigger value again, that is, the value that we use to see when GSI exceeds it and then implement a spawning closure. Generally, a higher trigger value closes the fishery later and closer to spawning while a lower trigger value closes the fishery earlier; to provide protection to maturing fish.

Our current trigger value is 25, and TC analysis showed that that results in spawning closures that start within a few days of when the population reaches 25 percent spawning. The question that's prompted here is, is initiating a closure when 25 percent of the population is spawning still appropriate? The TC did note that lowering the trigger value would reduce fishery spawning interactions.

You will see options in this document with lower trigger values. However, it is important to highlight that, when we use a lower trigger value we would implement a closure earlier. You may need a longer closure period to provide protection throughout the spawning season. Again this is getting at how these options are related. If you lower the trigger value, you really need a longer season. Also, lowering the trigger value and then having an earlier closure may shorten the time available to collect spawning samples. Then to talk a little bit about the closure length and our reclosure protocol, so I think the question here is, is the current four-week closure sufficient? Through the TCs analysis they found that in the past three years the Mass/New Hampshire spawning season has lasted 4 weeks, 2.3 weeks, and 4.9 weeks.

But, they noted that there was much greater confidence in the longer seasons due to a higher number of samples in those years. The TC concluded that that four week closure would likely result in frequent use of a reclosure protocol. They noted that longer initial closures would increase protection during spawning; and could simplify the protocol by removing the need for a reclosure.

You'll see in this document there are options for longer spawning closures. But, it is also important to note that a longer closure may increase the chance of multiple areas being closed at once. Now we'll go into the management issues and alternatives. Our first issue again is the trigger value; and we have four options here. Option A is going to be our status quo, so it's a trigger value of 25.

Again, that is closing the fishery when approximately 25 percent of the population is spawning. On the right you can see the default closure dates that are associated with that trigger value. Option B, we are still using a trigger value of 25; so again we're still going to close when approximately 25 percent of the population is spawning, but with additional years of data the TC was able to update those default closure dates.

You'll see it is three days earlier for Western Maine and Massachusetts/New Hampshire. The only change between A and B is the default closure dates. Option C is lowering the trigger value to 23. That would close the fishery when approximately 20 percent of the population is spawning; and you can see by looking at the default closure dates, they are earlier than the ones that we have at the top of the screen.

Then Option D is a lower trigger value of 22. That would close the fishery when approximately 15 percent of the population is spawning. Again, with the default closure dates you can see they are earlier and earlier the further down you go on this slide. Issue 2 is the closure length; so how long are we going to close for.

Option A is status quo, so a four-week initial closure, and then Options B, C, and D are all extensions on that so a five week closure, a six week closure, and an eight week closure. On a future slide I'm going to show how the trigger values and the closure lengths are related. But I did want to note for Option D that eight week initial closure.

The PDT included that because it may be long enough that we don't need a reclosure protocol for any of the trigger values in this document. Then Number 3 is our reclosure protocol. There are two options here. Option A is we keep a reclosure protocol; such that the spawning closure can be extended for two additional weeks.

Then Option B is that there is no reclosure protocol; there is no option to reclose for two additional weeks. Under Option A there are sub-options, and that is related to the threshold at which we would reclose. Hopefully my coloring of the percentages is a reminder to two slides before, and that those percentages look familiar. Option A is status quo; so that is defining our threshold as when 25 percent of more mature herring are found in that sample. That is related to the trigger value of 25.

Sub-Option 2 is a 20 percent; so again that threshold is at the 20 percent or more mature herring, and that is related to a trigger value of 23. Then Sub-Option 3 is 15 percent or more mature herring; and that is related to the trigger value of 22. Again, all of these options are related to one another, and they go back to what trigger value you chose.

Then this is the final slide here. This is Table 2 in the Addendum; and if there is one table to look at, I really recommend that it's this one. This one shows how the different management options are connected. As an example, if we take a trigger value of 23 so that would close when approximately 20 percent of the population is spawning. We can see what the average spawning season lengths are as well as the range of spawning season lengths.

We have an average of 4.3 weeks; but we have seen one as long as 5.7 weeks. This would suggest that when the Board subsequently chooses a closure length, you might want to consider a longer closure length for that trigger value than what you have now, because 4.3 weeks and 5.7 weeks is certainly longer than the four weeks we have now. Hopefully that shows how all the options are connected; and I will take any questions.

CHAIRMAN KELIHER: Ray Kane.

MR. RAYMOND W. KANE: Megan, can you go back to that slide on reclosures? My question is; are the vessels that are actually participating in the fishery landing, and those are the herring that are checked? They take a sample of 100 or 200 fish and check the spawn, or are the small boat vessels still doing the spawn check, you know running out there and grabbing samples, and dissecting right onboard? How is that done?

MS. WARE: I'm going to pass that to Renee; who is our TC Chair.

MS. RENEE ZOBEL: In the past reclosure samples have come from a variety of places and a variety of fisheries. They have been fisheries related, but they also could be fisheries independent, as far as the reclosure is concerned. Does that answer your question, Ray? It's been small boats and big boats. I mean the whiting fishery has been a place where we have taken spawning samples; when there is a closure in 1A, to see if a reclosure is necessary. But we've also taken samples once the fishery is opened back up off of the purse seiners, et cetera.

MR. KANE: Yes thank you. I know in Megan's presentation she talked that a couple years they didn't really have enough samples. I think it was in that 2.3 to 5.9 range. What is the minimum number of samples that we need?

MS. WARE: For the initial reclosure there is a 3-sample requirement to not use the default dates, so to project for the closure using GSI-30 protocol, and then for the reclosure I believe it's just one sample is needed to trigger that reclosure.

CHAIRMAN KELIHER: Are there any additional questions for Megan? Seeing none; we have before us the draft Addendum with no additional comments or questions for Megan. Is there any interest in modification of the draft Addendum, or adding to the draft Addendum? Seeing none; I think a motion would be in order; if the Board is considering advancing this to public comment. Doug Grout.

MR. DOUGLAS E. GROUT: I would move to approve this addendum for public comment today.

CHAIRMAN KELIHER: We have a motion on the table, a second, second by Ray Kane. Are there any additional questions or comments, Doug or the seconder? Mr. Pierce.

DR. DAVID PIERCE: After we vote on the addendum, are you going to be entertaining a motion for a preferred alternative to be brought to hearing; or would you like that motion to be made prior to adopting the addendum for public comment?

CHAIRMAN KELIHER: I think it's at the pleasure of the Board, Dr. Pierce. I have no preference either way. If you have some thoughts on that I think we could probably take that up after we advance this. Are there any additional questions or comments? **Seeing none; are there any objections? Seeing none; the motion carries without objection.** Dr. Pierce, do you have a question?

DR. PIERCE: Yes, I'll offer up a suggested preferred set of alternatives, and Megan can correct me if I'm out of bounds or confusing the way in which these are laid out. But I'm referencing Table 4, some of the options and the consideration in this action. With the Trigger Value being Issue 1, the Closure Length being Issue 2, and the Reclosure being Issue Number 3.

In light of the fact that we're looking at right now, as best we can judge, four years in a row of historical low recruitment. Megan noted that in her presentation; circling in red those low years of recruitment. In light of the fact that we may end up with a National Marine Fisheries Service decision to go with the Council recommended ACL for 2019 and beyond.

I would make a motion that we adopt as a preferred alternative within the addendum, Trigger Value Option D; that's a trigger of 22, Closure length Option D; which is the eight-week closure length, and for Reclosure Option B, the no reclosure protocol. That's my motion, Mr. Chairman for a preferred alternative in the Addendum.

CHAIRMAN KELIHER: We have a motion on the table, is there a second? There is no second to your motion. The motion dies without a second. Is there any other interest from the Board in putting a preferred alternative forward? Seeing none; we will advance the document to public hearing without a preferred alternative. That will take us to Item Number 5 on the agenda; which is the Advisory Panel Report from Jeff Kaelin. Terry.

MR. TERRY STOCKWELL: Before we move on to the next agenda item, just a question from the Council as to when and how many public hearings are going to be scheduled. The Council is not likely to have major issues; but would like to reserve the opportunity to comment.

CHAIRMAN KELIHER: Let me ask the jurisdictions, the states what they're interest is in holding public hearings. Can I see a show of hands? Maine, New Hampshire, Massachusetts, any states to the south of Massachusetts interested in a public hearing? Seeing none; so Megan if you could work with those states on the timing, and whether we'll need more than one. Does that answer your question, Terry? Thank you very much, for bringing that forward. Toni.

MS. TONI KERNS: Terry, are you asking us to have it overlap with the Council meeting, the public comment period?

MR. STOCKWELL: Not necessarily. There is a Herring Committee meeting being scheduled in either late March or April. It would be an opportunity for the Herring Committee, with our new Commission member to have some discussion, and hopefully provide comments if the Committee so wants to forward them through the Council. Council meeting is mid-April.

CHAIRMAN KELIHER: I'm sure Ritchie White, the newest Council Committee member will be glad to offer comment.

ADVISORY PANEL REPORT

CHAIRMAN KELIHER: If there are no other comments, I'll move on to Item Number 5, which is the Advisory Panel Report from the AP Chair, Jeff Kaelin.

MR. JEFF KAELIN: Good morning members of the Board. I'm Jeff Kaelin with Lund's Fisheries, I'm the AP Chair. I was going to let Megan run with this; but she's asked me to do it. The other thing I'll say, there also is a Federal Herring AP meeting, too, at the same time as that Committee meeting, so there could be an opportunity for that AP to review this.

I don't know if there will be an AP meeting on this addendum that we just approved or not. Well I appreciate the opportunity for the AP to have met. On January 3, the postponed motion that was considered is in three places; it's on the meeting overview, it's in the January 11 memo, which is our report, and you'll see it in a minute on the Advisory Panel report here too, on the first slide. I won't bother reading that.

I think everybody knows why this meeting was held. It says that we did meet by conference call; the members of the AP are listed here. I also know that Commissioner Kane was on the phone with us and Deirdre Boelke, who is the New England Council's FMP coordinator, also listened in. The staff reviewed the existing quota period options in Amendment 3, and the postponed motion from October 2019, and then the quota periods that were selected by the Board for 2019.

Three AP members did not support the motion; stating that the Board already has flexibility in setting the Area 1A quota periods, which has resulted in decreased access for midwater trawls in 2019. Board overstepping its reach in the management of a federal species was a concern. Already enough flexibility in Amendment 3, additional regulations would be burdensome on the industry.

No clear reason why this action is being considered; given the fishery can meet its goals under Amendment 3. A new addendum would complicate management of the species; increasing the regulatory burden on the fishermen, and ultimately decrease flexibility in the fishery. Three AP members did support the motion; although they commented their support was weak. The comments ranged from supporting additional flexibility in Area 1A, particularly when facing low quotas, because the fishery shouldn't be locked into a single management regime. It is important herring are caught when demand is highest. Another comment that they supported the concept of flexibility; but would like to see data on herring catches to understand impacts on the various gear types during the period of the fishery.

There was some support for the motion; stating it would be stronger if there was a clear explanation as to why the action is being considered, and also looking for data to analyze relative to landings data from multiple bait species. I think that AP member was beginning to consider the need for projections on menhaden productivity; given the fact that the herring productivity is going to be very low in the following years.

In the next slide one AP member wasn't in favor of additional regulations; but did recommend a quota period where 80 percent is allocated June to September, and 20 between October and December, a specific recommendation. I think the only one we had, and one AP member didn't feel the data necessary to make a recommendation was available, but did note the importance of spreading herring landings throughout the year.

Another member abstained from saying whether he supported the motion; but commented that Atlantic herring is a federal fishery with federal permit holders who could be negatively impacted by the motion. That gives you an idea of what people thought of the motion in the AP, and then we did get into comments on the 2019 quota period.

I believe the Board made a decision on this at the annual meeting. Several AP members expressed concern about that decision to use bi-monthly quota periods in the 2019 fishery, and concerned the decision was made without landings data, so the impact of the changes wasn't evaluated. There was a statement that members of the AP would have liked an opportunity for AP input; that has come and gone, obviously.

Access to the fishery by midwater trawls was negatively impacted by that decision; and the Massachusetts lobster fleet, it was stated by an AP member, relies on bait caught by the trawlers in the fall, so changes of the quota periods have broader impacts than may have been considered.

Under the bi-monthly approach the fishery could close every other month; which could create chaos, and the '18 and '19 quota periods are reflected on the slide. I think that is what we went through, Mr. Chairman. Thanks to Megan, for helping me put together the report; and I'm happy to answer any questions the Board might have.

CHAIRMAN KELIHER: Thank you Jeff, I appreciate that. It's a very thorough report; it sounds like you guys had a great discussion. Are there any questions for Mr. Kaelin? We'll start off with Dr. Pierce.

DR. PIERCE: Jeff, right at the end of your presentation you highlighted one AP member commenting that the Massachusetts lobster fleet relies on bait caught by midwater trawlers in the fall months, so changes to the quota periods have broader impacts on other fisheries. At the meeting was there any discussion of herring being caught on Georges Bank being adequate enough to account for what might not be available with the shifting quota in Area 1A seasonally? In other words, would that offshore fishery for sea herring meet the needs of the Mass lobster fleet; assuming that was discussed at the Advisory meeting?

MR. KAELIN: Well, I think the comment was really relative to the splitting of the 1A quota. It didn't really get into whether the Georges fishery would be available to provide bait or not. I don't think anybody really understands what happened to the herring; maybe they're in Canada that's where the Calanus went. I don't' really know.

We're out looking. I know the fleet is out looking now in Area 2 and Area 3 for fish. It's not a great time to go to Area 3; but you can sneak out there if the weather is good, and people are trying to look for herring and mackerel right now. Who knows, David? That didn't specifically come up, but we didn't get into Georges productivity in the AP meeting.

CHAIRMAN KELIHER: Justin Davis.

MR. JUSTIN DAVIS: It seemed like a theme in some of the AP member comments was that they wanted to see more data; more information about herring catches and certain other topics, in order to have a more informed opinion about the potential impacts of greater flexibility.

My question is; if the Board did decide today to take up the postponed motion and approve it, and initiate an addendum. Would there be an opportunity for the PDT and the AP to have some back and forth; and kind of so the PDT could get a little bit of information about what types of information the Advisory Panel members would like to see in the addendum document?

MR. KAELIN: Well that's a great question; and I think if the Board approved moving ahead with the motion and the addendum, and asked the PDT to do that. I'm sure that could be done. I think the AP would probably appreciate that. It would give you a little better idea of what the impacts would be on the various fleets involved.

CONSIDER THE POSTPONED MOTION FROM THE OCTOBER 2018 MEETING

CHAIRMAN KELIHER: Are there any additional questions for Mr. Kaelin? Seeing none; I think that conversation is a good segue into Item Number 6, which is Consider the Postponed Motion from the October, 2018 meeting. I won't read the entire motion; but if it passed it would have initiated an addendum, which considers providing the Atlantic Herring Board greater flexibility to set annual quota period specifications for the 1A fishery. Ritchie, you've got your hand up. Go ahead.

MR. G. RITCHIE WHITE: This is my motion originally; and after talking to a number of Board members, and also discussions with Megan about trying to better define what I was trying to accomplish. I have the sense now that let's let this lower quota run through the system this coming year.

Then see how that unfolds, and if it will be necessary to implement more flexibility, which I still kind of feel we'll need. But exactly what that kind of flexibility should be, I'm uncertain. I guess my sense is to let this sit for a year and let's come back to it next year; after we've seen what we do with an extremely low quota.

CHAIRMAN KELIHER: Process wise, Ritchie, the motion belongs to the Board. Is this something you would like to make a motion on in regards to postponement?

MR. WHITE: I would; as long as there is no other discussion. I didn't want to immediately do that if someone else wanted to discuss it.

CHAIRMAN KELIHER: On that note are there any additional comments in regard to Mr. White's suggestion? Eric Reid.

MR. ERIC REID: I appreciate Ritchie rethinking his original motion. We don't even know what the specs are going to be for this year. The difference between National Marine Fisheries Service and the New England Council is a pretty substantial difference in Year 1 and Year 2. We don't really even know what we're dealing with yet.

I appreciate the forethought in not dealing with this. I just think we should just take this and vote it up or down. With the maker of the motion not supporting his own motion at this time, I think it would be cleaner if we just voted it up or down and then revisit it, as opposed to tabling it to some time we don't even know when that's going to be.

CHAIRMAN KELIHER: We can go in both directions; a motion to table indefinitely. You could let it die on the table, or cleaner just to kill it outright. I'll take one more question from Mr. Stockwell.

MR. STOCKWELL: I guess my question is; and I do appreciate the ongoing discussion, what exactly does greater flexibility mean? As we continue our collaboration between the Council and the Commission process, their additional measures could effectively shut out some of the segments of the Federal fisheries in complicating raising issues with MSA and National Standard Guidelines. I think the go-slow approach is the better and more prudent at this point; particularly given Eric's comments about the soon to be extremely low specifications for next year.

CHAIRMAN KELIHER: Thanks for that Terry, I think based on Ritchie's comments, I think the idea that we've even defined flexibility is not clear. Is there any interest in moving this Addendum forward, from around the table? Seeing none; I'll look to Mr. White for a motion, since it is his motion, to determine the path forward.

MR. WHITE: Is the correct motion to table indefinitely? That's what I will move on this motion.

CHAIRMAN KELIHER: We have a motion on the floor to table indefinitely. The motion on the floor is to table indefinitely; which would allow the motion to actually just die on the table, if it wasn't taken back up at a later date. We have a second by Mr. Kane. We have a motion on the floor by Mr. White, seconded by Mr. Kane; which is move to table indefinitely. Do we have any questions or comments on the motion? Seeing none; is there any objection to the motion? Seeing none; the motion carries.

SET THE SUB-ACL SPECIFICATIONS FOR THE 2019 FISHING YEAR

CHAIRMAN KELIHER: This brings us to Item Number 7 on the agenda; which is to set the sub-ACL specifications for the 2019 fishing year, and unless somebody runs through the door in the next ten seconds, I would say we don't have it. Alison, can I put you on the spot to just update the Board on what you know, what you told me earlier?

MS. ALISON MURPHY: I touched base with folks back in my office early this morning; and the Final Rule will not file today and become public. I think we're still very hopeful that it will file and publish sometime this week. Knock on wood there can be a discussion maybe later in the week or as the Chairman sees fit to consider what is in the Final Rule.

CHAIRMAN KELIHER: Thank you, Alison for that update. I think there are a couple paths forward here. One would be to hold off on any decisions and table until the Policy Board to address this at the end of the week; with hopes that we would have new numbers. Then if we did not have numbers by then, likely conduct just an e-mail vote on the specifications to have the Commission accept them. Mr. Grout.

MR. DOUGLAS E. GROUT: I would like to move to postpone final action on Atlantic herring specifications until the Policy Board on Thursday if NOAA Fisheries provides the final rule.

CHAIRMAN KELIHER: Got a motion on the table, seconded by Mr. Train. Are there any additional comments from the maker? She's typing that up. We'll give her a second to get that up on the board. The motion is Move to postpone final action on Atlantic herring specifications until the Policy Board on Thursday if NOAA Fisheries provides the final rule. It was a motion by Mr. Grout; seconded by Mr. Train. Are there any questions or comments on the motion? Adam.

MR. ADAM NOWALSKY: Just process-wise I'm trying to understand. Are we as a Board essentially giving the Policy Board the authority to take action on this; by virtue of this motion, and does that then say that for any spec setting to any Board that the Policy Board could supersede that decision moving forward? I'm just trying to understand what authority we're ceding to the Policy Board in this action. I'm not opposed to the concept of delaying a decision. I understand the importance of the Final Rule. But I think we should be clear what this Board may be ceding.

CHAIRMAN KELIHER: I'll turn it over to the Executive Director to comment.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Adam, it's a great question. Essentially the short answer is yes. The Herring Board is delegating authority to the Policy Board to make the final specs. But I think the precedence is something that makes me a little less concerned in that we ended up in this spot because we had this lengthy Federal shutdown.

We are sort of not operating under normal timelines and circumstances. The specs would have been available for this Board a number of weeks ago; and everything would have worked out easily. But I think this action is being considered because of the unique situation here. I don't think it will apply across the Board for all other specifications down the road, necessarily.

CHAIRMAN KELIHER: Mr. Grout.

MR. GROUT: Just a follow up for clarification. This motion applies to one issue; this particular issue. It's not succeeding our authority to the Policy Board for any other issues; it's just because of this unique situation that has happened due to the shutdown. I'm hoping that we can postpone; and maybe make our work more efficient by actually doing our work here, as opposed to having to do it by an e-mail vote.

CHAIRAMN KELIHER: Adam, does that satisfy your curiosity?

MR. NOWALSKY: Again, I think it's just important that we have clear on the record what we're doing here; so we know what we can do on Thursday, and what we might do on similar situations in the future.

CHAIRAMN KELIHER: I think the comments by Mr. Beal and Mr. Grout certainly make it clear that this is really a unique situation caused by the Federal shutdown; and I'll hold additional comments in regard to the Federal shutdown until the hospitality suite later this evening. With that we have a motion on the board. Are there any other questions in regard to the motion? Seeing none; I'll read it into the record. Oh, Eric.

MR. REID: Is this specific to 1A, or is this for the whole fishery?

MS. WARE: It's for the whole fishery, so it's the Sub-ACLs for the different management areas.

MR. REID: Only because in the bullet points it references 1A, it doesn't say anything about 2 and 3. I appreciate that.

CHAIRMAN KELIHER: Okay are you all set, Eric? Okay. Any additional questions, seeing none; I'll read into the record the motion**. Move to postpone final action on Atlantic herring specifications until Policy Board on Thursday if NOAA Fisheries provides the final rule; motion by Mr. Grout, seconded by Mr. Train. Is there any opposition to this motion? Seeing no opposition the motion carries.** This will move us. Dr. Pierce.

DR. PIERCE: Just a quick point. Let's assume for a moment that the National Marine Fisheries Service stands with its initial call, which was not to go with the New England Council's decision about what the ACL should be. The Council went with a lower number. NOAA has indicated, at least earlier on in the preliminary discussions and published material that they're going to go with a higher number.

It will be a bit of an interesting situation that if indeed we find out that they're going with a higher number, then I'm assuming the Policy Board would support that higher number. Therefore, ASMFC supports a higher number than the New England Council. It just creates a strange and opposite point of view that I wouldn't support; but we would have no option but to do so, except to be stubborn about it and create complications by going with the lower number that is the New England Council's number. I just wanted to highlight that. I'm hopeful that the New England Council's position after further consideration by NOAA that they'll go with what New England said was the appropriate set of numbers.

CHAIRMAN KELIHER: Eric Reid.

MR. REID: I would like to point out that the National Marine Fisheries Service number in Year 1 is substantially higher than the New England Councils. In Year 2 it is substantially lower. I think the number is 12,000 tons. It's a double-edged sword. New England's is more of an – average isn't the right word – but it's more of an average. National Marine Fisheries Service is substantially higher and substantially lower; which is a little problematic for me. I don't know how that's going to affect our decision. I guess we've got to see what the Final Rule is. That is my one cent.

CHAIRMAN KELIHER: I'm sure both of those comments I think will highlight some additional conversations will happen at the Policy Board, instead of a strict rubber stamp. If there are no additional comments, seeing none;

UPDATE ON DRAFT ADDENDUM III AND THE NEW ENGLAND FISHERY MANAGEMENT COUNCIL 2019 PRIORITIES

CHAIRAMN KELIHER: We'll move on to Item Number 8, which is Update on Draft Addendum III and the New England Fishery Management Council 2019 Priorities. Megan.

MS. WARE: This is just an update; and a reminder that at annual meeting this Board did initiate Addendum III, which is to consider spawning protections for Area 3. Also at annual meeting this Board voted to send a letter to the New England Council; asking that the Council add spawning protections in Georges Bank to their 2019 priorities.

As an update to that letter, at their December meeting the Council did add a priority to consider spawning closures in Georges Bank for 2019; so that was added to their priority list. Given this action, I think at staff level the hope is to work cooperatively to identify what data is available for this action, and to explore potential paths forward to consider spawning protections in Georges Bank.

CHAIRMAN KELIHER: Thanks for that quick update, Megan. Ritchie.

MR. WHITE: Megan, and then possibly Terry. What is the best-case scenario timeline by which the Council could have spawning protection in place?

MS. WARE: I don't have an exact answer for you. But in talking with Council staff, my impression is that their work on this would likely start, or they are going to first focus on 2020-2021 specifications, and then work on this Georges Bank protection. That is their plan for the year. I don't have a date for when they would take an action on it or implement it.

MR. WHITE: Follow up. Thank you. Then I guess a question for Terry would be. If the Council decides to go forward with an action;

how long might that take? My concern being that we could have substantial fishing on spawned fish for at least two years. I'm not sure that that kind of timing is what we need to protect herring at this point.

CHAIRMAN KELIHER: Mr. Stockwell.

MR. STOCKWELL: It's not if the Council is going to proceed with this work plan, it's when. As Megan reported, the Council did add this as a 2019 work priority; but the Council's current plan is to focus on the 2020-2021 specs first. This body is about to vote on the 2019 specs. As most everyone knows there is going to be another stock assessment in 2020, so the Council needs to put forward a second-year plan.

Short answer to you, once we get the white paper how complicated do the two bodies want to make this? If the Commission and the Council want to make it very complicated spawning closures, it is going to take longer. If the two bodies can agree upon something sooner than later that is more simplified, I would project it would go out the latter part of 2020.

MR. WHITE: Additional follow up, Mr. Chairman if I may.

CHAIRMAN KELIHER: Sure, go ahead.

MR. WHITE: I appreciate your indulgence. This time schedule really concerns me with the state that we find ourselves with herring. It may be that doing everything we can to have a good year class as soon as possible may make the difference to restoring this stock in a timely manner. I'm certainly not looking for this body to take things on that the Council can do.

We've got plenty of work ahead of us, and I'm not looking for additional work. On the other hand, we can act quickly and nimbly. I just throw out an idea. Would it make any sense for us to try to implement something interim; so that we're not doing the Council's work, but can we protect some spawning, some spawn herring in the interim faster, while this work is being done?

I believe we have the ability to protect spawned herring from a landing standpoint, not a fishing standpoint. Does it make any sense for us to try to have something in place for the 2020 season? We could even do it quickly for the end of 2019 season that would restrict landing of spawned herring from Area 3. I kind of throw that out as a question and see what other people think.

CHAIRMAN KELIHER: I understand where you're going with this. I certainly would like to hear comments from the Board. I would also say, I think the protections in '19, '20, and '21, are going to be based on the incredibly low quotas that we'll be fishing on. Based on that my feeling is; that while I think it would be important to ensure that we get something developed jointly between both bodies that because of the low quotas, I feel like we've got time to do that and going through the process.

I would hate to get into a situation where, we moved in the direction of turning this into a Board to ensure we had continuity with the Council and the Council with the Commission. I think we need to give that process, I personally believe we need to give that process time to work out. I think the low quotas over the next couple of years will do that. With that said; are there any additional questions or comments? Dr. Pierce.

DR. PIERCE: I agree with the Chair's perspective. In addition, I'm waiting for the discussion document that has been referenced in our reading materials. That discussion document is in progress I understand. In addition, as noted in our material for this meeting, the Plan Development Team has also begun investigating available data on Georges Bank spawning outside of state collected samples. The PDT still has work to do; the discussion document still needs to be brought before us. As indicated, this is more complicated than it might seem at first. I certainly support protection of Georges Bank spawn herring; I always have. But 2019 is impractical.

Now if we found out that the Council for whatever reason, the Council of which I am part, is unable to do anything for 2020. Then that puts more of a burden on us; that is this Board, to consider action that would be as you indicated, Ritchie, a bit of kind of an interim action. But by then we would have the discussion document.

By then we would have a lot more information to use as a basis for doing something in 2020. I'm confident that the Council will move this forward relatively quickly; in light of the status of the stock, and of course the overall ACL. I hear what you're saying. I think 2019 really would not work; but I think 2020 is ripe for further ASMFC discussions on what to do.

CHAIRMAN KELIHER: Mr. Stockwell.

MR. STOCKWELL: I appreciate your concerns and comments. They essentially echo the position that I was ready to advocate for. I would like to add that in addition to the extremely low quotas, the likely implementation of the 12-mile buffer, which will add further protection south of the Cape. The question I have is what is the Commission's plan for the research money that was allocated; and how could this inform our collaborative process in the next year?

CHAIRMAN KELIHER: I don't believe we've made final decisions on the research money; but I'll pass it to Bob.

EXECUTIVE DIRECTOR BEAL: You're correct. We haven't made final plans. But the way I envisioned this is that the Working Group, the joint Council Commission, and Technical Folks that are working on the white paper or discussion document, whatever we're calling it. I think that is all part of that discussion; you know what data is available, what data is still needed?

Once we determine what data is still needed, they can decide what the best way to use that money. The good news is we don't have to spend that money in the next six or eight months. We've got about two years to spend that; so we've got plenty of time to use that money as wisely as possible, but it is all part of the same preliminary discussion that's happening now, the way I see it anyway.

CHAIRMAN KELIHER: Is that satisfactory, Terry? I would put one more item on the table as well. ACCSP dollars that have been funding monitoring in regards to herring, there is talk about tightening up and reallocating some of those dollars. I know the research set-aside dollars that are going to be much less that is funding the sampling in the Commonwealth will be lower.

We do have some additional challenges when it comes to sampling, if in fact we get to a point where we need to collect samples from spawning with the low quotas. Ali, sorry I should have been looking farther down the table.

MS. MURPHY: I appreciate your comments; as well as Mr. Stockwell's. We would be supportive of these two bodies working together to collaborate on this issue going forward.

CHAIRMAN KELIHER: To Dr. Pierce's tenor, we cooperate until we can't cooperate any more. Is that where you were going with that Dr. Pierce? Are there any additional comments on this item? Justin.

MR. DAVIS: Just a quick question. The discussion we're having here is about spawning closures on Georges Bank. Is that exclusive of the Nantucket Shoals spawning area, and if so, is it just because there is not enough available information to even think about spawning closures on Nantucket Shoals?

MS. WARE: The Council priority, and Terry correct me if I'm wrong, was focused on Georges Bank. The Commission Addendum was Area 3. There is a bit of a difference there that we will have to reconcile between the two bodies as we start to work on this document. But we do have a lack of data on Nantucket Shoals; that is true.

CHAIRMAN KELIHER: Dr. Pierce.

DR. PIERCE: I hadn't thought about that but it's true. But I suspect when we get deeper in discussions about protection of spawning on Georges Bank, the link between Nantucket Shoals and Georges Bank will become quite obvious. As a matter of fact, the scientific perspective, U.S. perspective is the Georges Bank we built after it had collapsed in the 1970s, and the early '80s that we built because of spawning on Nantucket Shoals that seeded the Georges Bank area.

That is the prevailing scientific opinion. There is a linkage there that has to be respected. I suspect that once our discussion document is completed, and once we have more discussions, you know with the Council staff. The connection will be obvious; and there will be no other option but to pursue an approach that would deal with the fishing in the Nantucket Shoals area right adjacent to Georges Bank, I mean they're connected. That is what I foresee.

CHAIRMAN KELIHER: Are there any additional comments? Seeing none; that was our last agenda item.

ADJOURNMENT

CHAIRMAN KELIHER: One more call for any additional business to be brought up to the Herring Board. Seeing none; a motion would be in order to adjourn. I didn't hear one, but motion to adjourn is accepted, thank you. Thanks everybody!

(Whereupon the meeting adjourned at 10:00 o'clock a.m. on February 5, 2019)

Atlantic States Marine Fisheries Commission

DRAFT ADDENDUM II TO AMENDMENT 3 TO THE ATLANTIC HERRING INTERSTATE FISHERY MANAGEMENT PLAN FOR BOARD REVIEW

Gulf of Maine Spawning Protections

ASMFC Vision: Sustainably Managing Atlantic Coastal Fisheries

April 2019

In February 2019, the Atlantic States Marine Fisheries Commission's (Commission) Atlantic Herring Management Board initiated the development of an addendum to Amendment 3 of the Interstate Fishery Management Plan (FMP) to provide options to strengthen spawning protections in Area 1A (inshore Gulf of Maine). This Draft Addendum presents background on the Commission's management of Atlantic herring, the addendum process and timeline, and a statement of the problem.

Commission's Process and Timeline

October 2018	Atlantic Herring Board Tasks PDT to Develop Draft Addendum II
Nov. 2018-Jan. 2019	PDT Develops Draft Addendum II for Public Comment
February 2019	Atlantic Herring Board Reviews Draft Addendum II and Considers Its Approval for Public Comment
February – April 4, 2019	Board Solicits Public Comment and States Conduct Public Hearings
May 2019	Board Reviews Public Comment, Selects Management Options and Considers Final Approval of Addendum II
TBD	Provisions of Addendum II are Implemented

Draft Addendum for Board Review

1. INTRODUCTION

The Atlantic States Marine Fisheries Commission (ASMFC) is responsible for managing Atlantic Herring (*Clupea harengus*), under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACFMA). The U.S. Atlantic herring fishery is currently managed as a single stock through complementary fishery management plans (FMPs) by ASMFC and the New England Fishery Management Council (NEFMC). ASMFC has coordinated interstate management of Atlantic herring in state waters (0-3 miles) since 1993. Management authority in the exclusive economic zone (EEZ, 3-200 miles from shore) lies with the NEFMC and National Marine Fisheries Service (NMFS).

Atlantic herring reproduce by spawning (releasing) eggs each year in the fall and early winter months. To protect aggregations of spawning fish and support the sustainability of the resource, spawning closures are annually implemented in the Gulf of Maine (GOM). The start of these closures is determined by the collection of biological samples which are used to project inter-annual changes in the timing of spawning. The closures are initially implemented for four weeks, but can be extended for two additional weeks if sampling indicates the continued presence of spawning fish.

Results of the 2018 Benchmark Stock Assessment indicate that the health of the Atlantic herring resource has declined in recent years. Specifically, the Assessment found that recruitment has been well below the time-series average since 2013, with 2016 representing the lowest level of recruitment on record (NEFSC 2018). In addition, spawning stock biomass, a measure of the reproductively mature portion of the population, has decreased.

Given this new stock information, the Board initiated Draft Addendum II in October 2018 to consider strengthening the protections provided to spawning herring in Area 1A (Figure 1). This document considers extending the length of the spawning closures as well as altering the point at which they are triggered, in order to provide greater protection to the stock.

2. OVERVIEW

2.1 Statement of the Problem

The 2018 Benchmark Stock Assessment indicated significant declines in recruitment in the Atlantic herring stock, particularly over the last five years. This suggests a reduction in herring biomass in the coming years. Given successful spawning and recruitment are essential to the future health of the resource and fishery, the Board initiated Draft Addendum II to consider strengthening the protections provided to spawning herring in the Gulf of Maine. Specifically, the Draft Addendum considers management alternatives related to the length of a spawning closure and the point at which a spawning closure is initiated.

2.2 Background

2.2.1 Atlantic Herring Spawning

Atlantic herring primarily spawn in the northern extent of the species range (Cape Cod to Newfoundland). Within the Gulf of Maine-Georges Bank stock complex, three primary spawning regions have been identified: 1) the coast of Gulf of Maine; 2) Georges Bank; and 3) Nantucket Shoals. Each of these primary spawning areas are comprised of smaller, discrete spawning sites (e.g. Jeffreys Ledge in the Gulf of Maine). Figure 2 provides an overview of known herring spawning locations in New England waters.

Atlantic herring generally reproduce in the late summer and fall; however, the onset and duration of spawning may vary by several weeks from year to year (Winters and Wheeler, 1996). In addition, spawning typically occurs earlier in the eastern Gulf of Maine as opposed to the western Gulf of Maine and waters off of Massachusetts and New Hampshire (Reid et al., 1999).

When spawning, herring deposit adhesive eggs that stick to coarse sand, pebbles, cobbles, and boulders on the ocean floor (NEFMC 2018). Essential fish habitat identified for herring eggs include benthic habitats of inshore and offshore Gulf of Maine, Georges Bank, and Nantucket shoals in depths of 5-90 meters (NEFMC 2018). Eggs are often laid in layers, creating mats along the ocean floor. A single female herring can produce between 55,000 and 210,000 eggs (Kelly and Stevenson, 1983). Once hatched, herring larvae can be found in the inshore and offshore pelagic habitats of the Gulf of Maine, Georges Bank, and in the upper Mid-Atlantic Bight (NEFMC 2018).

2.2.2 Benchmark Stock Assessment

Results of the 2018 Stock Assessment presented concerning trends for the Atlantic herring resource. The assessment showed that age-1 recruitment has been below the time-series average for the last five years (Figure 3) (NEFSC 2018). In addition, four of the six lowest estimates of recruitment have occurred in recent years (2013, 2015, 2016, and 2017) (NEFSC 2018). While the assessment did note that recruitment estimates at the end of the model time series may have greater uncertainty, the document highlighted that 2016 represented the lowest level of annual recruitment on record (NEFSC 2018).

Overall, the assessment concluded that, in the terminal year of the model (2017), the stock is not overfished and overfishing is not occurring; however, the assessment did state that, given declines in recruitment, spawning stock biomass is likely to remain low, putting the stock at risk of being overfished (NEFSC 2018). In addition, the assessment noted that without improved recruitment, the probability of overfishing in the future is high (NEFSC 2018).

2.2.3 Existing Gulf of Maine Spawning Closure Protocol

Under Amendment 3, spawning aggregations in the Gulf of Maine are protected through the use of spawning closures. These closures prohibit directed fishing during specific times of the year in three distinct areas: Eastern Maine, Western Maine, and Massachusetts/New

Hampshire (Figure 1). Based on the goals of the Atlantic Herring Fishery Management Plan (which include providing adequate protection for spawning herring, preventing overfishing of discrete spawning units, achieving full utilization of herring catch, and maximizing social and economic benefits of the fishery), these spawning closures look to reduce interaction between fishing and spawning while also providing access to quota (ASMFC 2016).

The implementation of the spawning closures is determined by the GSI_{30} protocol. For female herring, GSI is a calculation of the gonad (ovary) mass as a proportion of the total body mass and it is used to measure herring maturity. Per the GSI_{30} protocol, three or more samples of herring, either from fishery independent or dependent sources, are used to model the relationship between GSI and date, and forecast the timing of spawning. Given larger herring spawn first, the GSI values are standardized to a 30 cm fish to ensure protection of the majority of the population. If there are insufficient samples in a given year and area to forecast the timing of spawning, a default closure date is used. This default date is derived from historical GSI samples over the last decade as well as applicable literature.

The initiation of a spawning closure is determine by a trigger value established in Amendment 3. The relationship between GSI and the date is monitored as the season progresses and compared to the trigger value; when GSI is projected to exceed the trigger value, a spawning closure is implemented. Generally, a higher trigger value closes the fishery later and closer to spawning while a lower trigger value provides additional protection to maturing fish by encompassing time before the spawning season begins. Through Amendment 3, the Section implemented a GSI trigger value of 25 which sought to close the fishery in the later stages of maturity but just before spawning.

Under Amendment 3, the length of a spawning closure is initially set at four weeks. A closure can be extended by two weeks if a sample taken from the area indicates a significant number of spawning herring. A 'significant number' of spawn herring is defined as 25% or more mature herring, by number in a sample, that have yet to spawn. To qualify, a sample must have a minimum of 80 randomly selected adult sized fish.

A full copy of the spawning closure protocol can be found in Section 4.2.6 of Amendment 3. Implementation dates of spawning closures from 2015-2018 can be found in Table 1.

<u>2.2.4 Evaluation of Current Protections</u>

In a January 2018 memo to the Board (Dean *et al.,* 2018; included as Appendix 1), the Atlantic Herring Technical Committee (TC) evaluated the performance of the GSI_{30} spawning closure protocol. The aim of this review was to assess whether the program was meeting its objectives, given it had been implemented two years prior. Data used in this evaluation included spawning samples collected through 2017. The memo evaluated several components of the GSI_{30} protocol, including the trigger value and the length of the closure, and updated the calculation of default closure dates. The TC also looked at the overall success of the GSI_{30} protocol and concluded that it represents a significant improvement over the previously used system as it is better able to respond to inter-annual changes in the timing of spawning (Dean *et al.,* 2018).

One of the questions evaluated in the TC memo was whether spawning commences near the current trigger value. This is an important question to ask since initiating a closure too early or too late may diminish the effectiveness of the spawning closures. To answer this question, the TC compared the start of spawning closures in Massachusetts/New Hampshire to the estimated percentage of spawning herring in the population (Dean *et al.,* 2018). Only closures in the Massachusetts/New Hampshire spawning area were evaluated given significantly fewer samples have been collected in Eastern Maine and Western Maine. Overall, the TC found that, from 2015 to 2017, the current GSI_{30} trigger value (25) resulted in a spawning closure that started within a few days of when the population reached 25% spawning (Figures 4 and 5) (Dean *et al.,* 2018). For example, in 2017, the spawning closure started 2 days prior to there being approximately 25% spawning herring in the population.

An important question to ask following the TC's analysis is whether initiating a closure when approximately 25% of the population is spawning is appropriate given the condition of the stock. The TC's memo does note that reducing the GSI_{30} trigger value would initiate a spawning closure earlier and would reduce the probability of exceeding 25% spawning fish in the catch (Figure 5). However, it is important to note that a lower trigger value corresponds with an earlier default date which may precipitate the need for a longer closure to provide protection throughout the spawning season (Dean *et al*., 2018). In addition, lowering the trigger value may shorten the time available to collect spawning samples and project a closure given the earlier default date.

The TC memo also evaluated whether the existing four week closure period is sufficient to cover the typical spawning season. To conduct this analysis, the TC defined a spawning season as starting when 25% of the herring population has begun spawning and ending when 75% of the herring population has ended spawning (Dean *et al.,* 2018). The TC then compared the lengths of the spawning seasons under this definition. The analysis showed that, between 2015 and 2017, spawning seasons in the Massachusetts/New Hampshire area were 4 weeks, 2.3 weeks, and 4.9 weeks, respectively (Figure 4). The TC expressed greater confidence in the longer spawning season estimates given a significantly higher number of samples in 2015 and 2017. Based on these results, the TC concluded that use of the 4 week initial spawning closure would likely result in frequent use of the re-closure protocol (Dean *et al.,* 2018). The TC also noted that if the Section was interested in simplifying the closure protocol and increasing protection during spawning, the Section could consider a longer initial closure period of five to six weeks (Dean *et al.,* 2018). Notably, longer closure periods may result in a greater overlap between the three spawning closures, resulting in multiple areas being closed at the same time.

It is important to highlight that the trigger value and the closure length are interconnected components of the spawning closure protocol. Earlier trigger values which decrease the percentage of spawning herring in the catch result in longer spawning seasons (Figure 6). As a result, under a lower trigger value, a longer closure may be needed to provide protection throughout the spawning season. Table 2 outlines the relationship between the trigger value and the approximate length of the spawning closure season. Specifically, it shows that as the trigger values decrease, the percentage of spawning herring in the population at the start of the closure also decreases but the average length of the spawning season increases. For example, under a trigger value of 23, a spawning closure is initiated when approximately 20% of the herring population is spawning and the average spawning season length is 4.3 weeks (but can range up to 5.7 weeks). Under a trigger value of 22, a spawning closure is initiated when approximately 15% of the herring population is spawning and the average spawning season length is 5.1 weeks (but can range up to 6.6 weeks).

2.2.5 Overview of Herring Fishery

The domestic Atlantic herring fishery is predominately commercial. Landings in the Atlantic herring fishery increased in the 1960's, peaking in 1968 at 477,767 mt (1.05 billion pounds; NEFSC 2018), largely due to a foreign fishery which developed on Georges Bank. Catch declined in the early 1980's to 44,613 mt (98.4 million pounds) in 1983 but subsequently increased through the late 1980's and early 1990's (NEFSC 2018). Landings in the 2000's were fairly stable around 113,358 mt (250 million pounds) but have decreased over the last four years to 50,250 mt (111 million pounds) in 2017 (NEFSC 2018).

Several gear types participate in the Atlantic herring fishery, including mid-water trawls, purse seines, small mesh bottom trawls, and fixed gear. In recent years, the majority of Area 1A landings have come from purse seiners (80% of landings between 2012 and 2015). Historically, 0% of the Area 1A sub-ACL has been allocated to the months of January – May. In addition, vessels using single and paired midwater trawls are prohibited from fishing for Atlantic herring in Area 1A between June 1 and September 30.

In recent years, the greatest amount of herring from Area 1A has been landed in July and August (Table 3). Specifically, between 2015 and 2017, average herring landings in July and August were 6,067 mt and 7,564 mt, respectively. Average Area 1A landings were lower in September (2015-2017 average is 2,688 mt) and then increased again in October (2015-2017 average is 5,768 mt). This increase in October coincides with mid-water trawl vessels being permitted to fish for herring in Area 1A. Monthly landings trends are likely impacted by the existing spawning closures, which occur in the fall and prohibit directed fishing for herring in portions of Area 1A.

The 2018 annual catch limit (ACL) for the Atlantic herring fishery was originally set at 111,000 mt. However, in response to results from the 2018 Benchmark Stock Assessment (see *Section 2.2.2*), NOAA Fisheries took an in-season action to reduce the 2018 ACL to 49,900 mt in order to decrease the risk of overfishing in 2018 and increase the estimated herring biomass in future years. It is expected that ACLs in 2019 through 2021 will continue to be low given the condition of the stock; a proposed ACL for 2019 is 24,488 mt. Given these low quotas, it is possible that the directed herring fishery will catch the majority of Area 1A sub-ACL prior to the implementation of spawning closures in the fall. As a result, the full benefits and/or costs of changes to the spawning protocol may not be evident for several years.

3. MANAGEMENT PROGRAM

The management alternatives in this section consider modifying the provisions of *Section 4.2.6: Spawning Restrictions* in Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring. Table 2 outlines the relationship between the GSI_{30} trigger value and the closure length. Table 4 summarizes all the alternatives under consideration.

Issue 1: GSI_{30} Trigger Value

The default closure dates in Option A represent those implemented under Amendment 3. In Options B-D, additional spawning samples collected through 2017 were used to update the calculation of default dates (analysis based on samples from 2005-2017). The Eastern Maine default closure date does not change between the GSI_{30} trigger values as, due to a low number of spawning samples collected to in that area, the default date is based on literature.

Option A: Status Quo (GSI_{30} Trigger Value = 25)

Under this option, the GSI_{30} trigger value is 25. This option closes the fishery in the later stages of maturity but just before spawning. The default closure dates associated with this trigger value are those implemented in Amendment 3.

Eastern Maine	August 28
Western Maine	October 4
Massachusetts/New Hampshire	October 4

Option B: GSI_{30} Trigger Value = 25 with Updated Default Dates

Under this option, the GSI_{30} trigger value is 25. This option closes the fishery in the later stages of maturity but just before spawning. The default closure dates associated with this trigger value have been updated to incorporate additional spawning samples collected through 2017.

Eastern Maine	August 28
Western Maine	October 1
Massachusetts/New Hampshire	October 1

Option C: GSI_{30} Trigger Value = 23

Under this option, the GSI_{30} trigger value is 23. This option closes the fishery at an earlier date to provide more protection to pre-spawning fish and reduces the probability of catching spawning fish at the beginning of the spawning season; however, it may not provide complete protection to spawning fish toward the end of the season, unless the closure length is extended (Issue 2). The default closure dates associated with this trigger value are below.

Eastern Maine	August 28
Western Maine	September 23
Massachusetts/New Hampshire	September 23

Option D: Trigger Value = 22
Under this option, the GSI_{30} trigger value is 22. This option provides the earliest date to close the fishery, providing the greatest protection to pre-spawning fish; however, it may not provide protection to spawning fish toward the end of the season, unless the closure length is extended (Issue 2). The default closure dates associated with this trigger value are below.

Eastern Maine	August 28
Western Maine	September 19
Massachusetts/New Hampshire	September 19

Issue 2: Spawning Closure Length
Option A: Status Quo (Four Week Initial Closure)
Under this option, the spawning closures established in Area 1A extend for four (4) weeks. As shown in Table 2, for a GSI_{30} trigger value of 25, a four week closure is slightly longer than the average spawning season of 3.7 weeks but shorter than the maximum observed spawning season of 4.9 weeks.

Option B: Five Week Initial Closure
Under this option, the spawning closures established in Area 1A extend for five (5) weeks. As shown in Table 2, for a GSI_{30} trigger value of 25, a five week closure is longer than maximum spawning season observed of 4.9 weeks. For a GSI_{30} trigger value of 23, a five week closure is longer than the average spawning season of 4.3 weeks but shorter than the maximum observed spawning season of 5.7 weeks.

Option C: Six Week Initial Closure
Under this option, the spawning closures established in Area 1A extend for six (6) weeks. As shown in Table 2, for a GSI_{30} trigger value of 25 and 23, a six week closure is longer than the maximum observed spawning season of 4.9 weeks and 5.7 weeks, respectively. For a GSI_{30} trigger value of 22, a six week closure is longer than the average spawning season of 5.1 weeks but shorter than the maximum observed spawning season of 6.6 weeks.

Option D: Eight Week Initial Closure
Under this option, the spawning closures established in Area 1A extend for eight (8) weeks. As shown in Table 2, an eight week closure is longer than the maximum spawning season length for all trigger value alternatives and may reduce the need for a re-closure protocol.

Issue 3: Re-closure Protocol
Option A: Status Quo
A spawning closure can be extended for two (2) additional weeks if one (1) sample taken from within a spawning closure area, by Maine, New Hampshire or Massachusetts, indicates a significant number of spawn herring. Sampling will resume in the final week of the initial closure period or at the end of the initial closure period. Mature or 'spawn' herring are defined as Atlantic herring in ICNAF gonadal stages V and VI. A sample is defined as a minimum of 80

randomly selected adult sized fish, with a target of 100 fish, from a fishery dependent or independent source.

Sub-Option 1 (Status Quo): In the re-closure protocol, a ‘significant number’ of spawn herring is defined as 25% or more mature herring, by number in a sample, that have yet to spawn. This corresponds to the percentage of spawning herring in the population when an initial closure is implemented under a trigger value of 25.

Sub-Option 2: In the re-closure protocol, a ‘significant number’ of spawn herring is defined as 20% or more mature herring, by number in a sample, that have yet to spawn. This corresponds to the percentage of spawning herring in the population when an initial closure is implemented under a trigger value of 23.

Sub-Option 3: In the re-closure protocol, a ‘significant number’ of spawn herring is defined as 15% or more mature herring, by number in a sample, that have yet to spawn. This corresponds to the percentage of spawning herring in the population when an initial closure is implemented under a trigger value of 22.

Option B: No Re-Closure Protocol
There is no re-closure of a spawning closure. As a result, samples will not be collected at the end of an initial closure period to inform the possibility of a re-closure and a closure cannot be extended.

4. COMPLIANCE SCHEDULE

If the existing Atlantic herring management plan is revised by approval of this draft addendum, the Atlantic Herring Management Board will designate dates by which states will be required to implement the addendum. A final implementation schedule will be identified based on the management tools chosen.

5. LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2016. Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring. 105p.

Kelly, K. and D.K. Stevenson. 1983. Comparison of reproductive characteristics and age composition of Atlantic herring (Clupea harengus) spawning groups in the Gulf of Maine. Maine Dept. of Mar. Resources. Res. Ref. Doc. 83/29: 46 pp.

Northeast Fisheries Science Center. 2018. 65th Northeast Regional Stock Assessment Workshop (65th SAW) Assessment Summary Report. Northeast Fisheries Science Center Reference Document 18-08.

Overholtz, W.J., Jacobson, L.D., Melvin, G.D., Cieri, M., Power, M., Libby, D. and K. Clark. February 2004. Stock Assessment of the Gulf of Maine – Georges Bank Atlantic Herring Complex, 2003. Northeast Fisheries Science Center Reference Document 04- 06.

Reid, R., F. Almeida, and C. Zetlin. 1999. Essential fish habitat source document: Fishery independent surveys, data sources, and methods. NOAA Tech. Mem. NMFS-NE-122. 39 p.

Winters, G. H., and J. P. Wheeler. 1996. Environmental and phenotypic factors affecting the reproductive cycle of Atlantic herring. ICES Journal of Marine Science 53:73-88.

Dean, M., Cieri, M., and R. Zobel. 2018. A Review of the modified Gonadal-Somatic Index (GSI) Monitoring System for Atlantic Herring Spawning Closures in US Waters. http://www.asmfc.org/uploads/file/5a95d99eHerringSpawningClosureReport_Jan2018.pdf

New England Fishery Management Council (NEFMC). 2018. Amendment 8 to the Atlantic Herring Fishery Management Plan Draft Environmental Impact Statement. Volume 1. https://s3.amazonaws.com/nefmc.org/Herring-A8-DEIS.Submission.April-12.pdf

6. TABLES

Table 1: Area 1A spawning closure implementation dates from 2015 – 2018. Bolded text represents spawning closures which were enacted via the default date. It is important to note that the 2015 closures were implemented under the previously used length-based spawning closure protocol given Amendment 3 was not finalized until 2016.

	Eastern Maine	Western Maine	Massachusetts/New Hampshire
2015	**Aug. 15 – Sept. 11**	**Sept. 1 – Sept. 28**	**Sept. 21 – Oct. 18;** Re-closure Oct. 21 – Nov. 3
2016	**Aug. 28 – Sept. 24**	Sept. 18 – Oct. 15	Oct. 2 – Oct. 29
2017	**Aug. 28 – Sept. 24** Re-closure Oct. 16 – Oct. 30	Sept. 26 – Oct. 24	Oct. 1 – Oct. 28 Re-closure Oct. 29 – Nov. 11
2018	**Aug. 28 – Sept. 24**	**Oct. 4 – Oct. 31**	Oct. 26 – Nov. 22

Table 2: Relationship between GSI_{30} trigger value, approximate percentage of spawning herring in population when the closure begins, and spawning season length. Average spawning season lengths are based on data from 2015-2017. The range of spawning season lengths represents the shortest and longest spawning season length between 2015 and 2017 for each trigger value.

GSI_{30} Trigger Value	Approx. % of Spawners in Population When Closure Begins	Avg. Spawning Season Length (2015-2017)	Range of Spawning Season Length
25 (status quo)	25%	3.7 weeks	2.3 – 4.9 weeks
23	20%	4.3 weeks	2.7 – 5.7 weeks
22	15%	5.1 weeks	3.4 – 6.6 weeks

Table 3: Average Atlantic herring Area 1A landings (in metric tons) by month for 2015-2017. During these years, the directed herring fishery in Area 1A began in June and, as a result, the months of January – May are not shown in the table.

Month	Average 2015-2017 Landings (mt)
June	3,098
July	6,067
August	7,564
September	2,688
October	5,768
November	2,040
December	837

Table 4: Summary of options under consideration in this action

Trigger Value (Issue 1)	Closure Length (Issue 2)	Re-closure (Issue 3)
Option A (Status quo – Trigger of 25)	Option A (4 weeks – corresponds to trigger value options A or B)	Option A1 (re-closure if 25% or more mature herring; percentage corresponds to trigger value options A or B)
Option B (Trigger of 25 with updated default dates)	Option B (5 weeks – corresponds to trigger value options A, B or C)	Option A2 (re-closure if 20% or more mature herring; corresponds to trigger value option C)
Option C (Trigger of 23)	Option C (6 weeks – corresponds to all trigger value options)	Option A3 (re-closure if 15% or more mature herring; corresponds to trigger option D)
Option D (Trigger of 22)	Option D (8 weeks – corresponds to all trigger value options, minimizes need for re-closure)	Option B (no re-closure protocol; could be selected with any of the trigger values but problematic with shorter closure length options)

7. FIGURES

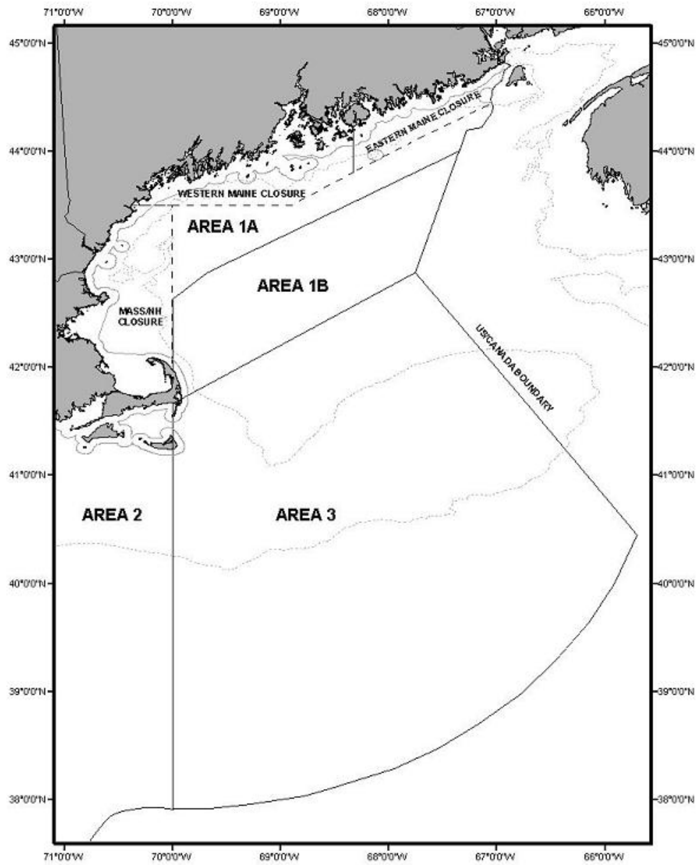


Figure 1: Atlantic herring management areas and spawning closure areas in the Gulf of Maine.

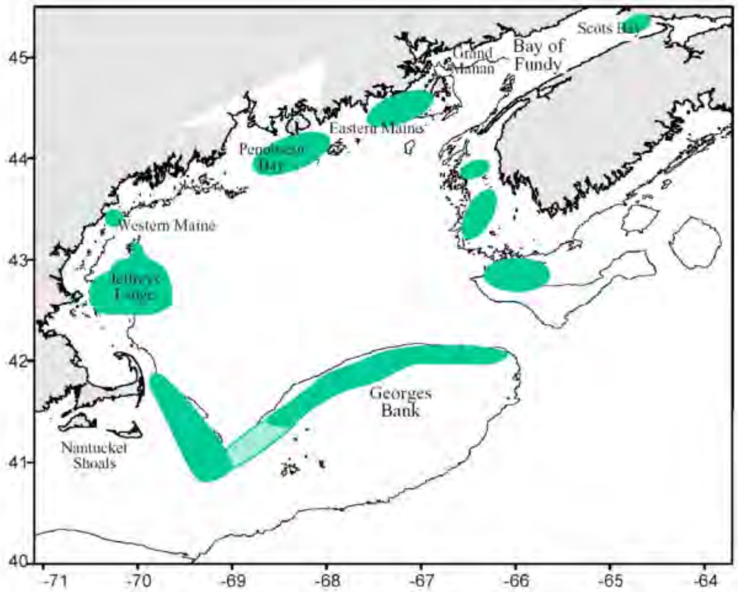


Figure 2: Overview of major Atlantic herring spawning areas, identified in green, in the Gulf of Maine and on Georges Bank. Source: Overholtz et al. 2004.

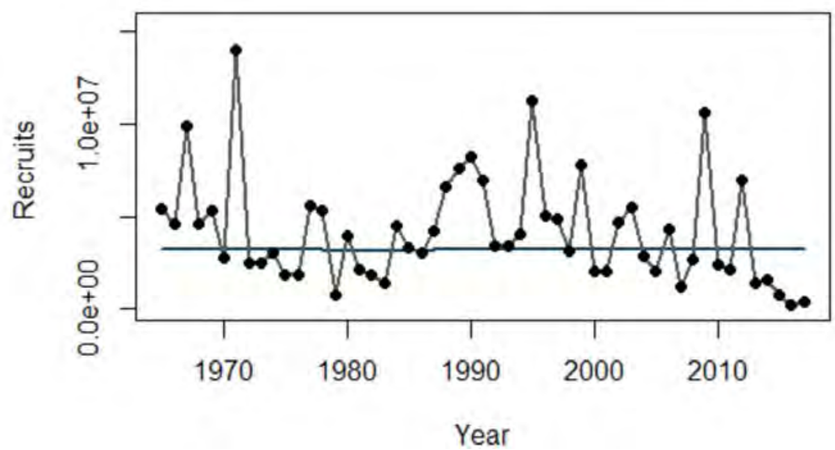


Figure 3: Atlantic herring annual recruitment, in 1000's, from 1965-2017. The horizontal line is the time-series average. Source: NEFSC 2018.

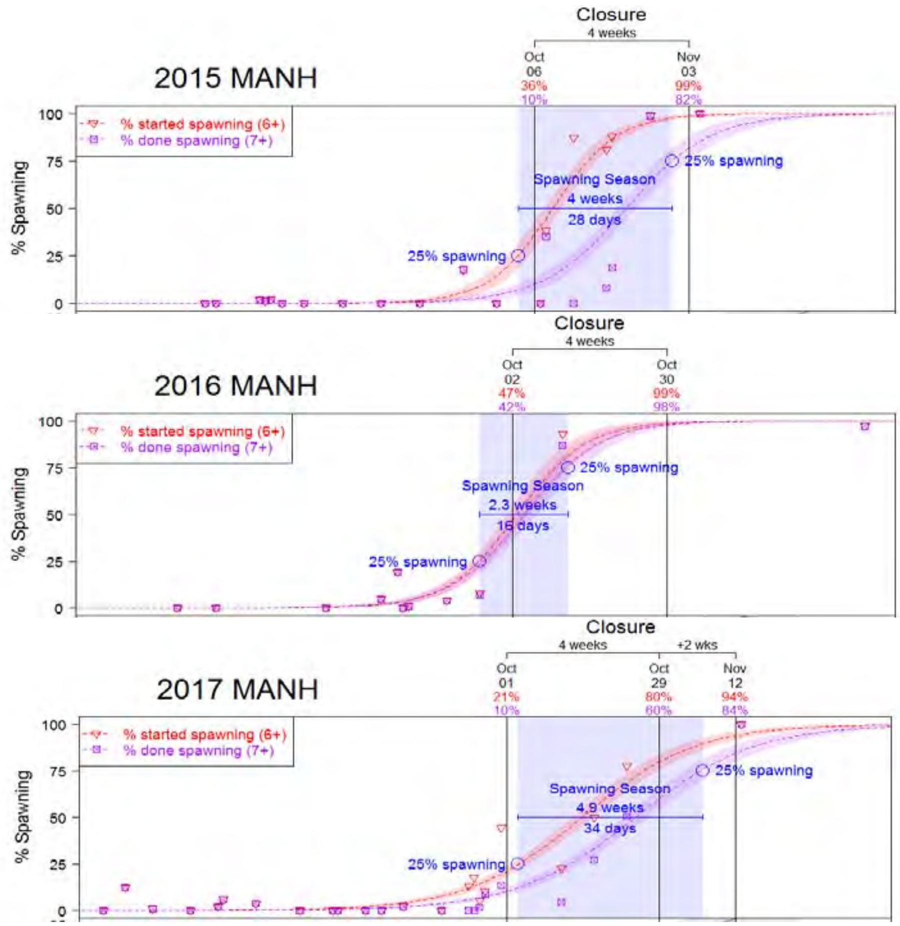


Figure 4: Estimated spawning seasons under the current GSI_{30} spawning closure protocol for the Massachusetts/New Hampshire spawning area in 2015 through 2017. The spawning season is identified by the blue shaded regions while the black vertical lines represent the spawning closures enacted by management. The length of the spawning season is calculated as starting when 25% of the herring population has begun spawning and ending when 75% of the herring population has ended spawning. The trigger value used to initiate the spawning closures was 25. In 2017, there was the use of the two week re-closure protocol given the continued presence of spawning herring. It is important to note that in 2015, the previously-used spawning closure protocol was used to determine the spawning season, as opposed to the GSI_{30} protocol shown above. As a result, the 2015 closure dates shown above do not match those in Table 1. Source: Dean et al. 2018.

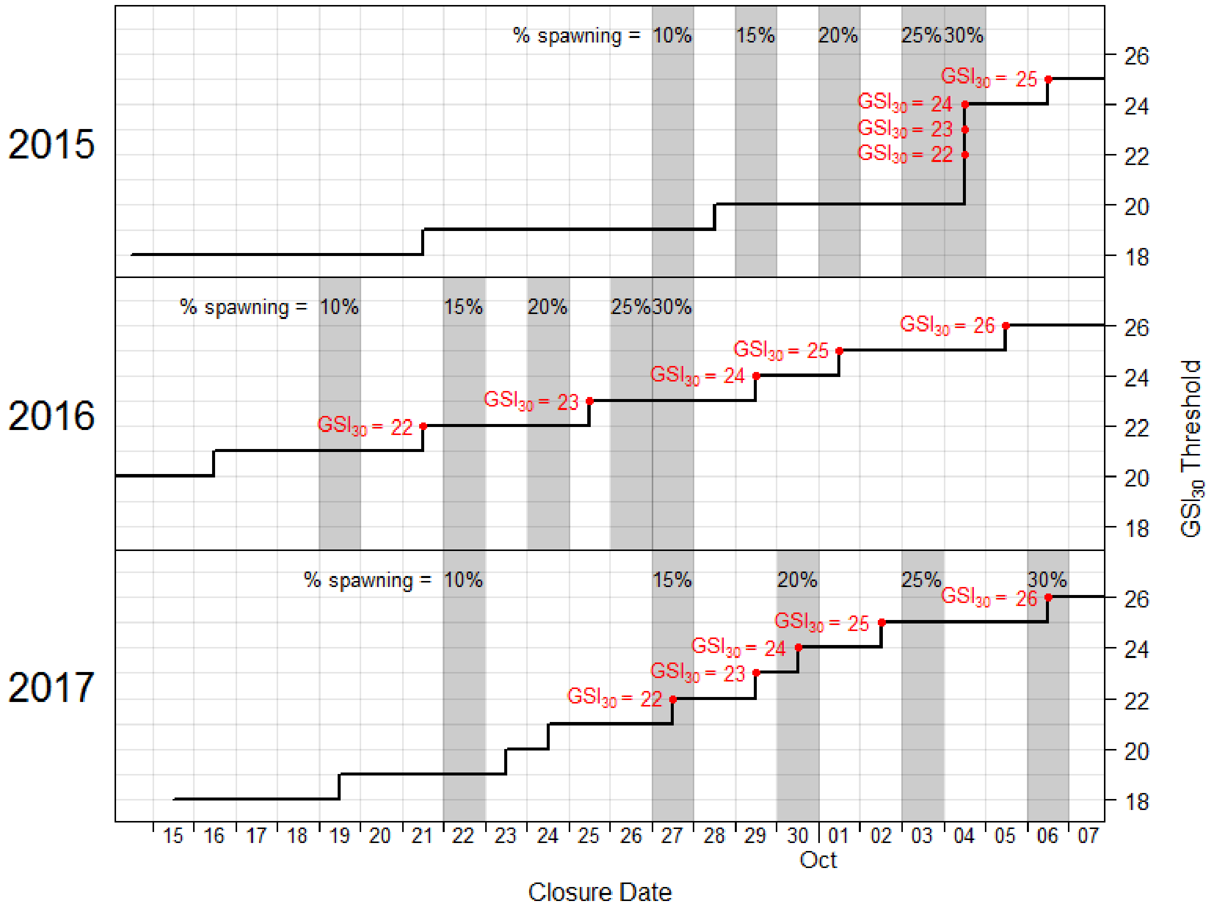


Figure 5. Date when the Massachusetts/New Hampshire spawning closure would have started, under different GSI_{30} trigger values. The vertical gray bands indicate the percent of the population expected to be spawning for that trigger value in a given year. Note: in 2015, spawning closures under GSI_{30} trigger values 24, 23, and 22 all would have started on the same date due to a lack of resolution in the samples; several samples were collected at the beginning of spawning but few were taken when approximately 15%-25% of the population was estimated to be spawning. Source: Dean et al. 2018.

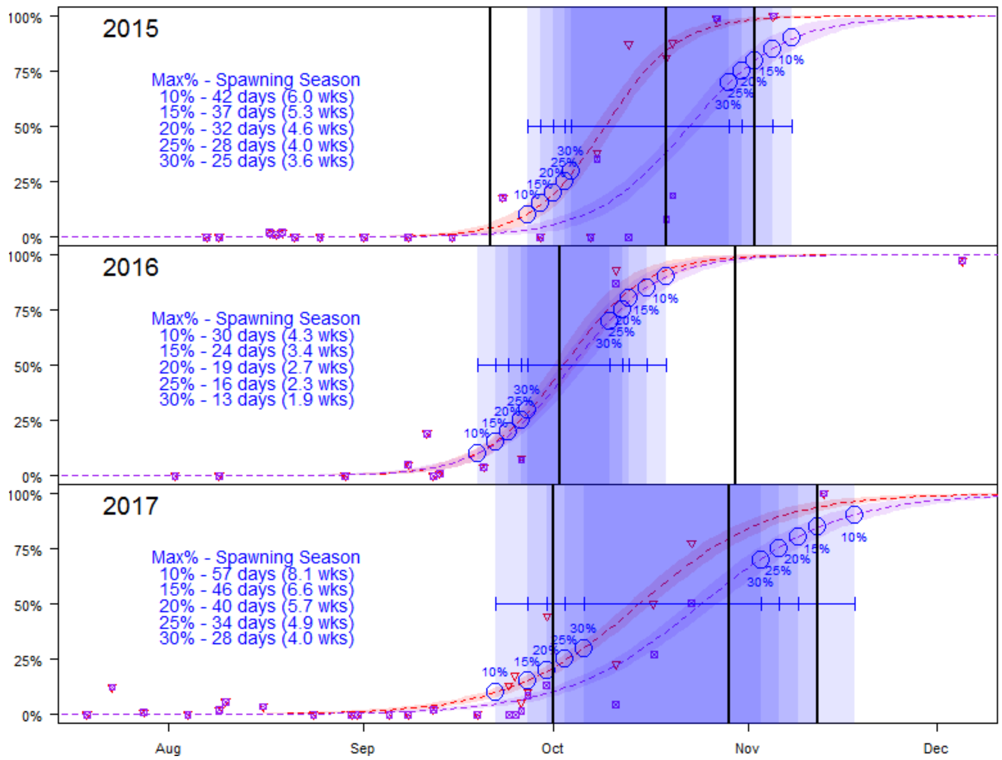


Figure 6. Effect of choice of maximum allowable percentage spawning in the catch on duration of the spawning season. This figure shows that as a lower percentage of spawning fish in the catch is required, the length of the season closure extends. Source: Dean et al. 2018.

Appendix 1

Atlantic States Marine Fisheries Commission

A Review of the modified Gonadal-Somatic Index (GSI) Monitoring System for Atlantic Herring Spawning Closures in US Waters

By Micah Dean (Massachusetts Division of Marine Fisheries)
Dr. Matt Cieri (Maine Department of Marine Resources)
and Renee Zobel (New Hampshire Department of Fish and Game)
Of the ASMFC Atlantic Herring Plan Development Team
January 2018

Introduction

In 2015, the ASMFC adopted Amendment 3 to the Atlantic Herring FMP, which established a new model-based GSI monitoring program for herring spawning closures. This closure system, first implemented in 2016, replaced an earlier program that had operated for more than 15 years. The earlier system relied on monitoring the development of female herring (stages 3-5) within 2 size classes and compared the average observed GSI of each size class to its own threshold. Once three consecutive samples within a week showed that either size class exceeded their threshold, the fishery would close. If three consecutive samples were not available in the week prior, area-specific default closure dates would apply. Amendment 3 sought to critically evaluate the parameters and assumptions of this earlier system (size classes, GSI thresholds, default dates, closure duration) and implement modifications to improve performance.

Since the adoption of Amendment 3, there has been a concerted effort to collect GSI and maturity data from all sampled herring (not just stage 3-5 females) throughout the entire spawning season, including during the closure period. These new data provide an invaluable perspective from which to evaluate the performance of the current spawning closure program. The aim of this paper is to review the current spawning closure system in light of these new data, and evaluate the validity of the model's assumptions and whether the program in general is meeting its objectives.

Program Objectives

There are four main objectives of the ASMFC herring spawning closure program:

1) *Reduce interaction between fishing and spawning:*

From a management perspective, it is impractical to eliminate *all* fishery-spawning interaction and still allow full utilization of the annual quota. Consequently, there must be some acceptable low level of spawning fish present in the catch both before and after the spawning closure. A long-established rule allows the fishery to operate if a sample contains less than 25% spawning fish after the closure has been lifted (i.e., re-closure protocol). For the purpose of this review, we will mirror this logic and consider <25% spawning to be acceptable at the beginning of the season as well.

2) *Maximize coverage of the spawning season AND access to quota*:

To provide the greatest benefit with the least cost, the spawning closure should ideally cover the spawning season and no more. This requires understanding the timing and duration of spawning and aligning the closure system to the reproductive cycle. Closing the fishery too early or too late may unnecessarily restrict the fishery and provide inadequate protection for spawning herring.

3) *Account for interannual variation in spawning time*:

The onset of spawning in Atlantic herring can vary by several weeks from one year to the next. Measuring gonadal development via sequential GSI samples allows for predicting when spawning is likely to commence each year. Over-reliance on fixed closure dates (i.e., "default" dates) increases the possibility of a mismatch between the closure and spawning.

4) *Allow flexibility to extend closures, if necessary*:

Given the observation error inherent in small samples from a high-volume fishery, combined with the natural variability in reproductive biology, there may be instances when the timing and duration of the spawning closure is insufficiently matched to the actual spawning season. In these cases, a backup measure is needed to prevent the fishery from opening prematurely to significant spawning activity.

Current Closure Protocol

Samples are routinely collected from the directed herring fishery as it operates within the three defined spawning areas (EM = Eastern Maine; WM = Western Maine; MANH = Massachusetts/New Hampshire). Samples of 100+ fish are collected and the GSI of female herring in maturity stages 3-5 are recorded. To account for the effect of length on GSI, all values are standardized to that of a 30 cm fish (i.e., GSI_{30}), using a previously established formula. Once three samples from a given spawning area have been collected and processed, a linear model is fit to the mean GSI_{30} of stage 3-5 females, using sample date as the sole predictor variable. If a significant increase in GSI_{30} can be detected ($\alpha = 0.05$), the model is used to predict the closure date (i.e., when the threshold value of $GSI_{30} = 25$ will be reached). The model and predicted closure date are updated as additional samples are collected. Once the predicted closure date is five days away, the closure date is announced to the fishery (and thus 'fixed', regardless of subsequent samples). If an update to the model predicts that the threshold value will be reached in less than five days, the closure date will be set at five days from the model update date (i.e., a five day notice to the fishery will always be provided). If there are insufficient samples to predict a closure date, a default closure date, which represents the average date that the threshold value would have been reached in past sampling seasons, will apply.

Validity of Assumptions

Several assumptions underlie the current spawning closure program. The validity of each is evaluated here using recent full-season maturity and GSI data for the Massachusetts-New

Hampshire (MANH) spawning area. Unfortunately, a lack of samples from the other spawning areas (Western Maine, Eastern Maine) prevents an equivalent analysis.

Assumption 1: Larger herring arrive and spawn earlier than smaller herring
It has long been noted that within a sample of fish, the GSI of smaller herring is less than that of larger herring. However, during the re-design of the spawning closure program, existing data suggested that this was due to larger herring maturing earlier, and that all sizes approached a similar maximum GSI prior to spawning. Consequently, the length effect on GSI was estimated from sample data and used to adjust all GSI values to that of a standard length (i.e., GSI_{30} = expected GSI of a 30 cm female herring).

Recent data confirm this assumption in that larger herring comprise a greater portion of fishery samples early in the season, and are replace by smaller fish as the spawning season progresses (Figure 1). In addition, the average size of fish decreases sequentially as the population moves through the maturity stages (Figure 2). This suggests that not only are larger fish present earlier; they are also maturing and likely spawning before smaller fish. The 30 cm standardization also appears to be having the desired effect of combining information from all sizes to achieve a more consistent measure of the maturation for the spawning population as a whole (Figure 3).

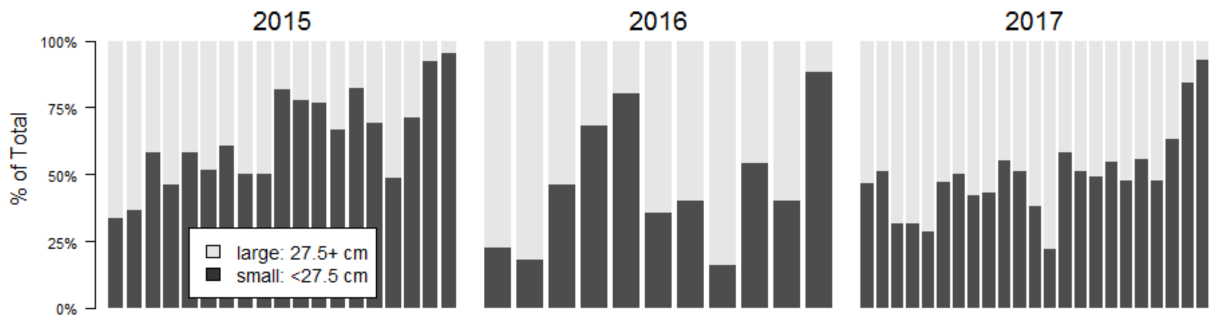


Figure 1. Fraction of herring in “large” or “small” size classes over the sequence of samples from the Massachusetts-New Hampshire spawning area, 2015-2017.

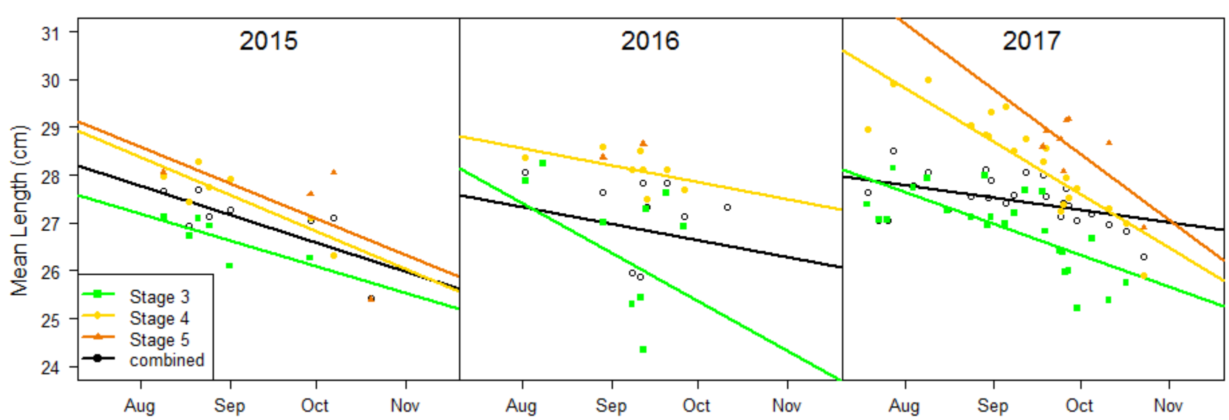


Figure 2. Mean length (cm) of female herring sampled for GSI, by maturity stage and sample date.

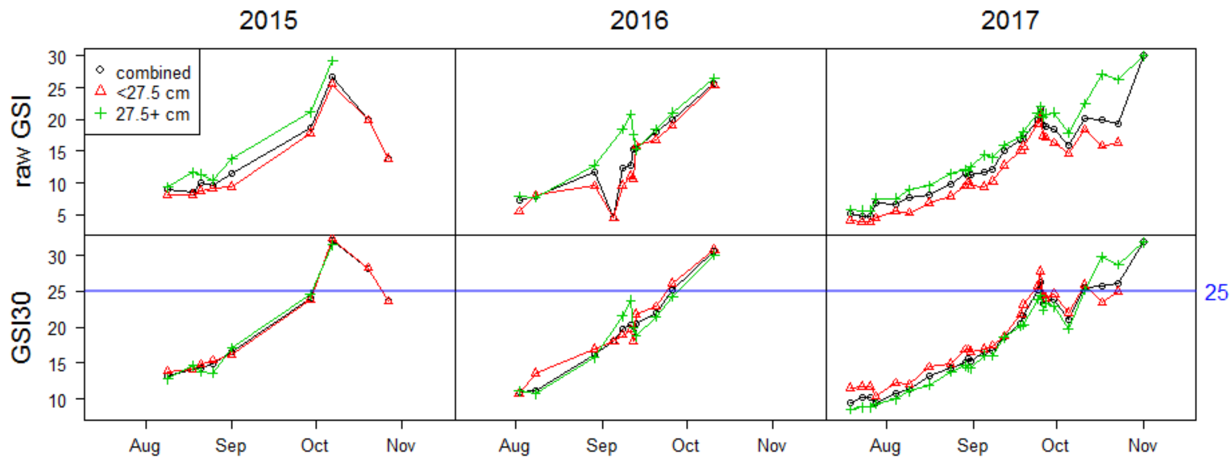


Figure 3. Mean GSI (top) and mean GSI_{30} (bottom) by sample year, date, and size class.

Assumption 2: Spawning commences near the closure threshold of $GSI_{30} = 25$

To adequately address this assumption, we need an objective measure of when spawning actually occurs. Prior to the collection of full-season maturity data, the only information available to us were pre-spawning GSI measurements from prior seasons. As such, the closure threshold was selected from a range of observed values at the high end of maturity stage 5, which is the last stage prior to spawning. While this approach is relevant for the maturation of an individual herring, the mean GSI of a sample (and the population) represents a mix of individuals with different developmental trajectories, even after accounting for the length effect. In other words, the peak GSI for the population may be less than that of individual fish due to this heterogeneity in spawning time.

Fortunately, by collecting maturity samples both during and after the spawning season, we can now quantitatively describe the timing and duration of the spawning season. Although more "noisy" than GSI data, we can clearly see a sequential progression of maturity stages in each of the last three years (Figure 4). The earliest samples are dominated by stage 3 (early maturing) fish, followed in sequence by later maturity stages and ending in post-season samples comprised primarily of spent (stage 7) and resting (stage 8) fish. Interestingly, the last sample in each year included some fish just entering the maturation cycle (stage 2), suggesting a portion of the population may spawn in the spring.

To describe the start of the spawning season, we fit a logistic regression to the proportion of fish in each sample that had begun to spawn (stages 6+). Likewise, to describe the end of the spawning season, we fit a logistic regression to the proportion of fish that had completed spawning (stages 7+). In both cases, stages 1 (juveniles) and 2 (initial maturation) were omitted from this analysis because it is not likely they would have spawned in the current season. A threshold percentage value can then be selected, above which we consider the "spawning season" to be underway (Figure 5). As mentioned previously, there is a long-standing rule that accepts 25% spawning herring in a fishery sample; however, lower values could be selected if there is a desire to further minimize the potential for fishery-spawning interaction. Please keep in mind that a 25% threshold for defining for the spawning season refers to the expected value for the population, meaning that individual samples may contain greater than, or less than, 25% spawning herring.

The previous closure system was still in effect in 2015, yet for the first time we were able to collect maturity samples throughout the entire spawning season. The closure began on the default date of 9/21 in this year due to a lack of 3 consecutive GSI samples from either large or small herring above their respective thresholds. In retrospect, maturity data indicate that this resulted in closing the fishery nearly two weeks early (Figure 6). Consequently, when the initial four-week closure ended, additional samples contained more than 25% spawning fish, leading to an additional two-week closure. In total, the fishery was closed for six weeks, even though the spawning season (under the 25% definition) was only four weeks long. However, if the new model-based system had been in place in 2015, the closure would have achieved a better match to the spawning season, beginning 3 days after the 25% spawning point and likely without the need for a re-closure (Figure 7).

The progression of spawning appears to have occurred earlier and more rapidly in 2016 (Figure 8). However, with only one sample during the closure and one post-season sample, the description of the spawning season has the greatest uncertainty in this year. The newer model-based closure protocol was first implemented in this year, resulting in a closure 5 days after 25%[1]. A sample collected 10 days into the closure period contained 87% spent or resting herring, indicating the bulk of the population had already spawned. No additional samples were available until early December, when it was further confirmed that the spawning season had concluded. The logistic model fit to these data suggested the entire 2016 spawning season was only 2.3 weeks long; However, it should be emphasized that the scarcity of samples toward the end of the season adds significant uncertainty to this estimate. It's possible that the season was several weeks longer and we simply lacked the temporal resolution to measure it.

The 2017 season resulted in the most detailed and complete description of spawning to date, with 29 samples collected between July 19th and November 1st (Figure 9). In this year, the model-based system resulted in a closure that was slightly before 25% spawning (2 days). The accumulation of fish entering and passing through the spawning stage can clearly be seen in the sequence of maturity samples. These data suggest that the 2017 spawning season was 4.9 weeks long (34 days), making the initial 4-week closure period insufficient. Samples collected during the fourth closure week indicated that 50% had yet to finish spawning, resulting in an additional 2-week re-closure.

The current GSI_{30} threshold of 25 appears to result in a closure that starts within a few days of the point when 25% of the population is expected to be spawning, considered here to be the start of the spawning season. However, in years with few GSI samples (2015) or accelerated maturation (2016), the current threshold may result in greater than 25% spawners in the catch. Selecting a lower GSI_{30} threshold (i.e. 23 or 24) would reduce this possibility. Regardless, the current model-based system achieves a far better match to the spawning season than the prior

[1] The model actually recommended closing on 10/1/16, four days after 25% spawning, but managers opted to wait an additional day.

version, which tended to close the fishery several weeks early and rely more heavily on default dates.

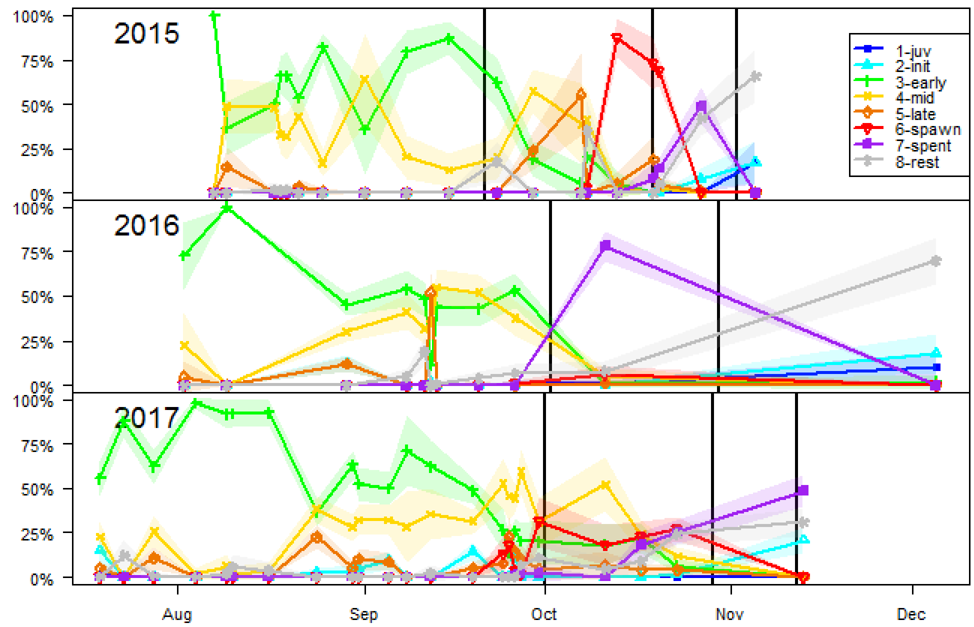


Figure 4. Fraction of MANH herring in each maturity stage by sample year and date. Black vertical lines indicate closures.

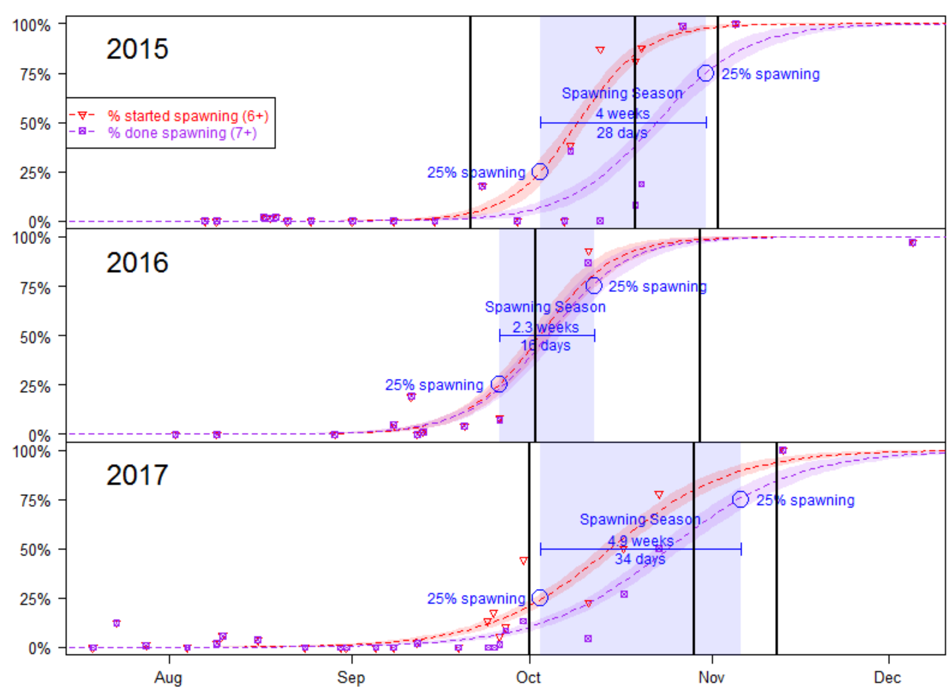


Figure 5. Observed fraction of sampled herring that had started spawning (red: stage 6+) and completed spawning (purple: stage 7+), with fitted logistic regression lines. The shaded blue region represents the spawning season, as defined by the period between when 25% of fish had begun to spawn and when 25% of fish had yet to complete spawning. Vertical black lines represent spawning closures.

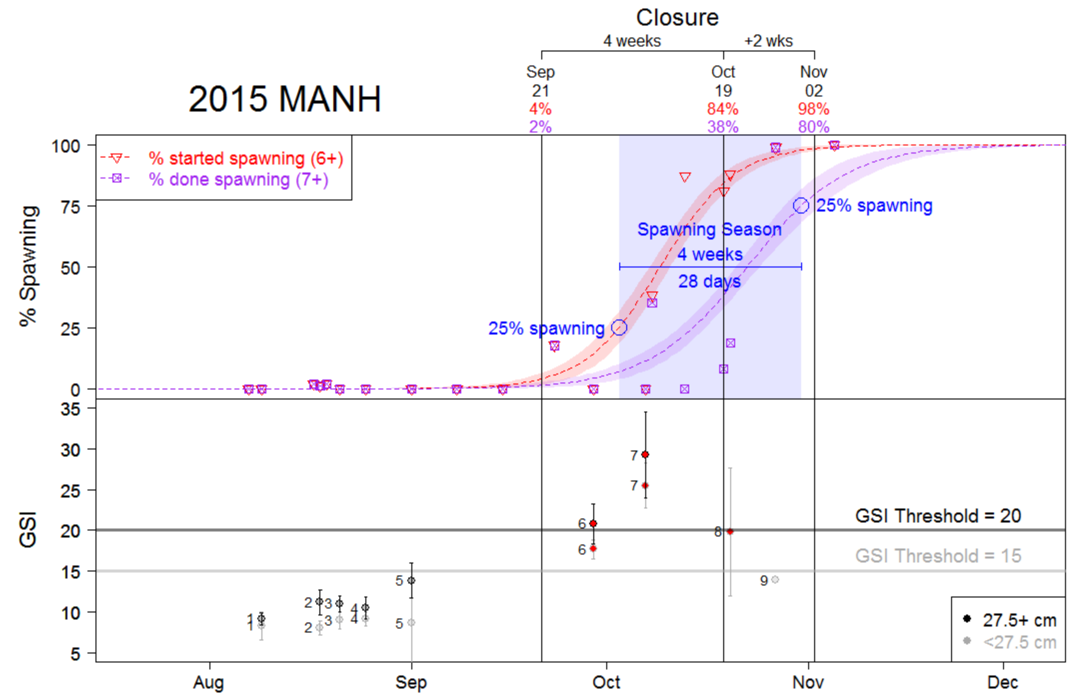


Figure 6. Estimated spawning season (top) and mean GSI (bottom) by sample date, for 2015 in the MANH spawning area. Closure dates refer to the actual closure dates under the old closure system.

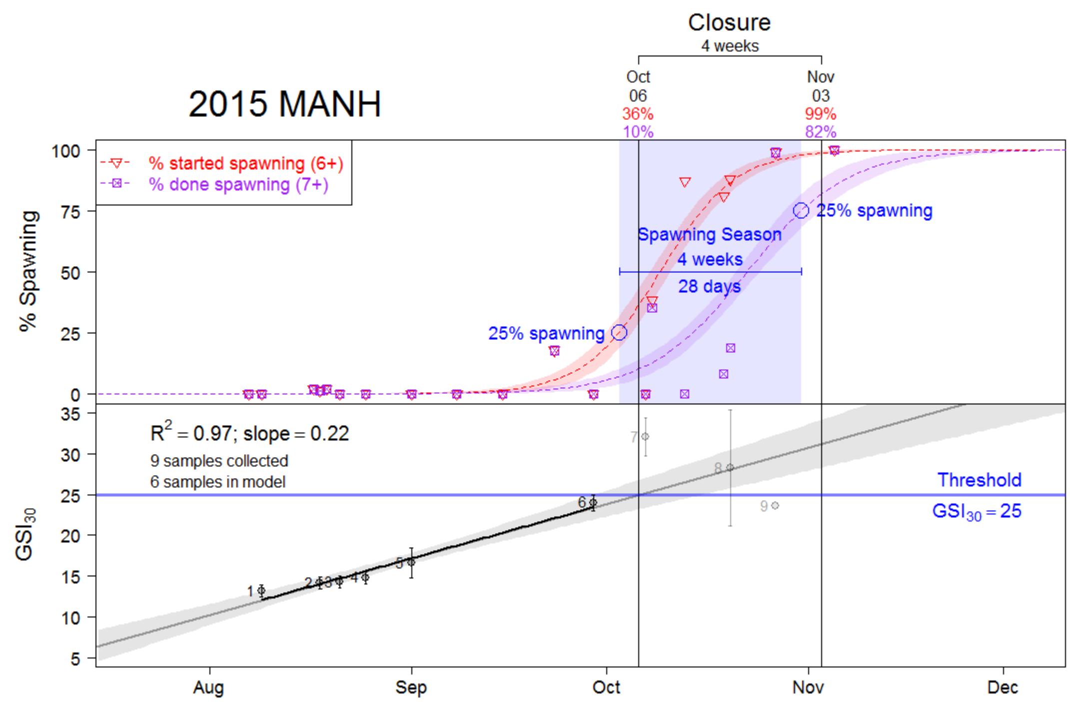


Figure 7. Estimated spawning season (top) and mean GSI_{30} (bottom) for 2015 in the MANH spawning area. Closure dates refer to what would have occurred under the current model-based system.

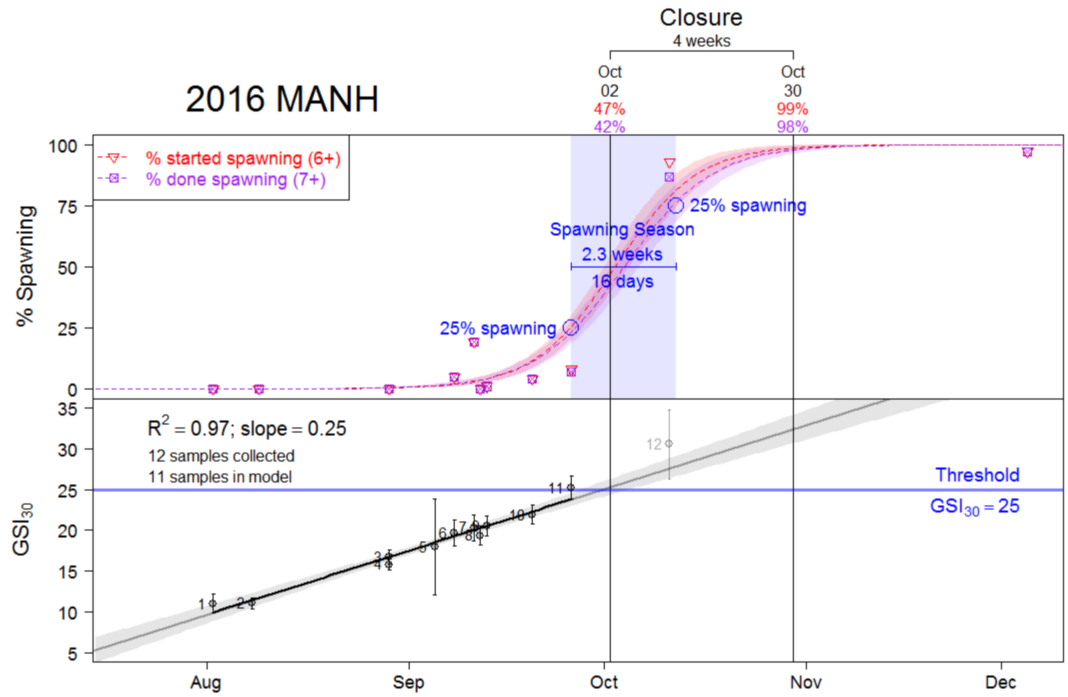


Figure 8. Estimated spawning season (top) and mean GSI (bottom) for 2016 in the MANH spawning area. Closure dates refer to the actual closure dates under the current closure system.

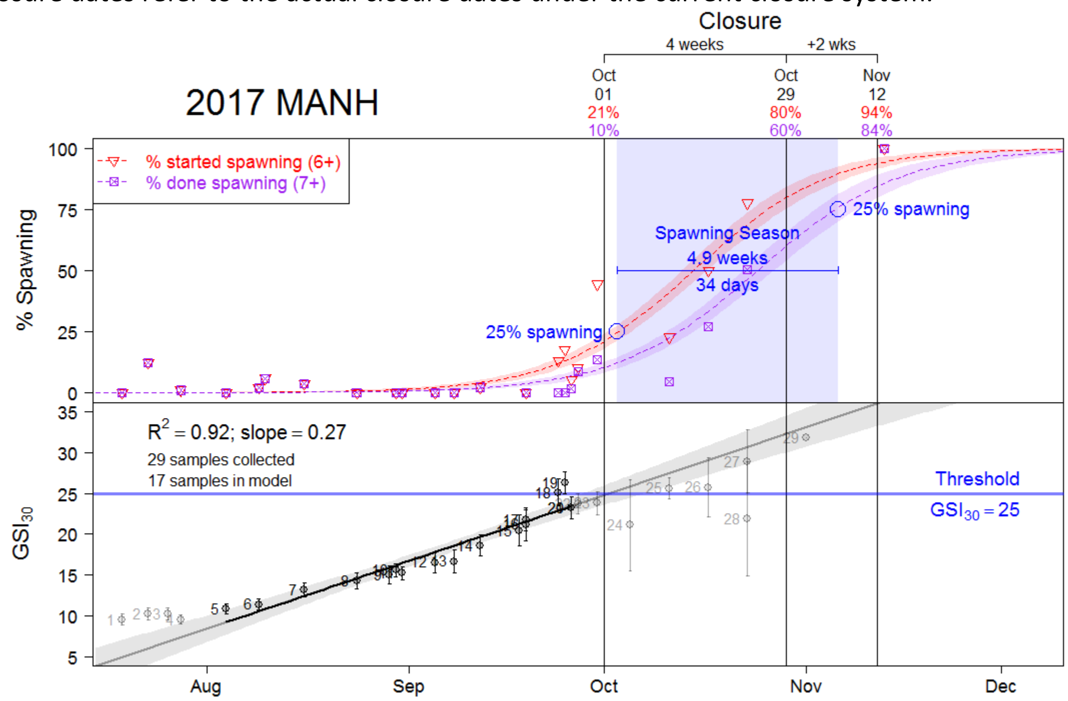


Figure 9. Estimated spawning season (top) and mean GSI (bottom) for 2015 in the MANH spawning area. Closure dates refer to the actual closure dates under the current closure system.

Assumption 3: Four weeks is a sufficient to cover the typical spawning season
The appropriate closure duration largely depends upon the percent of spawning fish deemed to be acceptable in fishery catches. Under the assumption that 25% spawning is acceptable, the spawning seasons of 2015-2017 were estimated to be between 2.3 to 4.9 weeks long; although, there is far greater confidence in the longer season estimates (2015 and 2017) than with the shorter (2016) due to a low number of samples from during/after the closure in that year. Consequently, an initial closure period of 4 weeks is likely to result in frequent use of the re-closure protocol to extend the closure. If the uncertainty inherent in frequent use of the re-closure protocol is deemed undesirable, the initial closure period could be lengthened (e.g., to 5 or 6 weeks). Furthermore, if 25% is considered an unacceptable level of spawners in the fishery, alternative values could be selected. However, it should be noted that lowering the management target for maximum acceptable % spawning will increase the defined spawning season (Figure 10) and therefore require a longer initial closure period, a lower GSI_{30} threshold (Figure 11) and an earlier default date (Table 1).

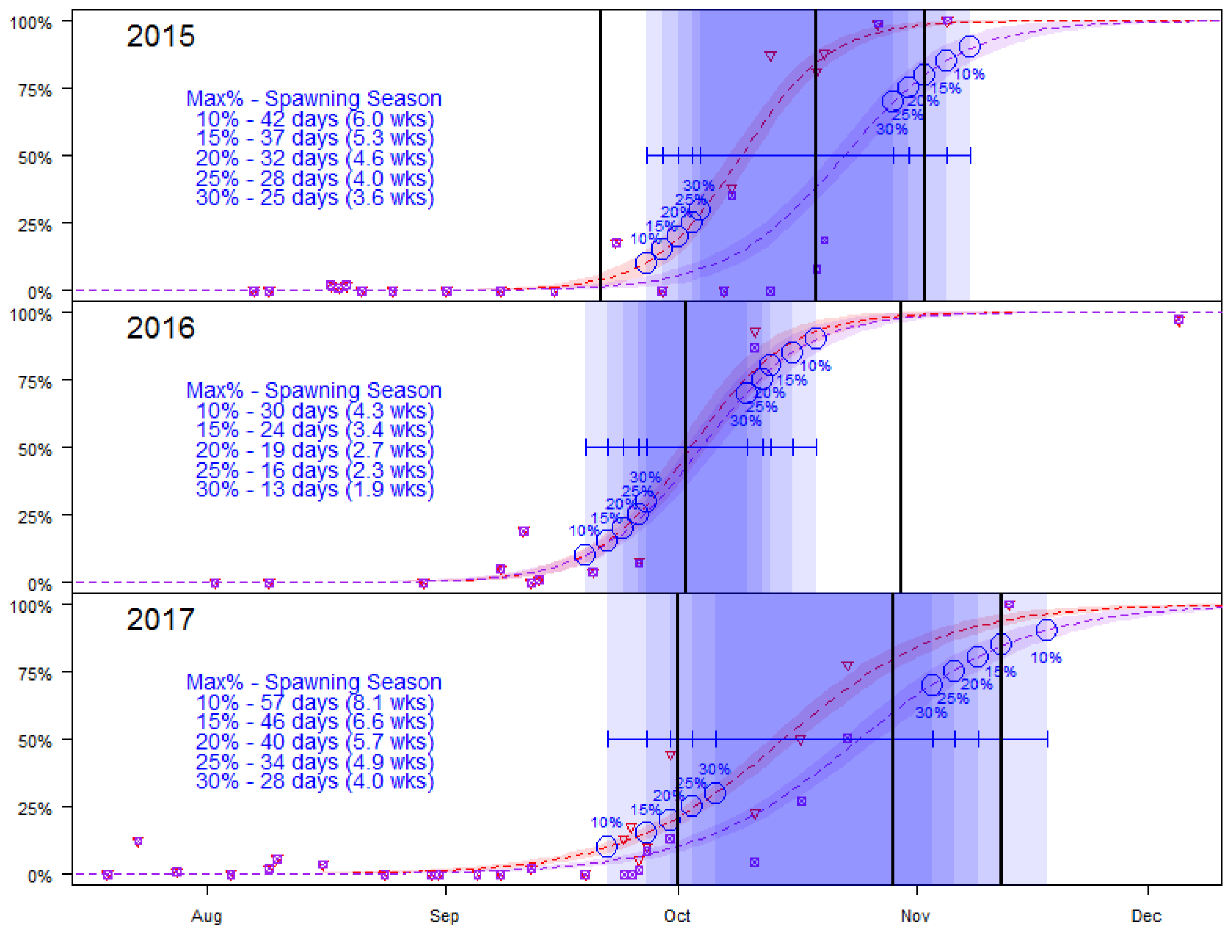


Figure 10. Effect of choice of maximum allowable % spawning in the catch on duration of the spawning season.

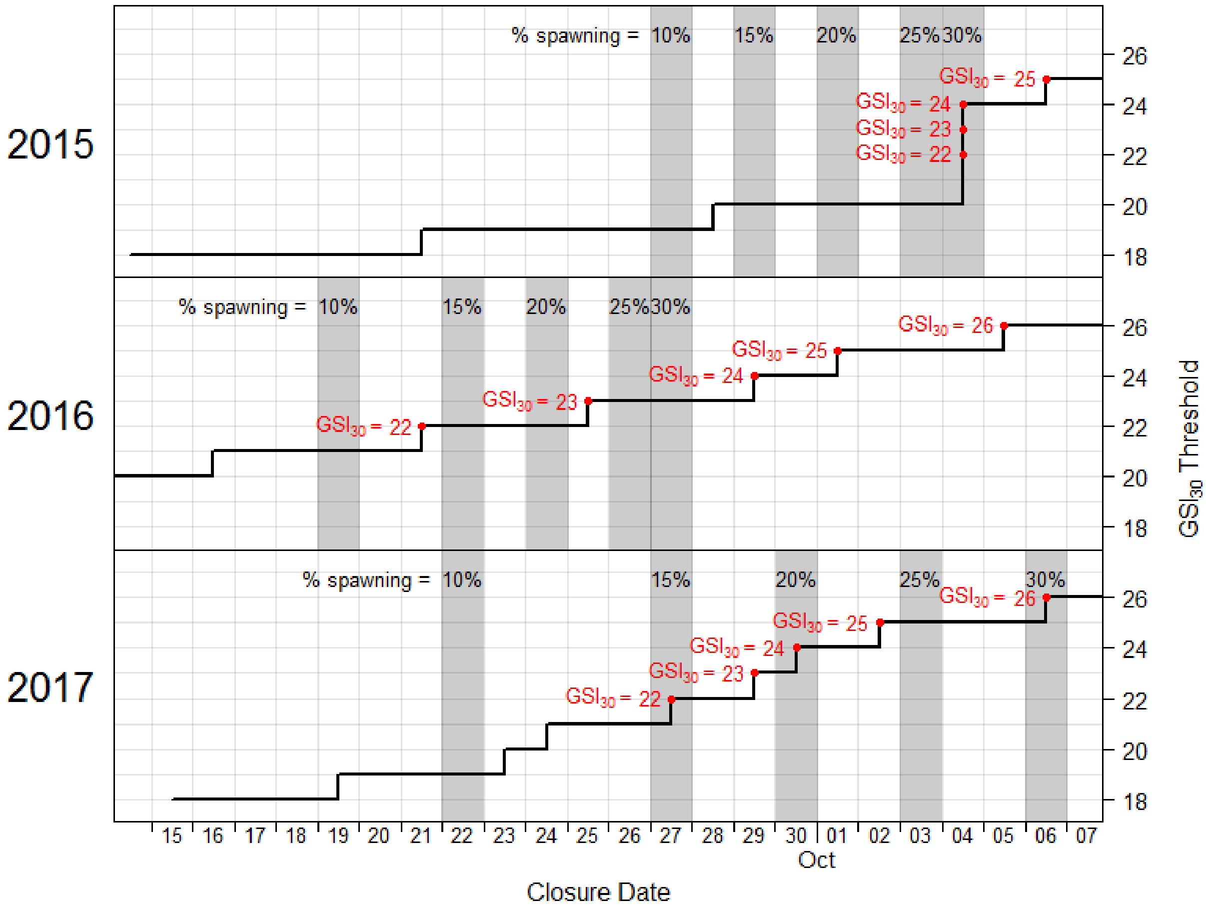


Figure 11. Date when the MANH spawning closure would have started, under different GSI_{30} thresholds. The vertical gray bands indicate the percent of the population expected to be spawning.

Table 1. Updated default dates for different GSI_{30} thresholds and spawning areas, using GSI observations from 2005-2017. As with the original analysis conducted under Amendment 3, sample data from the WM and MANH spawning areas were combined due to a lack of detectable difference in spawning time. There are insufficient samples from which to estimate a default date for the EM area. As such, the previous default date would remain (based on historical observations of herring eggs on lobster traps).

	Default Date		
GSI_{30} Threshold	MANH	WM	EM
26	Oct-6	Oct-6	Aug-28
25	Oct-1	Oct-1	Aug-28
24	Sep-27	Sep-27	Aug-28
23	Sep-23	Sep-23	Aug-28
22	Sep-19	Sep-19	Aug-28

Assumption 4: GSI increases linearly during the last 2 months prior to spawning
During the development of Amendment 3, a review of 15 years of sample data suggested that a linear model could adequately represent the increase in GSI during the pre-spawning period (i.e., ~2 months preceding spawning), despite an expected exponential relationship over the full course of gonadal development. The recent effort to sample the population over the full season now provides us with a longer time series of GSI observations to evaluate the conditions under which this assumption remains valid.

Data from the most recent 3 sampling seasons indicate that the rate of change in mean GSI_{30} (i.e., slope of the linear model) does increase slightly as the population approaches spawning (Figure 12). This results in a trend toward earlier forecasted closure dates with the addition of subsequent samples. However, the linear model continued to explain more than 90% of the variation in mean GSI_{30} (i.e., R^2) prior to the spawning closure in all years. In 2017 (the year with the best sampling coverage), it appears that GSI_{30} increased linearly over most of the pre-spawning period, and only departed from linearity in the days immediately preceding spawning (at the GSI_{30} threshold of 25). Subsequent samples during the closure period showed that mean GSI became more variable as fish moved out of the spawning stage, leaving behind a smaller pool of pre-spawning (stage 3-5) females to sample from. Although four GSI samples were collected from the MANH spawning area in July of 2017, the Herring PDT decided to omit these samples from the model due to concerns that further extending the period of observation could increase non-linearity, and because July samples were never included in the original analysis from which the system was developed.

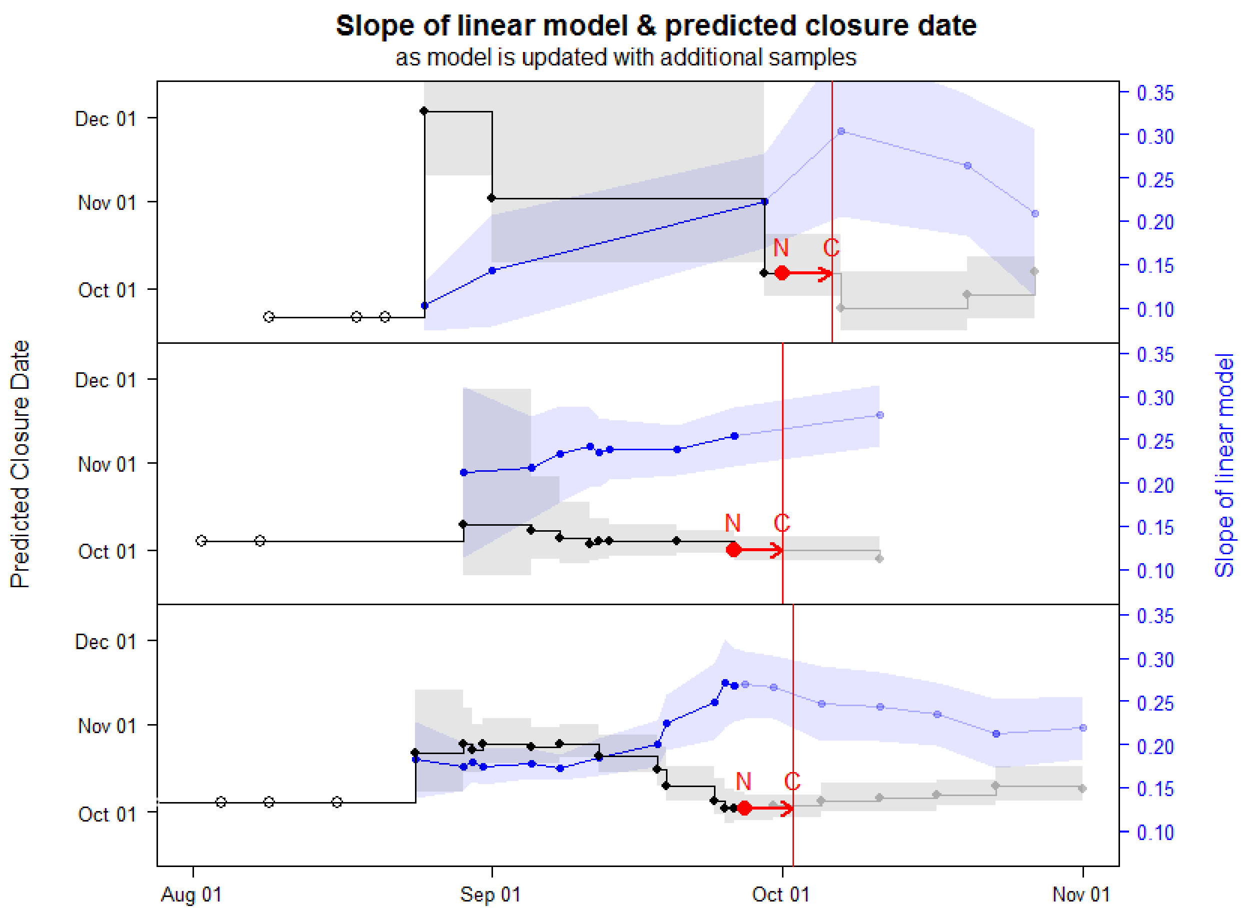


Figure 12. Slope of linear model GSI_{30}~DATE (blue, right y-axis) and predicted closure date (black, left y-axis) as the model is updated with additional samples. Open black circles show where the default closure date would apply: when <3 samples have been collected and/or the model fails to detect a significant increase in GSI_{30}. The red point labeled "N" indicates when the closure date is finally selected and the fishery notified. The red vertical line labeled "C" indicates the final selected closure date (5 days after the notify date). Darker points and lines indicate samples used in the model, whereas lighter points and lines indicate samples collected after the final closure date was selected.

Conclusions and Considerations for the Section
The current model-based spawning closure system appears to be meeting all of the Section's main objectives. The assumptions regarding length effects and spawning time appear sound, which allows the new system to be far better aligned with the reproductive biology of the population. Overall, this represents a clear improvement over the previous system.
If managers want to further minimize the risk of spawning herring in the catch, the TC notes two changes for consideration by the Section.

1) The TC found that in the two years with the most comprehensive maturity data (2015, 2017), the spawning season lasted 28 days and 34 days, respectively. This suggests that 2 week re-closures may occur frequently in the herring fishery, given that the initial closure period is currently set at 4 weeks. To simplify the herring closure protocol, provide greater predictability to industry, and provide greater protection during the spawning season, the Section could consider a longer closure of 5 or 6 weeks, reducing the need for a 2-week re-closure.
2) To further minimize the risk of spawning herring at the beginning of the season, a lower GSI_{30} threshold could be selected. As a reminder, the current threshold is 25; however, analysis suggests that a GSI_{30} threshold of 23 or 24 would reduce the probability of greater than 25% spawners in the catch. In addition, this change would have the added benefit of shortening the monitoring period by restricting it to the portion of the season when GSI increases most linearly. This may result in more consistent closure forecast dates from one sample to the next. However, please note that lowering the GSI_{30} threshold will require an earlier default date (Table 1) and will further increase the likelihood for re-closures, if the initial closure period remains at 4 weeks.

Finally, the TC highlights the need for fishery independent sampling during the spawning closures, especially in eastern and western Maine where there has are fewer fishery-dependent samples available. The information that these samples provide will be critical for our ability to further evaluate and improve the performance of this system.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

TO: Atlantic Herring Management Board

FROM: Kirby Rootes-Murdy, Senior FMP Coordinator

DATE: April 12, 2019

SUBJECT: Public Comment on Atlantic Herring Draft Addendum II

The following pages represent a draft summary of all comment received by ASMFC on Atlantic Herring Draft Addendum II as of 5:00 PM (EST) on April 4, 2019 (closing deadline).

A total of 8 comments were received on Draft Addendum II from individuals and organizations. A total of 5 organizations submitted comments on Draft Addendum II. The remaining three comments came from individual stakeholders, including commercial fishermen and concerned citizens.

Three public hearings were held in three jurisdictions, and one additional public hearing was conducted by webinar during which no public comment was offered. 21 individuals are estimated to have attended the hearings.

The following tables (pages 2-4) are provided to give the Board an overview of the support for specific options and issues contained in the Draft Addendum. Summaries of the public hearings can be found next and are ordered from North to South. This is then followed by letters sent by organizations and emails received from both organizations and individuals.

M19-26

Public Comment Summary Tables

Issue 1: GSI30 Trigger Value				
	Option A	**Option B**	**Option C**	**Option D**
	Status Quo: GSI30 Trigger Value = 25	GSI30 Trigger Value = 25 with Updated Default Dates	GSI30 Trigger Value = 23	GSI30 Trigger Value = 22
Individual	1			1
Organization	2		1	
Hearings				
ME			2	
NH				
MA				1
TOTAL	**3**	**0**	**3**	**2**

Additional Comments:

Lund's Fisheries is opposed to reducing the trigger for spawning closures in the Gulf of Maine.

One individual suggested using a percentage shut down in the Eastern Closure area. When purse seining, they recommended taking a sample, for example a five gallon bucket, and having the spawning closure trigger set at 20%. If you have 20% spawning individuals in the seine sample, you should dump the catch and contact DMR for a closure.

One individual at the Maine hearing supported no options for trigger value; preferred the old system of year-round spawning closures with a 20% catch tolerance. They believe a spawning closure from 0-200 nm is the most effective way to conserve the fish.

Three individuals at the New Hampshire hearing offered support for Option B or C and were opposed to Option D.

Issue 2: Spawning Closure Length				
	Option A	**Option B**	**Option C**	**Option D**
	Status Quo: Four Week Initial Closure	Five Week Initial Closure	Six Week Initial Closure	Eight Week Initial Closure
Individual	1		1	
Organization	2	1		
Hearings				
ME	1	1		
NH				
MA				1
TOTAL	**4**	**2**	**1**	**1**

Additional Comments:

NMFS supports shorter spawning closure periods.

Lund's Fisheries is opposed to extending the spawning closures in the Gulf of Maine.

At the New Hampshire hearing, two individuals supported either Option A or B.

Issue 3: Re-closure Protocol		
	Option A	**Option B**
	Status Quo	No Re-closure Protocol
Individual	1	1
Organization	3	
Hearings		
ME	1	
NH	2	
MA	1	
TOTAL	**8**	**1**

Additional Comments:

NMFS supports more flexible re-closure protocols.

One individual at the Maine hearing was undecided as to whether maintaining re-closure protocol was the most effective procedure.

One individual at the New Hampshire meeting was in support of Option A, Sub-Option 2, and was strongly opposed to Option B.

Issue 3: Re-closure Protocol (Option A Sub-Options)			
	Sub-Option 1	**Sub-Option 2**	**Sub-Option 3**
	Status Quo ("Significant number" = 25%)	"Significant number" = 20%	"Significant number" = 15%
Individual			1
Organization	2	1	
Hearings			
ME	1		
NH		2	
MA			1
TOTAL	**2**	**3**	**2**

Additional General Comments:

NMFS urges the Commission to consider management measures that are consistent with the Federal fishery management plan and allow the fishery to fully utilize the optimum yield. They support options that provide opportunities for the herring industry, such as shorter spawning closures and more flexible re-closure protocols.

Lund's Fisheries is in strong opposition to further restrictions on the Area 1A herring fishery by reducing the trigger for, and extending the duration of, spawning closures in the Gulf of Maine. They encourage the Management Board to indefinitely postpone further consideration of Addendum II to A3.

One individual commented that current sampling is not sufficient and we need to close the inshore spawning areas quicker and for a longer period of time until sampling improves.

One individual at the Massachusetts hearing commented that mid-water trawlers have had a disproportionately negative impact on the resource compared to other gear types, and that if herring crash, it will have significant impact on other fisheries. They additionally noted that there should be more time between the public hearing and the last day of the public comment period.

Draft Addendum II Public Hearing
Augusta, ME
March 6, 2019
9 Participants
Staff: Melissa Smith (DMR), Matt Cieri (ME DMR/Herring TC),
Patrick Keliher (DMR Commissioner/ Herring Board Chair)

Issue 1: Trigger Value

➔ **General support for Option C**

- One individual didn't support any options for trigger value and referenced the old system of year-round spawning closures with a 20% catch tolerance. This individual spoke to the effectiveness of the old ways and how it deterred effort on aggregating fish. While spawning may not be an issue this upcoming season, he concluded that a spawning closure from 0 – 200 nm was the most effective way to conserve fish.
- Two individuals spoke to Option C, referencing the 20% level of population spawning fish as a suitable target. However, additional concern was placed on how this (or any option) would work in the case where only juvenile fish were being landed, as that would not constitute an appropriate sample collection for spawning data.

Issue 2: Closure Length

➔ **No consensus**

- One individual supported Option B, a 5 week initial closure. Rationale for supporting this stemmed from multiple comments heard by industry during previous fishing seasons that suggested an extra week may have been more suitable and sufficient to not require further re-closures.
- One individual supported status quo, Option A, especially regarding Eastern Maine, as the area is data poor. Until more data becomes available, they did not feel the options were suitable.

Issue 3: Re-Closure Protocol

➔ **No consensus**

- One individual supported status quo, especially regarding Eastern Maine, as the area is data poor. Until more data becomes available, they did not feel the options were suitable.
- One individual was undecided as to whether maintaining re-closure protocol was the most effective procedure for the spawning program.

Draft Addendum II to Amendment 3 of the Interstate Fishery Management Plan for Atlantic Herring for Public Comment

Atlantic States Marine Fisheries Commission

March 6, 2019

Augusta, Maine

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Dan Wood	Athearn Marine	Machiasport Me
Earl Small		Eastport me
Gary Small		Eastport ME
Chris Weiner		
Sam Fuller		Boothbay Hbr, ME
COREY PROCK		ROCKLAND
JASON PARENT	Western Sea	Rockland, ME
Steve Wood	Prowler	Boothbay Harbor
Glenn Lawrence	Double Eagle	Owls Head

Draft Addendum II Public Hearing

Portsmouth, NH

April 2, 2019

7 Participants

Staff: Kirby Rootes-Murdy (ASMFC), Renee Zobel (NH DFG/TC Chair),
Cheri Patterson (NH DFG Commissioner Proxy),
Doug Grout (NH DFG Commissioner)

Issue 1: Trigger Value

➔ **Three in support of either Option B or Option C**

- Three individuals spoke in support of setting the trigger value at 25 with data through 2017 (Option B) or at 23 (Option C). The reason cited was that these options would allow the fishery to still operate while affording greater protection to spawning herring in light of the 2018 stock assessment results. In offering comments, one individual questioned whether the trigger values will be needed for the 2019 fishery given the reduction the Sub-Annual Catch Limit for Area 1A.
- All three individuals also indicated they were opposed to a trigger value of 22 (Option D) and cited concern that it may have a significant economic impact on the fishery.

Issue 2: Closure Length

➔ **Two in support of either Option A or B**

- Two individuals spoke in support of having the spawning closure be status quo (4 weeks; Option A) or slightly longer than the current 4 weeks (5 weeks; Option B). The reason cited was the new GSI_{30} Sampling Program has become a more accurate way of evaluating spawning events within the population and responding appropriately. In offering comments in support of these two options, it was noted that the length of the closure has an impact on whether a re-closure is needed in a given year. While some expressed concern about the current length potentially creating scenarios in certain years where a re-closure is more likely, there was ultimately more support for a shorter closure than a longer one.

Issue 3: Re-Closure Protocol

➔ **Two in support of Option A2**

- Two individuals spoke in support of maintaining the re-closure protocol with an updated definition of a 'significant number' of spawn herring as 20% or more of the sample (Option A2). Reason cited was that it provides a tool to protect spawning herring if necessary after an initial closure has ended.
- One individual who spoke in support of Option A2 also indicated they were very much opposed to Option B.

Draft Addendum II to Amendment 3 of the Interstate Fishery Management Plan for Atlantic Herring for Public Comment

Atlantic States Marine Fisheries Commission

April 2, 2019

Portsmouth, New Hampshire

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
Peter Whelan		Portsmouth NH
Geno Marconi	Marine Fisheries	Stratham NH
Ellen Goethel	F/V Ellen Diane	Hampton, NH
Ritchie White		Rye
[illegible]		Portsmouth
Peter Kendall		Rye NH
[illegible]	NHCFA	Ports. NH

Draft Addendum II Public Hearing

Gloucester, MA

April 1, 2019

5 Participants

Staff: Kirby Rootes-Murdy (ASMFC), Brad Schondelmeier (MA DMF),

Cate O'Keefe (MA DMF)

Issue 1: Trigger Value

- ➔ **1 supported Option D**
- One individual spoke in favor of Option D, highlighting that reducing the trigger value down to 15% would result in protection for an additional 10% of the spawning population by reducing the catch and allowing more spawning herring to survive.

Issue 2: Closure Length

- ➔ **1 supported Option D**
- One individual spoke in favor in favor of Option D, an 8 week initial closure. The rationale for supporting this was that the difference between 6 and 8 weeks was not a lot from an economic impact standpoint and the added protection to the spawning fish would be worth it.

Issue 3: Re-Closure Protocol

- ➔ **1 supported Option A, Sub-Option 3**
- One individual spoke in support of re-closure if 15% or more mature herring are detected through sampling. The reason cited was this would allow the greatest conservation benefit to the population during spawning of the re-closure options. This individual noted that when he goes to buy herring, many of the fish are in peak spawning, and that these fish should be in water, not on the counter.

Additional Comments

One individual noted that the mid-water trawlers have had disproportionate negative impact on the resource relative to other fishing gear types. For example, purse seine fishing allows for a sample pump, where the fishermen can evaluate whether the herring are a good product to bring to market or not and can release them with minimal damage. For mid-water and pair trawlers, once they have completed a set, there may be a significant number of dead herring that will not be good for market and are released; this is wasteful and harmful to the resource. This individual also noted that if the herring population were to crash it will have a significant impact on other fisheries. Last, this individual noted that there should be more time given between the public hearing and the last day of the public comment period.

Draft Addendum II to Amendment 3 of the Interstate Fishery Management Plan for Atlantic Herring for Public Comment

Atlantic States Marine Fisheries Commission

April 1, 2019

Gloucester, Massachusetts

-- PLEASE PRINT CLEARLY --

Name	Company/Organization	City, State
[illegible]	Stakeholder	Rockport
Allison Murphy	NOAA Fisheries	Gloucester MA
Audrey Williams	MIT Sea Grant	Cambridge MA
Brad Schondelmeier	MA DMF	Gloucester, MA
Joshua O'Connor	NOAA	NJ
Pam Thames	NOAA	Portland, Me

PROVIDIAN

F/V Ocean Spray Partnership
Deake's Wharf
446 Commercial St.
Portland, ME 04101

April 3, 2019

Atlantic States Marine Fisheries Commission
Attn: Kirby Rootes-Murdy
1050 North Highland St., Suite 200 A-N
Arlington, VA 22201

Kirby Rootes-Murdy,

I am writing to provide comments on behalf of the F/V Providian. The F/V Providian fishes for Atlantic Herring throughout the range of the fishery using both midwater trawl and purse seine gear. The F/V Providian harvests herring for the lobster bait markets in Maine, New Hampshire and Massachusetts.

We support status quo (no action) on Draft Addendum II to amendment 3 to the Atlantic herring interstate fishery management plan.

The timeline for this action is too aggressive and the final decision is too close to an already burdened fishing season to consider this action for the 2019 fishing season. It will have no effect on the protection spawning fish in the near future. The weekly 4/truck limit will have the fishery closed well before historic spawning dates.

At this point, there is not enough data to determine the need for changing the current closure protocols. The new model-based GSI monitoring system was just implemented in 2016. We are only considering data from two seasons that showed much different results for the length of the spawning season. For example, the data suggests that the 2016 spawning season was 2.3 weeks and 4.9 weeks in 2017. At best, this suggests that the spawning season is highly variable. There needs to be more years of data before and educated action to change spawning protocols can be justified.

Any decision made this early would be a politic and emotional decision based on current quota cuts that are already in place to protect the fish stock. The only reasonable action at this time is the status quo alternative.

Sincerely,

John-Paul Bilodeau
Regulations and Compliance

(207) 253-5626 Telephone (207) 253-5622 Fax jp@fvprovidian.net

New England Purse Seiner's Alliance

April 4th, 2019

Patrick Keliher, Chairman
Atlantic Herring Management Board
Atlantic States Marine Fisheries Commission
1050 N. Highland Street; Suite 200 A-N
Arlington, VA 22201

Re: Herring Draft Addendum II

Dear Pat,

I am writing on behalf of the New England Purse Seiner's Alliance ("NEPSA") to comment on Herring Draft Addendum II ("Addendum"). NEPSA is an industry group consisting of purse seine vessels that fish the inshore Gulf of Maine. Our vessels supply fresh herring exclusively to U.S. lobstermen during times of peak bait demand. NEPSA members are long-time participants in the fishery and have a vested interest in the future health of the herring resource.

One of the main reasons for the relative health of the herring resource in Area 1A is that it is the only area in which there are protections for spawning fish. Herring are highly vulnerable just before and during the spawning period due to their inclination to congregate densely in specific areas—and then remain in those areas even in the face of heavy fishing pressure. Sitting lazily on bottom, these fish are perfect targets for highly effective 'midwater' trawlers before they are able to spawn. Additionally, given the staggered nature of spawning activity, by targeting these dense congregations during peak spawning activity, any previously-fertilized eggs on bottom are at risk of being mowed down, too. Targeting spawning herring aggregations is a surefire way to negatively impact future recruitment. As such, you cannot effectively manage herring without the use of spawning closures. Thankfully, we long ago took steps to address this in 1A.

But, as the analysis in the Addendum shows, the current spawning closure system in 1A is not perfect. As such, NEPSA supports the following measures to increase the efficacy of the system:

Issue 1: Option C—Trigger Value 23
Issue 2: Option B—Five Week Initial Closure
Issue 3: Sub-Option 2—Re-Closure at 20% Maturity

We believe that this suite of measures will more adequately protect spawning activity in Area 1A. By lowering the trigger slightly, increasing the initial closure period, and modifying the re-closure level, it is likely that managers will be able to better protect the bulk of spawning activity. This will hopefully allow us to avoid the heavy midwater trawl fishing pressure that certain areas have seen because of the inadequacies in the current system in recent seasons.

To be clear, we strongly believe that these measures *must* be coupled with increased sampling in order for maximum effectiveness to be achieved. No model or number on paper will accurately predict something as variable as herring spawning activity. Ours support for these increased protections comes with a strong request for ASMFC to proactively prioritize funding in order to make sure that there is enough sampling to feed into the system and make it run properly. Given what our fleet is dealing with right now, it should not be too much to ask for the states to find enough money to sample adequately.

Furthermore, *our support for increased protections in 1A also comes with a* <u>*demand*</u> *for spawning protections in Area 3*. To be honest, we initially supported this addendum with the belief that it was going to be developed alongside an addendum to protect Area 3. To see that action delayed is incredibly frustrating. What has happened in Area 3 over the last decade is an atrocity. It is completely unacceptable that we sit here in 2019 without any spawning protections for those fish. It should be no wonder that George's Bank has collapsed, or that the resource overall has declined. You simply cannot allow the midwater trawl fleet to continually target spawning fish during peak spawning without having catastrophic results. We sincerely hope that the ASMFC will follow through with its promise to install protections for Area 3 by 2020 if the NEFMC has not fully approved an action by that time.

While these measures will likely impact our ability to fish in Area 1A, we know that our future relies on the health of this resource. Purse seiners have and will continue to fight for what it is right so that we can hopefully get our of the current catastrophe and ensure it never happens again.

Thanks for your time,

Chris Weiner
NEPSA

Atlantic States Marine Fisheries Commission
Attn: Kirby Rootes-Murdy, Senior FMP Coordinator
1050 North Highland St., Suite 200 A-N
Arlington, VA 22201
comments@asmfc.org

Herring Draft Addendum II

April 4, 2019

Dear Commissioners:
I am writing on behalf of the Atlantic herring catcher vessels E/V Starlight and F/V Sunlight; owned and operated by the O'Hara Corporation of Rockland ME and the Osgood family of Vinalhaven ME; on Draft Addendum II to the states Atlantic Herring Fishery Management Plan (FMP). These vessels represent a combined history in the fishery that exceeds 80 years.

We appreciate the Commission's review of the present spawning regulations in the fishery. However, it is difficult to discern any true benefits of additional changes to the current methodology from this draft document and do not support any changes at this time. As the document indicates spawning events are variable in time and length which points to the need for a flexible system to respond. The current system of 4 week closures with the ability to reclose as necessary provides this needed flexibility.

Status of the Stock
The document characterizes well the current known status of the resource following the 2018 benchmark assessment that finds the stock at a low level with poor recent recruitment. However, there is no mention of a major conclusion of the assessment that finds no evident relationship between spawning stock biomass (SSB) and recruitment. In fact, there is no known cause for the recent below average recruitment. Recruitment in the fishery is known to be variable over time and most often presents in pulse like patterns that are most likely due to environmental conditions – not directly related to SSB.

Technical Committee Evaluation
The Technical Committee (TC) evaluated the two years of data that follow the implementation of the GSI protocols in Amendment 3 (2016); and concludes the current program is an improvement that is better able to respond to inter-annual changes in the timing of spawning events. They also note that reducing the GSI trigger likely necessitates longer closures that result in multiple areas closed at the same time. And lastly the TC indicates that given the current quota reductions the majority of the fish in Area 1A will likely be caught prior to the spawning closures and any benefits and/or costs will not be known in the near future.

Comments

As a general principle we have been supportive of the inshore spawning regulations as they were initially developed by the Commission many years ago. In this case we do not support any changes to the current protocols based on scant available data of two years since the last changes to the program. Additionally, there is a lack of scientific support that tightening spawning restrictions and length of closures would actually result in an increase of SSB.

In review of the goals of the FMP relative to this action to protect spawning aggregations that states "these spawning closures look to reduce interaction between fishing and spawning while also providing access to quota (ASMFC 2016);" it is apparent that there is a need to increase sampling of the fishery to improve the timing and efficacy of spawning closures to achieve more certain results. Extending closures that overlap large areas reduces access and sampling opportunities with unknown benefits.

In the short term we also agree with the TC that the extremely low quotas in coming years will result in very few fish being taken during spawning activity and find no need to implement any changes at this time. Additionally, the stock will be reassessed in 2020 and its status could change again. There are no short term benefits identified in this action.

Magnuson Stevens Fishery Conservation and Management Act (MSA)

We continue to be concerned about the states actions that impact federally permitted vessels operating in federal waters. As you are aware the MSA is the overarching federal statute that mandates standards under which these fisheries must adhere. This document does not meet nor consider any of these National Standards for this action. Of particular note is lack of consideration of any social and economic impacts to the participants in the fishery or related fisheries that rely on access to the resource in the document.

Thank you for the opportunity to comment on this proposed action.

Sincerely

Mary Beth Tooley

Government Relations
O'Hara Corporation
10 Tillson Ave
Rockland Maine 04841
Mbtooley@oharacorporation.com

LUND'S FISHERIES

Wild caught product of USA

Managing the Needs of our Customers Through our Commitment to Sustainable Fisheries

April 4, 2019

Mr. Kirby Rootes-Murdy
ASMFC Senior FMP Coordinator
1050 N. Highland St., Suite 200 A-N
Arlington, VA 22201
Via: comments@asmfc.org
Re: Draft Addendum II to A3 – Gulf of Maine Spawning Closures

Dear Mr. Rootes-Murdy:

On behalf of the 150 employees of our family-owned seafood business and the independent fishermen supplying seafood to our processing facility in Cape May, New Jersey, thank you for the opportunity to comment in strong opposition to further restrictions on the Area 1A herring fishery by reducing the trigger for, and extending the duration of, spawning closures in the Gulf of Maine, as Addendum II would do.

Our two trawlers, with decades-long histories of access to the federal Atlantic herring resource, have already lost access to some portion of the 2019 fall herring fishery, with the Commission's management board's decision earlier this year to allocate the 1A quota on a bimonthly basis, rather than the traditional trimester system.

Also, with the federal herring quotas being cut drastically, again, over the next two or three years, this is not the time for the Commission to further limit access to the extremely limited Area 1A fishery.

A sceptic could ask, since spawning closures have been in place for years, and since recruitment into the fishery is projected at the lowest levels in the time series, how effective the closures have been in producing Gulf of Maine herring? Could environmental changes be overpowering our success in continuing to tinker with this fishery, for example?

In any case, with the potential to further limit our access to 1A herring, as this addendum would likely do, and given the tremendous disruption in the herring and lobster fisheries from the necessary federal quota cuts we are experiencing, we encourage the Management Board to indefinitely postpone further consideration of Addendum II to A3.

Thank you for your attention to and your consideration of our concerns.

With best regards,

Wayne Reichle

Wayne Reichle, President
wreichle@lundsfish.com

997 Ocean Drive, Cape May, NJ, 08204 – 609-884-7600

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930-2276

APR - 1 2019

Bob Beal
Executive Director
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200 A-N
Arlington, VA 22201

Dear Bob:

Pease accept these comments on draft Addendum II to Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring. Given the low herring catch limits expected for the next several years, we urge the Commission to consider management measures for the herring fishery that are consistent with the Federal fishery management plan and allow the fishery to fully utilize the optimum yield.

We reduced 2019 herring catch limits to prevent overfishing and reduce the risk of the stock becoming overfished. The available harvest in 2019 is less than half the 2018 available harvest, which will negatively affect participants in the herring and Atlantic lobster fisheries. The New England Fishery Management Council is currently developing herring catch limits for 2020-2021; those catch limits are expected to be as low or lower than 2019 catch limits. In order to hopefully minimize additional negative socioeconomic impacts on the fishing industry, I support options in Addendum II that provide opportunities for the herring industry, such as shorter spawning closures and more flexible re-closure protocols.

Thank you for the opportunity to provide comments on Addendum II. We will continue to provide input and guidance on this management action. I look forward to working with the Commission and Council in their consideration of spawning protection measures on Georges Bank. This is an opportunity for the Commission, Council, and National Marine Fisheries Service to continue working together on spawning protection measures in all areas to better align state and Federal measures. If you have any questions about our comments, please contact Allison Murphy at (978) 281-9122, allison.murphy@noaa.gov, or Carrie Nordeen at (978) 281-9272, carrie.nordeen@noaa.gov.

Sincerely,

Michael Pentony
Regional Administrator

cc: Tom Nies, NEFMC Executive Director
Patrick Keliher, Atlantic Herring Section Chairman
Toni Kerns, Commission Fishery Management Plan Coordinator

From:	Darren Turner
To:	Comments
Cc:	Patrick Keliher
Subject:	Atlantic Herring Draft Addendum II Comments
Date:	Saturday, February 23, 2019 3:26:05 PM

Dear Kirby,

Please add these comments to the public hearing comments for the Atlantic Herring Draft Addendum II proposal:

I am not in favor of the proposed changes and prefer the status quo for issue #1 and #2. I prefer option b for issues #3.

My family is from Eastport, ME and has fished for herring full time and opportunistically in Eastern Maine over the last four decades. The fish do not show up this far east until August. The quota and weather generally end our season in mid October which only gives us a ten week window to fish. When the 20% spawn herring tolerance was taken away, it devastated our business. It prevents us from fishing 4 weeks out of our 10 week season. The proposed spawning closure changes intend to increase the closure times, which will reduce my already limited fishing opportunity. I would like to see the 20% tolerance reinstated.

The claim that we need to protect herring more than we currently do is not a proven theory. Records show that Gulf of Maine fishermen have harvested 16,000 to 60,000+ metric tons of herring annually for 70+ years without depleting the resource. Therefore, to claim that we need to cut the quota to 4,354 tons is absurd. I personally witnessed more fish in Eastern Maine waters this past summer and fall of 2018 than I have in over twenty years on the water. I question the accuracy of the recruitment assessment when my personal experience has shown me the otherwise. The ocean is to big and to complex for surveys and models to be accurate. So it is very hard for me to sit back and watch unnecessary management measures destroy the fishing infrastructure of two fisheries.

The extended times and date changes have the possibility to create more overlap between area closures. I don't believe the claimed crisis is proven enough to justify the hardships it will cause in both the herring and lobster fisheries.

Thank you,

Darren Turner

From:	e small
To:	Comments
Cc:	MELISSA SMITH; William Tuell
Subject:	Herring Draft Addendum II)
Date:	Thursday, February 28, 2019 6:39:10 PM

I'm a herring fisherman from Eastport Me. and I'm in the Eastern Closure area and I have read that we haven't had any sampling up this way so the date isn't changing so my thought is we should go to a Percentage shut down in this area. So when we are purse seining we should take a sample, say a five gallon bucket and the spawning closure should start at 20 % if you have 20% in the seine you should dump the catch and contact DMR for a closure. I've been fishing herring in the 80's and 90s then again in the last 5 years and I haven't seen any spawning herring in Cobscook, Passamaquoddy Bay Area. All the herring in this area is between 6 to 10 inches.

I'm also going to volunteer to do some sampling and report to the state or if anyone from DMR wants to go we'll do some sampling though out the eastern closure area so we can get a better idea on what happening in this area.

Thank you
Earl Small
19 Evans St.
Eastport Me. 04631
(207)461-7751

From: Stephen Weiner
To: Comments
Subject: Herring Draft Addendum II
Date: Thursday, April 04, 2019 4:42:01 PM

I support the following as pertains to Herring Draft Addendum II:

~ Issue 1, Option D

~ Issue 2, Option C

~ Issue 3, Sub-Option 3

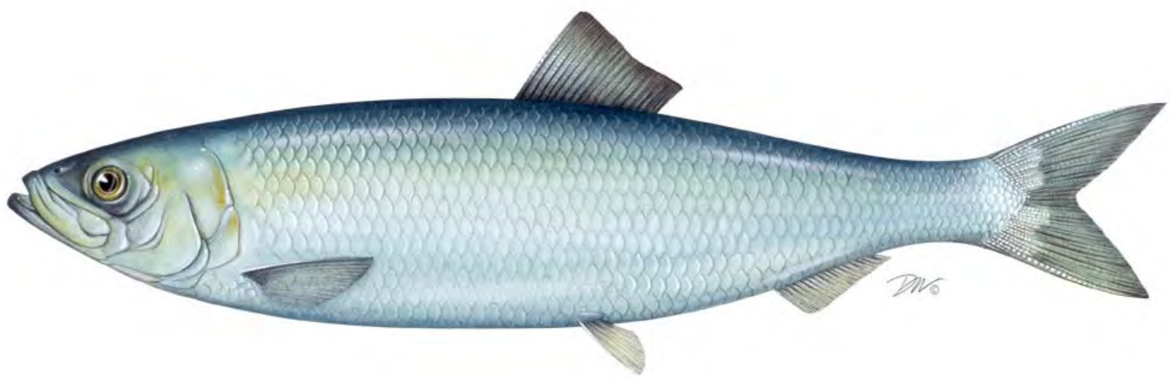
The sampling currently being done is not sufficient and until it improves we need to close these inshore spawning areas quicker and for a longer period of time. In a perfect world we would have dedicated and consistent sampling which would guide our decisions but as of now we do not. Closing herring fishing and then reopening and then closing again is not the optimal solution. Longer closure periods keeps that from happening.

Steve Weiner

2018 REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR

ATLANTIC HERRING
(Clupea harengus)

2017 FISHING YEAR



Atlantic Herring Plan Review Team

Renee Zobel, New Hampshire Fish and Game
Melissa Smith, Maine Department of Marine Resources
Kirby Rootes-Murdy (Chair), Atlantic States Marine Fisheries Commission

Table of Contents

I. Status of Fishery Management Plan

Date of FMP Approval	November 1993
Amendments	Amendment 1 (February 1999) Amendment 2 (March 2006) Amendment 3 (February 2016)
Addenda	Addendum I to Amendment 1 (July 2000) Technical Addendum #1A to Amendment I (October 2001) Addendum II to Amendment I (February 2002) Technical Addendum 1 to Amendment 2 (August 2006) Addendum I to Amendment 2 (March 2009) Addendum II to Amendment 2 (December 2010) Addendum V to Amendment 2 (October 2012) Addendum VI to Amendment 2 (August 2013) Addendum I to Amendment 3 (May 2017)
Management Unit	US waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the Exclusive Economic Zone (East Coast of Maine), and from the US/Canadian border to the southern end of the species range (Cape Hatteras, North Carolina).
States With Declared Interest	Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey
Active Boards/Committees	Atlantic Herring Section, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, and Plan Review Team

Atlantic herring (*Clupea harengus*), also known as sea herring, are an oceanic fish that occur in large schools and undergo seasonal inshore-offshore migrations. Herring are important to the Northwest Atlantic ecosystem as a forage species and to the fishing industry as bait for lobster, blue crab, and tuna. To a lesser degree this resource also serves as a food, typically canned, pickled, or smoked. The U.S. Atlantic herring fishery is currently managed as a single stock through complementary plans by the Atlantic States Marine Fisheries Commission (ASMFC) and the New England Fishery Management Council (NEFMC).

The stockwide annual catch limit (ACL) is divided amongst four distinct management areas: inshore Gulf of Maine (Area 1A), offshore Gulf of Maine (Area 1B), Southern New England/Mid-Atlantic (Area 2), and Georges Bank (Area 3). The Area 1A fishery is managed by ASMFC's Atlantic Herring Section (Section), which includes representatives from Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York and New Jersey.

The 1993 ASMFC Atlantic Herring Fishery Management Plan (FMP) was implemented to address the growth of the herring resource and interest in Internal Waters Processing (IWP) operations. Amendment 1 to the FMP was developed to complement the goals and objectives of the NEFMC federal management plan. It established total allowable catch limits (TACs) for specific management areas. The Days Out program was established for state waters.

Addendum I (2000) redefined spawning areas in state waters. It also reduced the exploitation of herring spawning aggregations by imposing a limited landing restriction on herring caught in spawning areas (20% tolerance for spawn herring in Maine and Massachusetts). Technical Addendum #1A (October 2001) was approved to change the delineation of the Eastern Maine spawning area.

Addendum II (2002) was developed in conjunction with NEFMC's Framework Adjustment 1 to allocate the Management Area 1A TAC on a seasonal basis. This addendum also specified procedures to allocate the annual Internal Waters Processing (IWP) quota.

Amendment 2 (2006) to the FMP was developed to complement management measures in Amendment 1 to the federal FMP. Identical management area boundaries were adopted, in addition to a joint TAC specification setting process between NEFMC and ASMFC, and management area closure when 95% of the TAC is harvested. Technical Addendum I to Amendment 2 (2006) was developed to address inconsistent interpretation of the zero tolerance spawning provision.

Addendum I (2009) identified tools to address effort in Area 1A in order to maintain a steady supply of herring throughout the fishing season. States adjacent to Area 1A could set bi-monthly, trimester or seasonal quotas and roll the quota into later periods if there was under-harvest. It also required states to implement weekly reporting for timely quota management.

Addendum II (2010) was developed to complement Amendment 4 to the federal FMP. It revised the specifications process (sets measures for three-years) and terminology (e.g., TAC is now called ACL) to be consistent with federal management.

Addendum V (2012) compiled the previously approved spawning regulations into one document and revised the spawning sample provisions.

Addendum VI (2013) was developed to complement the NEFMC's Framework Adjustment 2 to the federal FMP. It established new provisions and consistent measures for the four management areas. States were allowed to seasonally split sub-ACLs for each management area, and up to 10% of unused sub-ACL could be carried over to the following fishing year (after data is available). Addendum VI also established new closure triggers: a directed fishery closes when 92% of an area's sub-ACL is projected to be reached, and the stock-wide fishery closes when 95% of the total ACL is projected to be reached.

Amendment 3 (2016) to the FMP consolidates prior amendments, addenda, and recent management decisions into a single document; it is now the comprehensive document for Atlantic herring management in state waters. The amendment refines the spawning closure system using a modified GSI-based spawning monitoring system. Additionally, the fixed gear set-aside is now available to fixed gear fishermen through December 31.

Addendum I to Amendment 3 was developed to stabilize the rate of catch in Area 1A and distribute the seasonal quota throughout Trimester 2 (June through September). The Addendum includes a variety of management tools which can be used by the Section, including weekly landings limits, restrictions on carrier vessels, vessel declaration requirements, and modifications to the 'days out' procedure for a variety of gear type and permit categories.

II. Status of the Stock

The most recent benchmark stock assessment for Atlantic herring was peer reviewed in August 2018 (SAW-65). The assessment found that Atlantic Herring are not overfished and overfishing is not occurring, but highlighted concerns about trends in recruitment and spawning stock biomass. Recruitment has been below the time series average for the last five years. In particular, 2016 recruitment was the lowest on record at 1.7 million fish. While recruitment has been variable throughout time, recent and continuing low levels of recruitment indicate that there will be fewer fish available to harvest in future years. Spawning stock biomass (SSB) has also been lower in recent years. In 2017, SSB was estimated at 141,473 mt, below the SSB threshold of 189,000 mt (417 million pounds). Fishing mortality has decreased in recent years, with a 2017 level of 0.45, below the fishing mortality threshold of 0.51.

III. Status of the Fishery

There is an Atlantic herring fishery in the United States and Canada. The U.S. Atlantic herring fishery is controlled by annual catch limits (ACL) set by NOAA Fisheries. The stockwide ACL is distributed among the four management areas. Specifications are set every three years and adjusted annually to account for overages or underages from the previous fishing season. Once 92% of the sub-ACL for an area is reached, the respective fishery is closed. The stockwide fishery closes when 95% of the total ACL is projected to be reached. Following a closure, there is a 2,000 lb trip limit to allow for incidental bycatch of Atlantic herring for the remainder of the fishing year. In addition to quota-based closures, the "days out" and spawning closure programs provide additional measures to control fishing effort.

For the 2016-2018 fishing season, the Council and Commission set the ACL at 231 million pounds (104,800 mt), a 2.6% decrease from the 2013-2015 fishing limits. For all three years, the ACL is further subdivided by Atlantic herring management areas as follows: Area 1A = 66.79 million pounds, Area 1B = 9.9 million pounds, Area 2 = 64.1 million pounds, and Area 3 = 90.16 million pounds. The Area 1A sub-ACL is distributed seasonally with 72.8% available from June 1-September 30 and 27.2% available from October 1-December 31. Underages from June through September may be rolled into the October through December period.

The domestic Atlantic herring fishery is predominantly commercial; recreational catch accounts for less than 1% of landings. Over the time series of 1965 to 2017, annual landings by the United States Atlantic herring fleet generally increased and averaged roughly 131.4 million pounds (59,612 mt). Landings reached the lowest level in 1983, at 51.263 million pounds (23,253 mt), and peaked in 2006 at 268.533 million pounds (121,804 mt).

Catch, in metric tons, from Area 1A is shown in Table 1. Preliminary information from 2018 indicates that 24,814 mt were caught in Area 1A, representing 89.4% of the sub-ACL. Since a directed fishery closes when 92% of an area's sub-ACL is projected to be reached, there was no closure in the Area 1A fishery in 2018.

Table 1: Area 1A catch, sub-ACL, and associated directed fishery closures from 2013-2018. Source of catch information: NOAA Fisheries Atlantic Herring Fishery Monitoring

Year	Sub-ACL (mt)	Catch (mt)	% Utilized	Sub-ACL Closure
2013	29,775	29,820	100%	Oct-15
2014	33,031	33,428	101%	Oct-26
2015	30,580	29,406	96%	Nov-2
2016	30,524	27,826	91.2%	Oct-18
2017	32,115	28,682	89.3%	NA
2018	27,743**	24,814*	89.4%	NA

*Preliminary landings data
**Adjusted August 22, 2018 from 31,962 mt to 27,743 mt

2018 Fishing Season

Based on preliminary data provided in state compliance reports, Maine and Massachusetts accounted for over 90% of the commercial Atlantic herring landings in 2018 (Table 2). Landings generally decreased across the states with the largest decreases occurring in Rhode Island (53% reduction from 2017) and New Hampshire (53% reduction from 2017). Connecticut did see noticeable increase in landings in 2017 (93%).

Table 2. 2018 commercial landings by state and percent of total harvest. 2018 landings data is considered preliminary at this time. Source: State compliance reports.

	Commercial Landings (lbs)	Percent of Total
ME	59,691,749	62.8%
NH	1,335,250	1.4%
MA	28,431,238	29.9%
RI	2,140,745	2.3%
CT	82,701	0.1%
NY	32,304	0.0%
NJ	3,374,027	3.5%

Table 3 outlines the 'days out' program and effort control measures which were implemented in Area 1A. Based on the accelerated landings of Area 1A quota during Trimester 2 in both 2015 and 2016, and the adoption of Addendum I, the original landing schedule for Area 1A was established at 3 days a week for vessels with a Category A permit. This was subsequently increased to 4, then 5 days as it became clear that landings were occurring at a slower pace than the two previous years. As of September 10 harvest had reached 97% of the Trimester 2 allocation, with the fishery moving to zero landings days through September 30. On October 1, a 5 days consecutive landings limit was implemented for Trimester 3. This was increased to 7 days in November once it became clear that landings were below the sub-ACL for Area 1A. Trimester 3 landings continued well into December, creating a longer season similar to 2017 (see Table 1).

Table 3: 2018 'days out' program for trimester 2 and 3 in Area 1A.

Trimester	Date Effective	Consecutive Landing Days for Category A Permit	Weekly Landings Limit for Category A Permit	Poundage that can be Transferred to a Carrier Vessel
2	June 1, 2018	4	480,000	80,000
	July 22* 2018	5	640,000	160,000
	August 22, 2018**	5	640,000	160,000
	September 10, 2018	0	0	0
3	October 1, 2018	5	NA	NA
	November 16, 2018	7	NA	NA

*Effective 6 p.m. Sunday July 22 for Maine, 12:01 a.m. Monday July 23 for New Hampshire and Massachusetts

ACL Adjusted August 22, 2018 from 31,962 mt to 27,743 mt

Spawning Area Closures

The Atlantic Herring Area 1A (inshore Gulf of Maine) fishery regulations include seasonal spawning closures for portions of state and federal waters in Eastern Maine, Western Maine and Massachusetts/New Hampshire. In 2017, the Commission's Atlantic Herring Section permanently implemented the GSI_{30} Based Forecast System for spawning closures in Area 1A. This forecasting method relies upon at least three samples, each containing at least 25 female herring in gonadal stages III-V, to trigger a spawning closure. If sufficient samples are not available, the spawning closure occurs on the default dates outlined in Amendment 3. Prior to 2017, the GSI_{30} spawning protocol had been implemented as a 1-year pilot program in 2016.

The Eastern Maine spawning area closed on the default date of August 28th through September 24th, given there were no samples from the area at the time. There was no spawning area closure for Western Maine in 2018.

For the Massachusetts/New Hampshire spawning area, closure began October 26th and continued through November 22nd, based on forecasting produced from eight samples.

IV. Status of Research and Monitoring

Under Amendment 3, states are not required to conduct fishery independent surveys for Atlantic herring. However, state survey programs designed to catch other species may encounter herring regularly, so some states do collect biological information on Atlantic herring. A summary of these surveys results follow.

Maine and New Hampshire: The states jointly operate an inshore bottom trawl survey in the spring and fall that is designed to catch groundfish, but regularly encounters Atlantic herring. In 2018, Atlantic herring catch was higher than in previous years in the spring survey but lower in than in previous years for the fall survey. In the Spring survey, Atlantic Herring were caught in 98 out of the 118 tows, and a maximum number of 16,146 were caught in one tow. In the fall survey, Atlantic Herring were caught in 64 of the 96 tows, and a maximum of 4,223 were caught in one tow.

Maine Department of Marine Resources also conducts commercial portside catch sampling. In 2018, 71 sampling events occurred, covering purse seine, mid-water trawl, and small-mesh bottom trips. The number of sampling events was a decline from 2018 levels (96).

New Hampshire Fish and Game Department also conducts a juvenile finfish seine survey in the Great Bay, its tributaries, and other coastal harbors. In 2018, 5,415 Atlantic herring were observed during the months of June and July.

In 2015, **Massachusetts** Division of Marine Fisheries and UMass-Dartmouth School for Marine Science and Technology (SMAST) applied for the 2016-2018 Atlantic herring Research Set-Aside (RSA), and were awarded the majority of RSA quota. Portside sampling and the River Herring Bycatch Avoidance program were conducted with both the midwater trawl (MWT) fishery (primarily operating out of Massachusetts ports) including both herring and mackerel trips, at 42.1% (40 of 95) by trip and 57.9% (6,033 of 10,418 mt) by weight, in 2018. Data from an additional four Northeast Fisheries Observer Program (NEFOP) trips and one Maine Department of Marine Resources portside sampled trip landed in MA were incorporated into the bycatch avoidance program. MA DMF continued to utilize its real-time reporting mechanism (laptops with custom-designed reporting software) to receive NEFOP data from captains while at-sea. This negates the need to sample these observed trips, and supplements the overall coverage levels. Thus, combined trip coverage of 47.4% was achieved in 2018

The primary goal of the River Herring Bycatch Avoidance program is to characterize the landings of vessels and advise the fleets of river herring bycatch, in an effort to minimize bycatch independent of management actions. Participating fishermen have generated over $210,000 through RSA compensation fishing since 2014, all from Herring Management Area 1A. This year marked the final year of the 2016-2018 MA DMF and SMAST Atlantic Herring Research Set-Aside program. Over 3,000 mt of RSA quota were distributed among qualified participants, but fisheries circumstances created less demand for RSA quota than previous years. Only two companies utilized RSA quota, with only 216 of the 3,144 mt of compensation quota harvested. A total of $16,500 was generated by RSA harvest in 2018. Despite this reduced compensation, funds generated by the 2017 RSA (mainly through donations) continue to allow for high rates of sampling. Due to reduced fishery effort in 2018 there are still funds available for sampling activities. A no-cost extension was granted, thus, portside sampling and bycatch avoidance strategies will continue into 2019.

Rhode Island Division of Fish & Wildlife conducts a Seasonal Trawl Survey to develop abundance indices for Atlantic herring. Atlantic herring are mostly observed in the late fall and spring in the RIDFW seasonal trawl survey. Monitoring for 2018 suggested a decrease in the relative biomass and abundance of Atlantic herring in Rhode Island waters, a continued trend from 2017. An average of 0.24 kg/tow of Atlantic herring was observed in 2018, lower than the 1.28 kg/tow observed during 2017. Similarly, the Atlantic herring abundance index derived from the trawl data decreased from 84.65 fish/tow in 2017 to 70.13 fish/tow in 2018.

Connecticut Department of Energy and Environmental Protection monitors Atlantic herring through the Long Island Sound Trawl Survey (LISTS), which is conducted each spring and fall since 1984. The Long Island Sound Trawl Survey underwent significant changes to the collection procedure in 2018; as such, the QA/QC portion of the 2018 Survey is still underway and the finalized 2018 data is not available.

New York has *de minimis* status and does not conduct directed monitoring of Atlantic herring.

New Jersey Division of Fish and Wildlife monitors Atlantic herring through the New Jersey Ocean Trawl Survey, which collects samples during five surveys conducted throughout the year between Sandy Hook, NJ and Cape Henlopen, Delaware. In 2018, 189.76 pounds (2,320 individuals) of Atlantic Herring were caught in the ocean trawl surveys.

V. Status of Assessment Advice

The following research recommendations were included in the 2018 benchmark stock assessment.

<u>Research Recommendations from the 65th Northeast Region Stock Assessment for Atlantic Herring (2018)</u>

a. Further investigate methods for better survey coordination between the various survey programs, including survey design, timing, and standardized data formatting for easier sharing.
b. Investigate changes in dredge efficiency and saturation due to high scallop densities or high bycatch rates.

c. Analyze past juvenile scallop mortality events and develop better methods to model time-varying mortality in the assessment models.
d. Collect information needed for the management of the GOM fishery and development of appropriate reference points including biological parameters, fishery-independent surveys, and fishery-dependent data.
e. Continue development of scallop ageing methods and examination of scallop growth processes including density dependent effects.
f. Improve training of annotators used in optical surveys and develop standardized QA/QC procedures for data collected from imagery.
g. Investigate use of software for automated annotation of imagery from optical surveys.
h. Investigate methods to better estimating biomass and abundance variances from Habcam optical surveys including development of Bayesian geostatistical methods.
i. Investigate and estimate current and historical unreported landings and effects of spatially heterogeneous fishing mortality on mortality estimates.
j. Develop a spatially-explicit methodology for forecasting the abundance and distribution of sea scallops by incorporating spatial data from surveys, landings, and fleet effort (aka GEOSAMS).
k. Investigate and parameterize sub-lethal effects of disease, parasites, or discarding on mortality, growth, and landings.
l. Revive and streamline previously-developed methods for interpreting VMS data.
m. Further refine and test methods for forecasting LPUE.
n. Continued investigation of discard mortality, particularly during warm water periods, by incorporating environmental data.
o. Continue improvements of observer recordings for vessel fishing behavior including deck loading and shucking dynamics in responses to disease or poor scallop health.
p. Continue investigating the extent of incidental fishing mortality, particularly on hard bottom habitats

VI. Management Measures and Issues

Amendment 3 to the Interstate Fishery Management Plan for Atlantic Herring lists the following state regulatory requirements:

1. Each jurisdiction shall prohibit the landing of herring when the management area sub-ACL has been attained.
2. Vessels are prohibited from landing more than 2,000 lbs. of Atlantic herring from Area 1A when the fishery is closed, during a ‘day out’ or during spawning closures.
3. Jurisdictions will close the directed fishery when 92% of a management area’s sub-ACL is projected to be harvested.
4. Each jurisdiction must enact spawning area restrictions that are at least as restrictive as those in Section 4.2.6.
5. States adjacent to Area 1A will implement days out restrictions as identified in Section 4.2.4.1.
6. States are required to implement weekly reporting by all non-federally permitted fishermen on Atlantic herring (including mobile and fixed gear).
7. Any herring vessel transiting a management area that is under a herring spawning closure or a ‘day out’ must have all of its fishing gear stowed.

8. The harvest of herring for the primary purpose of reduction to meal or meal-like product is prohibited.
9. Internal Water Processing operations will be prohibited from processing herring caught in all state waters.

VII. PRT Recommendations

State Compliance

All states with a declared interest in the management of Atlantic herring have submitted compliance reports and have regulations in place that meet or exceed the requirements of the Interstate Fisheries Management Plan for Atlantic herring as described in Amendment 3.

Request for *De Minimis* Status

A state may be eligible for *de minimis* status if its combined average of the last three years of commercial landings (by weight) constitute less than one percent of the coastwide commercial landings for the same three-year period.

New York has requested and met the requirements for *de minimis* status in 2018. The state's 2016-2018 combined average commercial landings (64,779 pounds) is less than 1% of coastwide commercial landings during the same three year period.

Research and Monitoring Recommendations

In addition to the research recommendations outlined in the 2018 stock assessment, the PDT also recommends the following research priorities.

<u>Fishery-Dependent Priorities</u>

High

- Investigate bycatch and discards in the directed herring fishery through both at sea and portside sampling.
- Continue commercial catch sampling of Atlantic herring fisheries according to ACCSP protocols

<u>Fishery-Independent Priorities</u>

High

- Expand monitoring of spawning components.

Low

- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide a fishery-independent estimation of stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should continue to be encouraged.

<u>Modeling / Quantitative Priorities</u>

Moderate

- Conduct simulation studies to evaluate ways in which various time series can be evaluated and folded into the assessment model.
- Develop new approaches to estimating recruitment (i.e., juvenile abundance) from fishery-independent data.
- Examine the possible effects of density dependence (e.g., reduced growth rates at high population size) on parameter estimates used in assessments.

Low

- Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age structured assessment.
- Investigate the M rate assumed for all ages, the use of CPUE tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.

<u>Life History, Biological, and Habitat Priorities</u>

Moderate

- Continue tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis.

Low

- Research depth preferences of herring.

<u>Management, Law Enforcement, and Socioeconomic Priorities</u>

High

- Continue to organize annual US-Canadian workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

Moderate

- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component.
- Develop socioeconomic analyses appropriate to the determination of optimum yield.

Low

- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.

XI. Figures

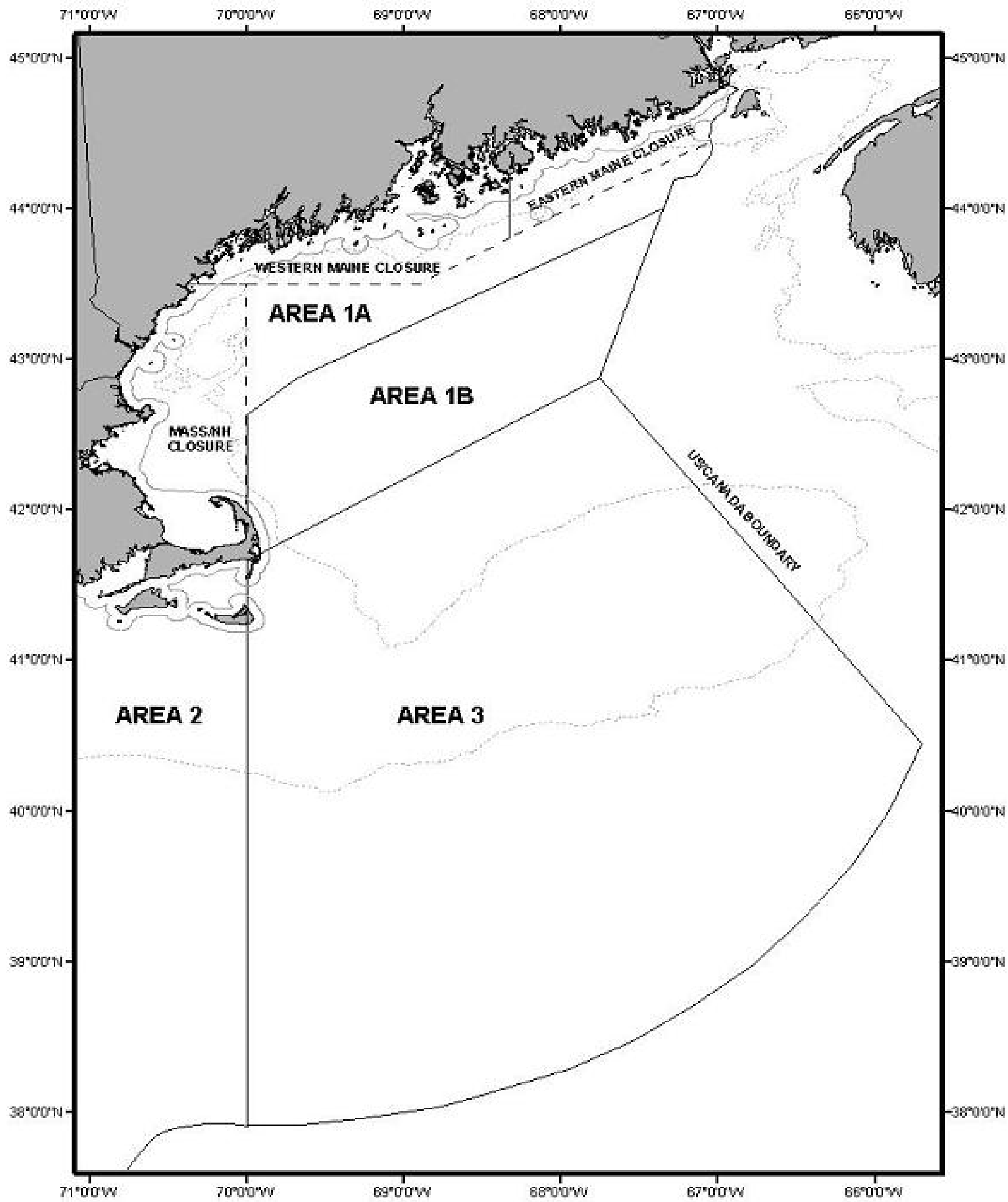


Figure 1. Map of Atlantic herring management areas with boundaries and the three spawning areas are within Area 1A, the inshore region of Gulf of Maine.

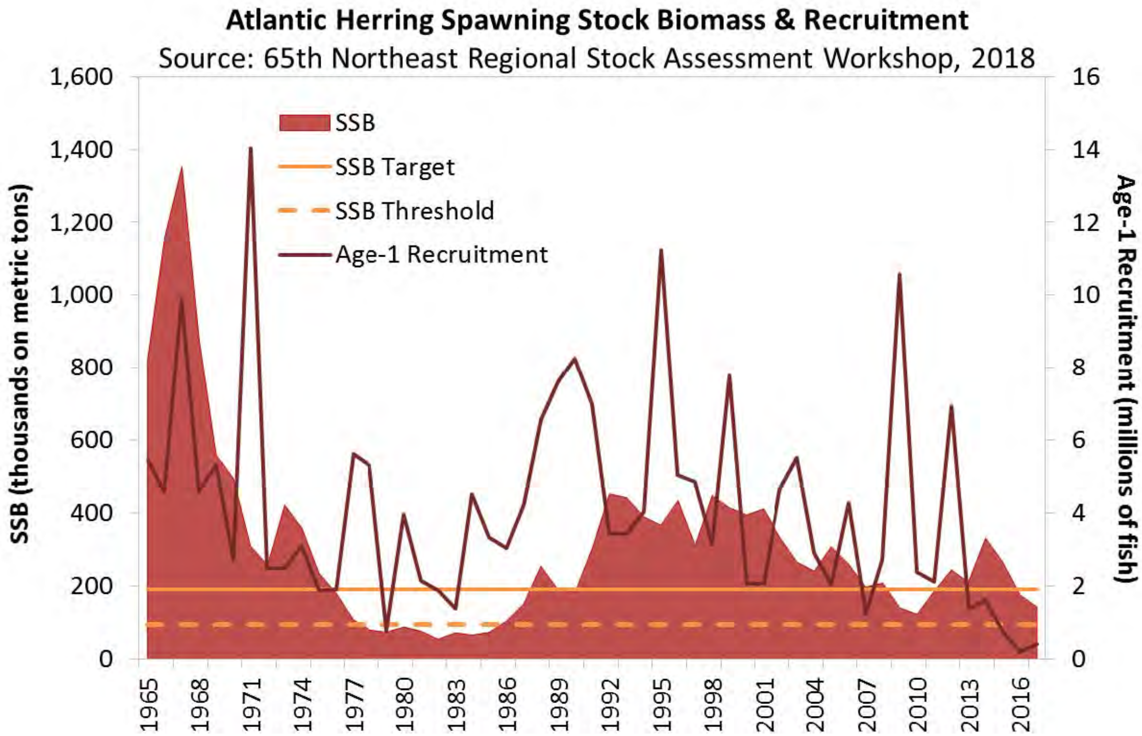


Figure 2. Spawning stock biomass from 1965 to 2017.

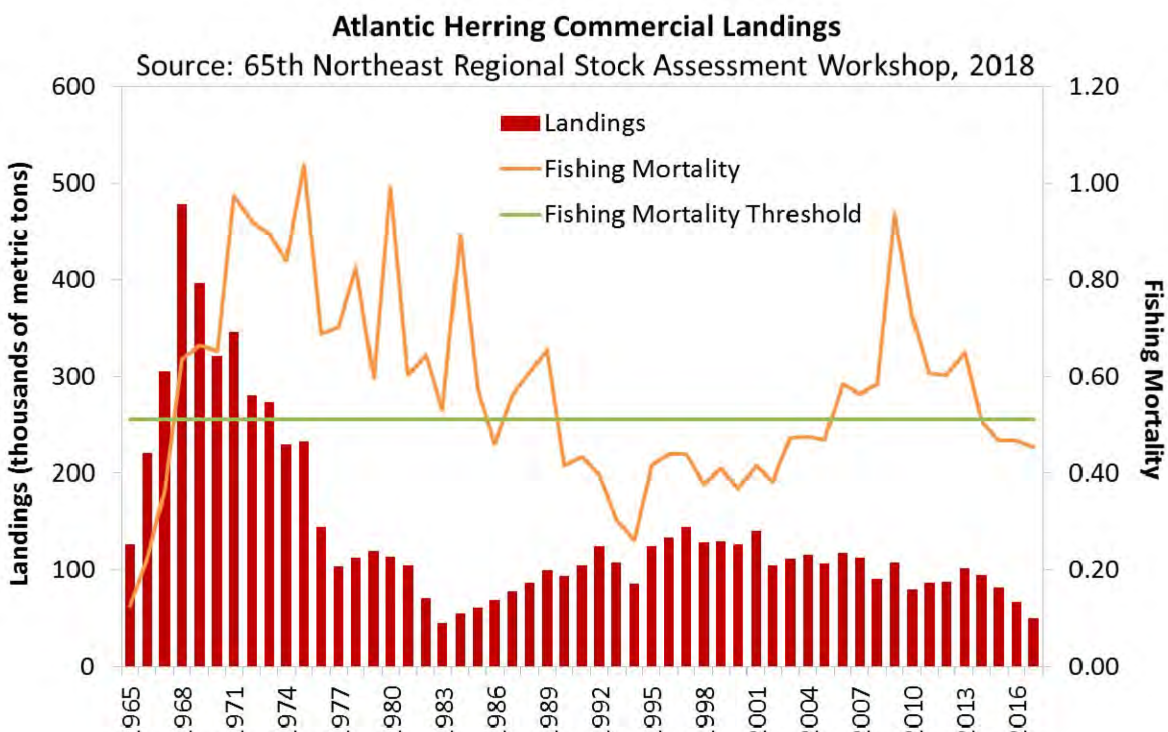


Figure 3. Commercial Atlantic herring landings by the U.S. fleet from 1965-2017

Atlantic States Marine Fisheries Commission

Atlantic Striped Bass Management Board

April 30, 2019
10:15 a.m. – 2:30 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*M. Armstrong*) — 10:15 a.m.

2. Board Consent — 10:15 a.m.
   - Approval of Agenda
   - Approval of Proceedings from February 2019

3. Public Comment — 10:20 a.m.

4. 2018 Atlantic Striped Bass Benchmark Stock Assessment **Action** — 10:30 a.m.
   - Overview of Benchmark Stock Assessment *(M. Celestino)*
   - Presentation of Peer Review Report *(R. Latour)*
   - Consider Acceptance of 2018 Benchmark Stock Assessment and Peer Review Report for Management Use *(M. Armstrong)*

5. Consider Management Response to the 2018 Benchmark Stock Assessment *(M. Armstrong)* **Action** — 11:30 a.m.
   - Review Technical Committee Report on Reductions Needed to Achieve Fishing Mortality Reference Points in 2020 *(N. Lengyel)*
   - Review Adaptive Management Timeline *(M. Appelman)*

6. Lunch — 12:30 p.m.

7. Consider Management Response, continued *(M. Armstrong)* **Action** — 1:30 p.m.

8. Consider Forwarding Comments to NOAA Fisheries Opposing Proposed Measures to Lift Ban on Recreational Striped Bass Fishing in Federal Block Island Sound Transit Zone *(M. Armstrong)* **Action** — 2:15 p.m.

9. Other Business/Adjourn — 2:30 p.m.

The meeting will be held at the Westin Crystal City; 1800 S. Eads Street, Arlington, Virginia 22202; 703.486.1111

MEETING OVERVIEW
Atlantic Striped Bass Management Board Meeting

April 30, 2019
10:15 a.m. – 2:30 p.m.
Arlington, Virginia

Chair: Mike Armstrong (MA) Assumed Chairmanship: 02/18	Technical Committee Chair: Nicole Lengyel (RI)	Law Enforcement Committee Rep: Kurt Blanchard (RI)
Vice Chair: David Borden (RI)	Advisory Panel Chair: Louis Bassano (NJ)	Previous Board Meeting: February 6, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, NMFS, USFWS (16 votes)		

2. Board Consent
- Approval of Agenda
- Approval of Proceedings from February 2019

3. Public Comment – At the beginning of the meeting, public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance, the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. 2018 Atlantic Striped Bass Benchmark Stock Assessment (10:30 a.m. – 11:30 a.m.) Action

Background
- The 2018 Benchmark Stock Assessment for Atlantic striped bass evaluates and informs management about the status of Atlantic striped bass stocks from Maine to North Carolina and was peer reviewed at the Northeast Fisheries Science Center's 66th Stock Assessment Workshop in November 2018.
- At its February 2019 meeting, the Management Board (Board) reviewed preliminary results of the 2018 Benchmark which indicated that the stock was overfished and experiencing overfishing. Unfortunately, due to the partial lapse in federal appropriations, the final assessment and peer review panel reports were not available for this meeting and formal review of those reports was pushed to the ASMFC Spring Meeting.
- The Assessment Summary Report and Peer Review Report are now available for Board review in **Briefing Materials** and on the SAW/SARC website.
- The full Assessment Report is available here on the ASMFC Spring Meeting webpage: http://www.asmfc.org/home/2019-spring-meeting
- The individual peer reviewer reports can be accessed here on the SAW/SARC website: https://www.nefsc.noaa.gov/saw/saw66/saw-66-panelist-reports.html

Presentations
- Overview of Benchmark Stock Assessment by M. Celestino
- Presentation of Peer Review Report by R. Latour

Board Actions for Consideration

- Consider acceptance of the 2018 Benchmark Stock Assessment and Peer Review Report for management use

5. Consider Management Response to the 2018 Benchmark Stock Assessment (11:30 a.m. – 12:30 p.m.) Action

Background

- After reviewing preliminary results of the 2018 Benchmark in February, the Board requested additional analysis from the Technical Committee (TC) as a first step in determining a management response to the assessment findings.
- Specifically, the Board tasked the TC to estimate the level of removals needed to reduce fishing mortality (F) to the target and threshold levels by 2020 and to provide one example recreational bag and size limit combination that would achieve those conditions on the coast and in the Chesapeake Bay.
- The TC's report will be included in **Supplemental Materials**.

Presentations

- Review Technical Committee Report by N. Lengyel
- Review Adaptive Management Timeline by M. Appelman

Board Actions for Consideration

- Consider management response to the 2018 Benchmark Stock Assessment

6. Lunch (12:30 p.m. – 1:30 p.m.)

7. Consider Management Response, continued (1:30 p.m. – 2:15 p.m.) Action

8. Consider Forwarding Comments to NOAA Fisheries Opposing Proposed Measures to Lift the Ban on Recreational Striped Bass Fishing in the Federal Block Island Sound Transit Zone (4:15 – 4:30 p.m.) Action

Background

- NOAA Fisheries released an Advanced Notice of Proposed Rulemaking (ANPR) **(Briefing Materials)** to provide background information and make the public aware of a proposal to remove the current prohibition on recreational striped bass fishing in the Block Island Sound Transit Zone.
- After reviewing the ANPR in October 2018, the Board sent comment to NOAA Fisheries requesting a delay on further action on the Transit Zone until the Board has an opportunity to review the benchmark assessment results and formalize a recommendation.
- After reviewing preliminary results of the 2018 Benchmark in February and anticipating consideration of the benchmark and peer review reports for management use at its next meeting, the Board moved to draft comment to NOAA Fisheries opposing the proposed measures (**Briefing Materials**).

Board Actions for Consideration

- Consider forwarding comment to NOAA Fisheries regarding proposed Measures to lift the ban on recreational striped bass fishing in the Transit Zone

9. Other Business/Adjourn

Atlantic Striped Bass

Activity level: High

Committee Overlap Score: Medium (TC/SAS/TSC/PDT overlaps with ERP, Atlantic menhaden, American eel, horseshoe crab, shad/river herring)

Committee Task List

- PDT – prepares and develops Plan addenda or amendment
- SAS/TC – various taskings relating to management response to 2018 benchmark
- TC – June 15th: Annual compliance reports due

TC Members: Nicole Lengyel (RI, TC Chair), Kevin Sullivan (NH, Vice Chair), Alex Aspinwall (VA), Alexei Sharov (MD), Carol Hoffman (NY), Charlton Godwin (NC), Ellen Cosby (PRFC), Gail Wippelhauser (ME), Gary Nelson (MA), Heather Corbett (NJ), Jason Boucher (DE), Jeremy McCargo (NC), Kurt Gottschall (CT), Luke Lyon (DC), Peter Schuhmann (UNCW), Gary Shepherd (NMFS), Steve Minkkinen (USFWS), Wilson Laney (USFWS), Katie Drew (ASMFC), Max Appelman (ASMFC)

SAS Members: Mike Celestino (NJ, SAS Chair), Nicole Lengyel (RI, TC Chair), Alexei Sharov (MD), Gary Nelson (MA), Gary Shepherd (NMFS), John Sweka (USFWS), Justin Davis (CT), Hank Liao (ODU), Katie Drew (ASMFC), Max Appelman (ASMFC)

PDT Members: Angela Giuliano (VA), Heather Corbett (NJ), Jorge Holzer (UMD), Kevin Sullivan (NH), Nicole Lengyel (RI), Gary Shepherd (NMFS), Max Appelman (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ATLANTIC STRIPED BASS MANAGEMENT BOARD

The Westin Crystal City
Arlington, Virginia
February 6, 2019

These minutes are draft and subject to approval by the Atlantic Striped Bass Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of proceedings of October 2018** by consent (Page 1).

3. **Move to task the TC with providing the Board with a report that shows the reductions in harvest needed to reduce F to F threshold (0.24) and F target (0.197) and also providing one example of recreational bag and size limit combination (if necessary, seasonal restrictions) needed to achieve these conditions a) on the coast and b) in the Chesapeake Bay and report back to the Board in May** (Page 18). Motion by Doug Grout; second by Justin Davis. Motion carried (Page 24).

4. **Move to have staff compose a letter to NOAA Fisheries opposing opening the Federal Block Island Sound Transit Zone for Board review in May** (Page 27). Motion by Pat Keliher; second by Ray Kane. Motion carried (Page 29).

5. **Move to approve changes to Virginia's Striped Bass Monitoring Program** (Page 35). Motion by Rob O'Reilly; second by John Clark. Motion carried (Page 36).

6. **Move to adjourn** by consent (Page 37).

ATTENDANCE

Board Members

Pat Keliher, ME (AA)
Steve Train, ME (GA)
G. Ritchie White, NH (GA)
Doug Grout, NH (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Raymond Kane, MA (GA)
Mike Armstrong, MA, (Chair) proxy for D. Pierce (AA)
Sara Ferrara, MA, proxy for Rep. Peake (LA)
David Borden, RI (GA)
Jason McNamee, RI (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Sen. Craig Miner, CT (LA)
Bill Hyatt, CT (GA)
Justin Davis, CT (AA)
Jim Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)
Russ Allen, NJ, proxy for T. Fote (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Heather Corbett, NJ, proxy for L. Herrighty (AA)
Loren Lustig, PA (GA)
Tim Schaeffer, PA (AA)
Andy Shiels, PA, Administrative proxy
John Clark, DE, proxy for D. Saveikis (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Russell Dize, MD (GA)
Mike Luisi, MD, proxy for D. Blazer (AA)
Bryan Plumlee, VA (GA)
Rob O'Reilly, VA, proxy for S. Bowman (AA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Michael Blanton, NC, proxy for Sen. Steinburg (LA)
Martin Gary, PRFC
Derek Orner, NMFS
Mike Millard, USFWS
Bryan King, DC

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Nicole Lengyel, Technical Committee Chair

Staff

Robert Beal
Toni Kerns
Katie Drew
Max Appelman
Jessica Kuesel

Guests

Karen Abrams, NMFS
Bill Anderson, MD DNR
Steve Atkinson, VA SSA.
Karl Blankenship, Bay Journal
Frank Bonanno, CCA
Josey Cline, ASA
Allison Colden, CBF
Jeff Deem, VMRC
Kelly Denit, NMFS
Chris Diehl, Conowingo, MD
Phil Edwards, RI DEM
Shaun Gehan, DC
Angela Giuliano, MD DNR
Ed Green, MD Charterboat Assn.
Zach Greenberg, PEW Trusts
Brian Hardman, Stevensville, MD
Ken Hastings, Mason Springs Cons.
Peter Himchak, Omega Protein
Shawn Kimbro, CCA
Phil Langley, PRFC
Arnold Leo, E. Hampton, NY
Savannah Lewis, MD DNR
Chip Lynch, NOAA
Chris Moore, CBF
Kelly Place, Williamsburg, VA
Danny Pritchard
Alan Risenhoover, NOAA
Dan Ryan, DC
Alexei Sharov, MD DNR
David Sikorsky, CCA
Marty Simonet, Ches. Beach, MD
Jack Travelstead, CCA
Mike Waine, ASA
Marcus Wilson, MD Charterboat

The Atlantic Striped Bass Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Wednesday, February 6, 2018, and was called to order at 2:25 o'clock p.m. by Chairman Michael Armstrong.

CALL TO ORDER

CHAIRMAN MICHAEL ARMSTRONG: Good afternoon folks. I would like to call to order the Striped Bass Board. I'm Mike Armstrong, your Chair.

APPROVAL OF AGENDA

CHAIRMAN ARMSTRONG: You all have an agenda; any improvements, additions? Yes, Toni.

MS. TONI KERNS: If it pleases the Chairman; I would like to give an update on the Striped Bass Cooperative Tagging Program.

CHAIRMAN ARMSTRONG: Yes that pleases me. Okay, any disapproval of the agenda with the added item? Seeing none; it is approved.

APPROVAL OF PROCEEDINGS

CHAIRMAN ARMSTRONG: You all have the minutes from October, 2018; any revisions, any objection to accepting it as written? Seeing none; the proceedings are approved.

PUBLIC COMMENT

CHAIRMAN ARMSTRONG: At this point we will accept brief public comments on items that are not part of the meeting today.

That would include the assessment. We aren't accepting comments on that. Seeing no comments we'll move on.

REVIEW OF THE PRELIMINARY ASMFC STOCK ASSESSMENT SUMMARY

CHAIRMAN ARMSTRONG: The first item is the Review of the Preliminary ASMFC Stock Assessment Summary. As you know, the official approval has not been issued by NMFS from the SARC yet, so this is called a preliminary review; so Mike, lead us through.

MR. MICHAEL CELESTINO: I was going to start my presentation off with exactly that remark. These results are considered preliminary. I also want to sort of preface the remarks by noting that we brought a number of models to the Assessment Review in November. The Committee put a ton of work into a migration model; and Gary Nelson in particular.

We anticipate the review not accepting that model for management; so we are bringing forward the model that we had reviewed in 2013. With that I will begin the presentation. I would like to start this presentation the same way we started our presentations in Woods Hole in November; with a huge thank you to all of our committees that worked on striped bass, the Technical Committee, the Stock Assessment Subcommittee, and Tagging Committees.

It really takes a village to move through a benchmark assessment; and everyone did an amazing job. I'll start with some of the bridge building that we did to get us to this new model. I mentioned earlier we started with the 2013 stock assessment review model and data configuration. We updated that with data through 2016; including the old un-calibrated MRIP estimates. We then took that same model completely unaltered, and just plugged in the new calibrated MRIP estimates. Then we created a base model with some of the changes that are described on the slide. In particular, again we are now using calibrated MRIP data, and we have some slides that I'll talk about in a couple of minutes.

We extended the plus group from 13 to 15. We reduced the number of fleets from 3 to 2. The previous implementation of this model had a commercial discard fleet that presented some logistic constraints to management. The Assessment Committee over the last number of years, and I think Gary Nelson in particular, was able to partition those commercial dead discards into Chesapeake Bay and coastal fleets.

We also made a number of changes to some of our indices. For example, we dropped two indices. We dropped the Virginia Pound Net Index. The Committee had concerns related to the single fixation design of that survey. We dropped the Northeast Fisheries Science Center's Trawl Survey.

The Committee had concerns related to low proportion of positive tows; as well as the elimination of inshore strata that were no longer sampled with the vessel change in about 2008 or so. We added an index. We added a Delaware Bay 30 Foot Trawl Survey that was designed to give us some additional information on Delaware Bay striped bass. We added a ChesMMAP Trawl Survey that was designed to replace some of the information that we were losing from the Virginia Pound Net Index.

We also took two indices that were previously modeled as just fitting to the trend in the data; the MRIP Index and the Connecticut Trawl. But as part of this assessment we were able to develop age composition information for those indices as well; so not the model is able to fit to not just the trend, but age proportions as well.

We also made a change to our Young of the Year Survey; so we have a Young of the Year Survey from Maryland and Virginia, and those surveys are ongoing. One of the things we've heard from review panels over the years are they would like to see a single index that represents the Chesapeake Bay as a whole.

As part of this assessment we were able to develop a Composite Index using some modeling techniques that have been used in other species; and so we now have a single bay wide young of the year Index. We also updated female maturity ogive. That work was done by Angela Giuliano and her colleagues at Maryland DNR. Scale and otolith ages are used and the terminal year for the base model is 2017.

First, I'll start talking about just some of the general catch information. The plot that's on the screen shows number of fish removals by source. The dark blue bars at the bottom are commercial harvest. The white with sort of blue hash marks are commercial dead discards. The gray bars are recreational harvest, and the gold bars are recreational dead releases.

The commercial harvest peaked in 1999 at about 1.2 million fish. You can see from 2004 through approximately 2014, landings averaged about 950,000 fish; and have been generally trending downwards, averaging about 600,000 fish from 2015 to 2017. You may recall that in that timeframe we also had implemented quota reductions as part of Addendum IV. Commercial dead discards, the releases were very low in the eighties, increased through the nineties, peaking in 1998 at about 350,000 fish, and declined through 2010 or so and have been relatively stable since.

Recreational harvest numbers, these are the gray bars. Recreational harvest increased from very low estimates in the 1980s, increased through the '90s, and peaked in 2010 at 5.4 million fish. Harvest has since declined to about 3 million fish in 2017. Then finally, recreational release losses peaked at 2006 at about 5 million fish, declined through 2011, and have been generally increasing since then.

Then the table that's on this plot just shows sorts of mortality; just in the terminal year 2017, and you can see most of our removals are from recreational dead releases in 2017 at just under 50 percent. Recreational harvest is responsible for 42 percent of the removals; commercial dead releases at 2 percent and commercial harvest are responsible for 8 percent of our total removals.

The next plot is just total removals by fleet;

just to illustrate removals by our coastal fleet and Chesapeake Bay fleet, and you can see the blue bars at the bottom are Chesapeake, the orange bars above are the coastal fleet, and the Chesapeake is responsible for about 40 percent of the total removals.

I'll go through and describe a bit about trends in recreational harvest and catch; as part of this assessment. This would bring me, I guess to a discussion on the MRIP calibration process. We were one of the first assessments to go through the peer review process with the new calibrated MRIP estimates. The 2006 NRC Review confirmed what many of you were generally aware of that the Effort Survey was becoming less effective over time.

Subsequent work resulted in adoption and implementation of a mail-based fishing effort survey, and that was implemented in 2018. We were able to use those estimates as part of the current assessment. Also as part of that review that review identified some concerns related to the intercept portion of that survey, and so that was able to be resolved as well.

The final estimates that we're using account for changes to the intercept portion of the survey; as well as the fishing effort survey as well. The plot that's on the screen now shows the percent difference between the original un-calibrated estimates and the final calibrated estimates for harvest; which is the top plot, and live releases on the bottom.

The red line going across the top bar in both instances is the average across the time series. Harvest, the percent difference between the un-calibrated estimates and the final calibrated estimates for harvest is about 140 percent. The percent change varied between roughly 50 percent and 400 percent.

Some of those larger percent differences that we see occurred early in the time series. Catches, harvest was low early in the time series; so small changes on low harvest can result in very large percent differences. But the part of the plot that I'll draw your attention to in particular, is the part between maybe 1995 or so through just before 2010. You'll see the bars are just below the average; and then after about 2010 or so you'll see the percent difference, the calibration accounts for a much greater difference from the early un-calibrated estimates later in the time series. The calibration process honed in on cell phone usage over time; and so with increasing cell phone usage, the calibrated estimates began to grow farther and farther apart from the un-calibrated estimates.

The plot below that is for live releases and shows a general similar trend. The time series average percent difference between the un-calibrated estimates and the calibrated estimates is about 160 percent; but we see that same trend of slightly below average adjustments prior to 2000, 2005 or so, and then slightly above average beyond that. Again, related to primarily cell phone usage.

The next plot shows catch comparison; so that we can see just the impact the calibration process had. In this plot harvest is plotted on the left; and live releases on the right. I'll point out that the scale of the two plots is different. Please keep that in mind. You can see at the Legend the gray lines; which are sort of really overlapping with the orange lines, are the un-calibrated estimates, and the APAIS calibrated estimates.

This is the completely un-calibrated estimates and the intercept portion calibration. You can see the intercept portion has very miner influence. But when calibrating for the effort survey, our understanding of harvest and live releases really change dramatically. In terms of harvest on the left, the scale is in millions of fish.

Again you can see there is not a lot of difference between the un-calibrated estimates and the calibrated estimates early in the time series; but that really grows over time. For example, prior to when the calibrated estimates were released, our understanding of how many fish were harvested. The peak harvest prior to the calibration we thought that they were about 2.5 to maybe 3 million fish harvested. After calibration that number is closer to 5 million.

The trends are similar with respect to the live releases. But you can see the scale is quite a bit different; so we initially thought prior to the calibration live releases peaked at about 20 million. After the calibration we think they peaked at about 50 million; based on the calibrated MRIP estimates.

In the interest of time I won't go through all the states. But we did see these same patterns held up among the states. Some states changes were more pronounced in some states relative to others. But the series of plots that are on the screen now show recreational harvest by state. They are oriented from north to south; so Maine is in the top left, North Carolina is in the bottom right.

The scales on these plots are all different among the different states and, again, show the general same trend. Not a lot of difference between calibrated and un-calibrated estimates early in the time series; and generally increases over time. The next plot is the same but now for live releases. The arrangement of states is in the same order. We can revisit these if people have questions; but in the interest of time I'll just sort of gloss over these. Then the final plot I have largely related to catch is catch composition. This is the catch at age broken out by fleet. The Chesapeake Bay is on the left; and the ocean fleet is on the right. The Y axis is year, and it is scaled from earliest in the time series at the top through most recent at the bottom, and the X axis is age; so Age 1 through Age 15 plus.

The sort of take-home message from these plots are you can see that early in the time series, in both instances for the Chesapeake and for the coast, but the pattern is more dramatic in the Chesapeake. You can see we don't see a lot of large old fish in the catch in Chesapeake Bay in the 1980s, so if you look at sort of the top right portion of pot there are no blue circles, which are our representation of catch.

As we move through time though, we start to see more and more fish showing up in those older age classes; as the age composition is expanding, but there is a suggestion in these data as well that we are starting to see a contraction of the age proportions later in the time series as well. I'll go quickly through all of our surveys.

I mentioned earlier the different changes we did for this assessment; so I won't go through those details again, unless there are questions. This plot just shows a sort of spatial depiction of where our different surveys are. I won't go through that and again unless there are questions. You can just see we're covering New York through the Chesapeake.

We have a variety of Age 0 and Age 1 surveys. The next plot is showing our Age 1 plus surveys. I'll just take a second to sort of walk through this a little bit. There is kind of a squiggly line that runs along the coast from Maine to Virginia. That is the MRIP survey that we're using and then the stars are the different surveys that take place, again just to kind of give you a sense of spatially where these surveys are taking place.

The next plot is our plot of young of the year survey indices. Partially in the interest of time I won't go through all of these individually. They largely speak for themselves; but I'm happy to revisit these during the question/answer portion. But you can see New York Young of the Year in the top left, moving left to right the Delaware Bay Young of the Year, Maryland Young of the Year, then the next row Virginia Young of the Year; and the composite.

Again, for this assessment we're using the

Composite Index. We're not using the individual Maryland, or Virginia on its own; we're using the composite of those two surveys. The next plot is our Age 1 Indices. Again, I probably won't talk a lot about these unless there are questions. You can see from these plots that we do see evidence of pulses of recruitment, strong recruitment years. We'll see those kind of reflected in the model estimates of recruitment that we will spend some time talking about.

Then finally the next plot we have is the Age Composition Surveys. Again, I won't really spend any time talking about these. Actually, maybe I will take a second. The MRIP Index we have, we made some minor changes to the way that that index is calculated. I mentioned earlier that Connecticut/Long Island Sound Trawl Survey. We're not just fitting to the trend, now we're fitting to the age composition as well; and so you do start to see a suggestion of a decline in the Connecticut Trawl Survey, and also a contraction of age composition data. The New York Ocean Haul Survey that survey has been discontinued. But it provides great information on age composition; so we've retained it for that reason, the New Jersey Trawl Survey kind of bounces around, the Maryland Spawning Stock Survey also kind of bounces around. Again, we can go back and revisit these if there are questions. But I just kind of want to get them just generally on your radars.

I guess on to the statistical catch-at-age modeling. I mentioned earlier that we're using the same model that was reviewed in 2013 that we did make data improvements that I mentioned earlier. This model is estimating recruitment abundance of our youngest age classes. We're getting estimates of fully recruited fishing mortality, estimates of catchability for all of our age composition surveys.

We're fitting to four different selectivity time blocks; to help us sort of get a more accurately modeled selectivity with changes in regulations. Again, I mentioned that the data are split into two fleets; again to give us a better handle on estimating selectivity for differences in fisheries between the Bay and the coast.

Onto the results, the first plot we have is fully recruited fishing mortality by fleet. Just in general you can see the gray line is the Chesapeake Bay fishing mortality, the yellowish gold line is fishing mortality along the Atlantic Coast. In general you see that fishing mortality in the Chesapeake is lower than in the coast.

There is a period of very low F in the late eighties. There is sort of an increase through the mid-1990s in both fleets; and then kind of some oscillation and perhaps stabilization of F for the remainder of the time series. The next plot is fully recruited fishing mortality. This is for the stock as a whole.

If you take the individual Fs at age for the previous two plots and add them together, and take the maximum F at age that is this plot, so our sort of understanding of coastwide fully recruited fishing mortality. It really sort of recapitulates what we saw at the fleet level. There is a period of very low fishing mortality in the late 1980s, increases through about 1995, and then that fishing mortality kind of oscillates roughly between 0.22 and about 0.3 or so.

The next plot we have is of recruitment. Recruitment is estimated in the model; so the year class is actually one year earlier. But you can see from 1982 through the early 1990s, there is a suggestion of a period of very low recruitment from 1994 representing the 1993 year class through 2004, representing the '03 year class.

There is a period of variable, but relatively high recruitment. After 2004, we see variable but relatively lower recruitment; though there are some stronger year classes, the 2011 and 2015 year classes are relatively strong. The dotted horizontal orange line is the time series average of recruitment.

The next plot we have is our trajectory of female spawning stock biomass. I'll show this plot again with our threshold; which will provide I think some reference, but you can see again this is the result that we largely saw in the previous assessment. There is a period of very low SSB early in the time series. We see a peak in about 1995 or '96, a decrease, a peak again in '03, and then a decline over the last 20 years or so in spawning stock. One of the things we do as part of our assessments is sort of a suite of sensitivity runs; and one very important one for us is the retrospective analysis.

This gives us a sense of just how much parameters might change with the addition of an additional year of data. This plot, on the left hand side we have the actual sort of time series of Age 8 plus abundance, female spawning stock biomass, fully recruited fishing mortality and recruitment. Each line represents a run of the model with one additional year of data removed.

I'll focus more for the plot on the right; which is the percent difference between 2017 and a model run with one year subtracted. I'll focus in particular with that subset on female spawning stock biomass and fully recruited fishing mortality. What we saw; and this was a bit of a difference from the 2013 iteration of this model. We see very little retrospective patterning here.

In the 2013 model our average retrospective, we saw about a 12 to 15 percent difference between the terminal year and some of these peeled, these earlier estimates. In this implementation we see an average over four years of almost 0 percent. But the range is about plus or minus 2 percent. We see that in spawning stock biomass and in fishing mortality; similar to what we've seen in previous iterations of this model.

We generally tend to underestimate biomass; so that with additional years of data SSB increases; and the opposite is true for fishing mortality. One caveat there is with the addition of one or two years of data. We actually expect with one year of additional data a slight decrease in SSB; and that is a bit of a variance from what we've seen in the past. But it's a fraction of a percent decline that we would expect to see.

One more sensitivity run that I'll describe. I mentioned in my first or second slide the series of model runs we did as part of our bridge building and continuity runs. We started with again the model that was peer reviewed in 2013; updated that with data through 2016, and that represents the dotted green line on the slide. It looks like that is showing up pretty reasonably.

The next step we did was take that exact model unaltered; and plug in the new MRIP estimates, the new calibrated MRIP estimates that I described earlier. That is the red dotted line that's on the plot. We did some additional bridge building along the way; but the other line we have on here is that black solid line. That is our final base run from the model.

Of course one of the biggest things that might jump out at you is if you look at the green dotted line again that's our 2013 model we just updated through the present. The rate of SSB decline is fairly shallow. It predicts a relatively shallow decline in SSB over time. What we see in the final base run is a very steep decline in SSB.

If you think back to the MRIP catch estimates that we saw; we think that a lot of that has to do with the new estimates in MRIP. We see that same signal in our surveys as well. We see it in a contraction of age composition data in most recent years. I only have one slide on our tag model work; which is just a compromise in terms of time. It's a disservice to all the work that the Tagging Committee did. But we only have so much time unfortunately; but one of the things that we always like to do with the tagging model is sort of use it as a check against our Statistical Catch at Age Model Estimate. It's a great way for us to sort of have confidence that the modeling results that we're seeing out of the Catch at Age Model are reasonable.

This plot shows total instantaneous mortality; so natural mortality plus fishing mortality. For the coastal programs the producer areas and for the Statistical Catch at Age. The Statistical Catch at Age is the black solid line. Aside from the earlier part of the time series where we don't have analogous tag model results, you can see that the trajectory and scale of all of our total mortality estimates are all in the same ballpark; they are actually quite similar.

Reference points, the Board and our terms of reference tasked us to address reference points. We wanted to develop a range of reference points that would address the objectives of the FMP. We explored both model-based and empirical estimates. In this model the non-migration model, the model-based estimates of reference points, and we looked at in particular spawning potential ratio reference points, just weren't providing us realistic estimates, particularly with respect to SSB. The F estimates were realistic; but the SSB estimates were not.

We weren't able to fully resolve. We have some hypotheses, but weren't able to fully resolve why that was. We are only brought forward to the review empirical reference points, and we used empirical reference points based on 1993 and 1995 estimates of spawning stock biomass. The current model is not stock specific.

We're modeling one stock but we're doing that through spatial fleets. We're not able to develop stock specific reference points; but we can from this model develop region-specific guidance. In order for us to fully flesh that out we would need some additional guidance from the Board; in terms of how to split the F up between the coast and the Bay. But we do have that available to us through this model.

To develop the reference points we do projections where we have not altered our methods from the 2013 assessment. From the model we get estimates of 1994 SSB for example, and then through our projections we're finding the fishing mortality that gets us to that SSB over the long term. A number of factors can influence that projection model.

This slide just kind of depicts the things that we changed and did not change. Sex ratio did not change; and that would affect the proportion female for our female SSB estimates, natural mortality was unchanged. Maturity I mentioned earlier that was updated, our maturity schedule, and we have the new statistical-catch-at-age model results. We updated the mean weight to age; and maybe one of the larger changes in the way that we've done the projections is we're using what we're terming a Hockey-stick Beverton-Holt stock recruitment model.

The next slide shows that graphically; which I think will help with sort of the explanation. The plot on the left is our stock recruitment relationship with a Beverton-Holt stock recruitment relationship fit to it. This was done external to the model. But one thing that the Committee acknowledged was that it doesn't seem like we're reaching the asymptote of that recruitment curve; and so the consequence of that is as SSB grows beyond that curve, recruitment can kind of wander off into unreasonable places, give us estimates of recruitment that had never been observed. The way around that what we wound up doing was using the plot on the right, we're using the Beverton-Holt model prediction of recruitment through median SSB. Then after SSB we're using average recruitment. This prevents that sort of wandering off of high recruitment values that aren't reasonable.

The next plot is a comparison of a description of our reference points and a comparison of reference points from the previous assessment and the current assessment. Again as a reminder, our threshold SSB reference point is the 1995 estimate of female spawning stock biomass, and the associated F threshold is the fishing mortality required to get to that SSB level over the long term.

The target is 125 percent of the threshold level; and the associated F reference point again is the fishing mortality required to get us to that SSB over the long term. The bottom portion of the table shows again a comparison of reference points. You can see the spawning stock reference points jump quite a bit; and that's due directly to our change in MRIP estimates. But the fishing mortality reference points didn't change substantively.

In the next plot, the next table shows us our stock status. Again, we've explored reference points related to 1993 and 1995, estimates of female spawning stock biomass. The yellow highlight in this table is highlighting '95 in particular. You can see an SSB in 1995 was just over 91,000 metric tons.

Our estimate of SSB in 2017 is about 68,000 metric tons; so we're under that threshold, and we're very certain that the probabilities are listed in the far right hand part of that table. We're very certain that that is the case. The stock is overfished; and the bottom part of that table shows our stock status with respect to fishing mortality.

The F required to get to the 1995 SSB estimate over the long term is 0.24. F in 2017 was 0.31, so the stock is also experiencing overfishing, and again the probability is very high that that is the case. This is the same plot that I showed earlier; just with that threshold value now depicted. You can see F in 2017 is above the threshold; and F has been above the threshold for 12 or 13 of the last 14 or 15 years.

The next plot shows female spawning stock biomass relative to the SSB threshold; again the 1995 estimate of SSB, and again you can see 2017 is below that and has been for the last three or four years. Again, we think a lot of this is from what we've seen with our change in MRIP estimates. Projections, these are similar to the projections I described earlier; but we're just doing now six year projections. We looked at four different scenarios. We looked at a scenario where we maintained; assuming that catch in 2017 was maintained over the subsequent six years.

We looked at three different fishing mortality scenarios; one in which we held constant fishing mortality in 2017 for the subsequent six years, one at which the F threshold, assuming we're fishing at the F threshold for the next six years, and then an additional scenario of fishing at the F required to get us to the 1993 estimate of SSB over the long term, holding that F value constant over six years. The methods for this projection were similar, nearly identical to the ones I mentioned earlier for our longer term projections. This plot is now showing those four different scenarios; so I'll just take a second to kind of walk us through this. Each panel is the SSB trajectory under each of those four projections. On the far left is the constant catch scenario, so assuming that we were catching 7 million fish over the next six years, the panel next to that is assuming we fish at the status quo F, F in 2017.

The panel next to that is assuming that we fished at the F required to get us to the 1993 level of SSB; and the last panel on the right is the projection assuming that we fish at the threshold. The horizontal blue line near the top of the plot is SSB from 1995. The solid black line is the trajectory of SSB from the projection, and the dotted lines are the confidence interval around that. You can see in each of those four panels the solid line, the trajectory of SSB under all four of those projections.

We do expect female spawning stock biomass to stay below the 1995 estimate of female spawning stock, under the four scenarios that we considered. This plot just shows the probability of being below that SSB threshold. If you look at the blue line in particular across all of those probabilities plotted on the Y axis, the probability is always above 95 percent that our estimate of SSB in 2023 would be below our estimate and below the F threshold. That is the last slide I have so I'm happy to try and answer any questions.

CHAIRMAN ARMSTRONG: I know there are thousands of questions. The first step I think we need to consider is how far we want to go today with this regarded as preliminary. That is up to the Board. We've seen a lot. I will editorialize that the assessment is likely to be the same, when it comes out.

We don't know that for sure. How far do we move? It's clear we need to do something at some point; and I guess we start the discussion now. But I have lots of questions; I'm sure other people have it too. Keep in mind this isn't officially the assessment yet. Question, Mike.

MR. MICHAEL LUISI: Very nice presentation, Mike. One of your first slides showed a list of all the data changes that took place when this benchmark was conducted. You mentioned it I think periodically throughout your presentation; but I would like to get a sense from you as to if you were to weight the significance of the changes, and how they applied to the changes that occurred as a result to spawning stock biomass and F.

You know is there one or two particular data inputs that were adjusted that kind of drove those, what I would consider significant changes to SSB and F? I might have a follow up, Mr. Chairman, depending on the answer.

MR. CELESTINO: That's a great question. I feel like we did a fairly robust, a very robust bridge-building process. The same signal seems to come through if we remove surveys, add surveys. We looked at I mentioned the composite-young-of-the-year index that changed. We didn't see a change as a result of that.

We are estimating recruitment; that's something that's missing from the slide. We're changing slightly the way we're estimating recruitment as a deviation from mean as opposed to a deviation from a Beverton-Holt. We didn't see any impact, a negligible impact from that; changing the maturity ogive, minor impact from that. I don't know if anything jumped out at me as being singularly responsible. The model seemed to be very robust to the changes we made.

CHAIRMAN ARMSTRONG: Go ahead, Mike.

MR. LUISI: I was trying to get to the point that the MRIP recalibrations likely played a major factor in the shifts that we've seen. While I'm absolutely concerned in the declines that we're seeing in spawning stock biomass, and the stock status as it would stand under this evaluation. I'm less concerned about the spawning stock, only because the overfished status or overfishing status is based on the reference point that we ultimately decide to select.

I think this Board needs to have that discussion about perhaps modifying reference points when we get to that point. But I have very great concern that a new element to the data inputs is having such a dramatic effect to the magnitude of what it is we're looking at; specifically that spawning stock biomass that had been very shallow for years, now seems to be jumping off the diving board. Just some concerns as to one element's impact to this analysis.

CHAIRMAN ARMSTRONG: John McMurray.

MR. JOHN G. McMURRAY: Just in regards to Mike's question. It's my understanding that when you have higher landings and you plug that into the VPA it will return the higher value for SSB, not just F. It kind of evens itself out there. But my question really had to do with the use of 1993 instead of 1995. I'm unsure of why that has happened in this process. I mean the stock was depleted in 1993; it was rebuilt in 1995. Maybe you could provide some explanation there.

MR. CELESTINO: Yes the Committee was responding to the Board task of trying to come up with a range of, a suite of reference points. Our goal was to bring a suite to the review; 1993 seemed like a good year to the Committee for a number of reasons, one the 1993 year class is a very strong year class, suggesting that SSB in that year was sufficient to produce that year class under perhaps favorable environmental conditions. That's how that year was selected primarily.

CHAIRMAN ARMSTRONG: John Clark.

MR. JOHN CLARK: Thank you Mike, and thanks to the Stock Assessment Committee. There was clearly a massive amount of work that went into this. Just kind of following up on some of the things that we've already heard, when I looked it was pulling out of the draft that went for the peer review.

It just seems that when they look at the continuity run and the bridge run, the final SSB is much closer to where the threshold would be. But with this new model, as Mike said, it looks like it jumped off a diving board. It seems like every time the model is improved the stock looks worse. Just curious as to how the threshold changed so much between like the bridge run and the base model, as you call it here.

MR. CELESTINO: MRIP is we think at play at that as well. Another thing that I think that I remember from our sort of bridge building process, the 1995 estimate does shift a bit, depending on whether we use separate Maryland and Virginia indices versus a composite index. There is a signal that's coming through in the composite index; and that seemed to influence some of the earlier parts of the time series. But over the entire time series we think that it's changes in MRIP that the calibration process is really influencing SSB over the time series.

DR. KATIE DREW: Just to add to that. I think another thing that we had looked at is with the MRIP index we now have age composition information for that. Whereas before, it was just sort of a general, we said it represents this chunk of ages, but now we actually went through and developed an index at age.

You can see a stronger signal in terms of a contraction of the age structure that with those years of poor recruitment you're not seeing that the age structure gets smaller, because you're not having as many fish move into the SSB, and you see that more clearly in the MRIP index now that we have the age structure.

Doing the bridge building run, where you don't include that age structure, things look better than when you do include that age structure. That's kind of part of what's happening is that the model can see that there is worse information on stock status from the age structure of the index.

CHAIRMAN ARMSTRONG: Rob.

MR. ROB O'REILLY: Thank you for your presentation, Mike, and everyone who has been involved in the work. The commercial removals are about 10 percent; and I was just wondering, with them being so low and with the history of difficulty associated with pinpointing commercial discards. What was gained by going from three-fleet to a two-fleet approach? That is the question.

MR. CELESTINO: One of the main goals of doing that was to address one of the Board concerns from some time ago. That third fleet created problems. I think the Board had considered fleet reference points for a period of time; and the one sort of wrinkle to that approach was having this commercial discard fleet.

If either of the two directed fleets could be in reasonable shape, not overfishing or overfished, but if the commercial discard fleet did require management action it created this sort of perverse scenario where to reduce discards we would have to increase directed catch. It seemed to present an obstacle to management. We were I think largely responding to a request from the Board to help with that management question.

CHAIRMAN ARMSTRONG: Emerson.

MR. EMERSON C. HASBROUCK: Thank you Mike for your presentation. Mike, one of your slides had a graphic showing; I think it was biological reference points and the terminal year SSB and F. I don't recall the full details of that slide; but if you could put that back up again, please? Yes that was the slide. What I'm trying to figure out here is if we're using the new MRIP data, all right the new MRIP data which shows that recreational harvest estimate is whatever it was, 150 percent of what the non-calibrated data shows, right? If the catch was that much greater, than to account for that doesn't the spawning stock biomass have to be bigger by an approximate amount? How is that taken into account in this table, or in the assessment? That's what I'm trying to figure out here.

MR. CELESTINO: That's a great question. Those percentages were for numbers of fish; so I think one explanation is we wouldn't necessarily see a one-to-one increase based on immature fish. It may be the maturity curve that's accounting for that.

CHAIRMAN ARMSTRONG: Go ahead, Emerson.

MR. HASBROUCK: Thank you for the follow up. But even if that is numbers of fish, then the poundage of harvest is greater; and therefore the SSB had to be greater to account for that additional harvest, right?

MR. CELESTINO: Yes and we do see a pretty substantial change in reference points, in direct response. Not necessarily a doubling, but probably close to about the level of increase. For example, 60,000 metric ton threshold to about 90,000 metric tons, not quite as much, but I don't have a great answer for why it's not a one-to-one change.

MR. HASBROUCK: I don't mean to monopolize the discussion here. But my question really wasn't why is there not a one-to-one. I just didn't know where that increase was coming into account. I guess it was this slide here that I had in the back of my mind. What you're saying then is that for spawning stock biomass for instance. The previous reference point was 57,626 for the threshold; and what's being used to determine overfished and overfishing status. Out of the latest assessment now is 91,436, is that correct?

MR. CELESTINO: Correct, yes.

CHAIRMAN ARMSTRONG: Roy Miller.

MR. ROY W. MILLER: Thank you, Mike. What we're seeing is of course consideration of the stock as a whole. Could you quickly review for me what if anything was done with regard to spawning-area-specific stocks, such as Chesapeake versus Delaware River, versus Hudson River? If those had been broken out, would the results have been different for any of those systems?

MR. CELESTINO: That's a trickier question to answer; because we don't have final results from the Northeast Science Center. But the short answer to the question is we did embark on a migration model, a stock-specific model that models explicitly the Chesapeake stock, and explicitly a combined or mixed Hudson River/Delaware Bay stock or Delaware River stock.

I'm not sure how much; well I guess I can say objectively what the results were. It did paint a different picture. The Review Panel, our understanding again from our conversations at the review in November were that the Review Panel did not think that model was suitable for management at this point, so I'm reluctant to go too much into those results. But I mentioned earlier the work that the Committee did, and again Gary Nelson in particular did this migration model. It was a tremendous amount of work. Our Committee had great confidence in the model. We wouldn't have brought it forward to the review if we didn't think it was suitable.

But we needed to convince a Review Panel, and our understanding is that we're not quite there yet with them. Short answer is it paints a slightly different picture; not terrible different on a combined stock basis, but a slightly different picture. I'm not sure how much I can say about it. I certainly don't want to put words in the mouth of the reviewers until their reports are released. I hope that's helpful.

CHAIRMAN ARMSTRONG: Mike or Katie. What will we see next meeting that's not included in this report now? I assume this information will be the same; if it passes muster. What additional things will we see?

DR. DREW: The complete report from the SARC will have a complete description of the migration model that did not pass; as well as sort of the results and the output of that so that you can evaluate the work that was done for that. But it will also have as well as more details on, we gave you a summary report on the results of this; but obviously the final report will be much more detailed, several hundred pages worth of actual assessment information.

But you will also then receive the Peer Review Panel report; where they will basically explain in more detail why the migration model failed, what needs to be done. They were favorable in the sense of they thought this was a good idea and we should continue to work on it. They gave us additional feedback on how to go forward; in terms of data collection and modeling approaches. That information will be included; as well as sort of an assessment of what they chose as the preferred model. But the numbers that you're seeing are not something that is going to change from that report.

CHAIRMAN ARMSTRONG: Okay and that's very important that what we're seeing now is what we can chew on. Doug.

MR. DOUGLAS E. GROUT: Yes I was curious about; you know seeing that the model is showing that the SSB has been declining for a while. You mentioned that you had gotten the MRIP data split out into age; which is good, and that probably some of the information in that influenced the models output of showing that we're having a decline in recent years, a steep decline in SSB in recent years. Did the other fisheries independent surveys show a similar decline in SSB the fish that are in the SSB age group?

MR. CELESTINO: We did in general see that. The exception that comes to mind is the Maryland Spawning Stock Survey. That probably showed more of a sort of stasis or static. I don't think we saw quite the contraction. But in the other surveys we really did; the Delaware Trawl Survey and New Jersey Trawl, Connecticut/Long Island Sound. We did see that contraction; and again in our MRIP Index as well.

CHAIRMAN ARMSTRONG: Russ.

MR. RUSS ALLEN: Thanks Mike, excellent presentation as always, and thanks everybody else that is working on this. One of the things that jumped out at me was that 48 percent of the removals for 2017, I believe came from recreational discards. That is kind of disturbing to me, for one. Then just looking at Table 1 in the summary, I see that it's the first time that removals from discards were higher than actual harvest for the recreational fishery since 1998.

My question is did the Technical Committee discuss this, Stock Assessment Committee discuss this, and do you have any thoughts on where that's headed? It's a very disturbing thing for someone who does not like to see dead discards; I mean it bothers me, so if you have any insight on that I would appreciate it.

MR. CELESTINO: Thank you for that question. My memory isn't super clear as to how much the Committee talked about that. My general sense is that we see that increase in recreational dead releases just around the time of implementing Addendum IV. One of the things when we all did our conservation equivalency and we sort of come up with our projections of what we think will be the required reduction.

We are never able to quite account for angling behavior. Some of those things might be at play Addendum IV and some angling behavior that was either unanticipated. Also some strong recruitment classes that are coming through, but I don't know that the Committee talked about it explicitly. My memory is not clear on it.

CHAIRMAN ARMSTRONG: I would think that that is an issue we're going to have to talk about as part of the actions coming up; probably not today, but certainly that is going to be in the package we're going to have to look at, because we can't ignore 50 percent of the mortality on this start. Ritchie White.

MR. G. RITCHIE WHITE: Kind of to follow along on that vein. Recreational release mortality increased since the last stock assessment; is that correct, and if so then I have a follow up?

MR. CELESTINO: Yes, we are seeing an increasing trend, especially in the last couple of years.

MR. WHITE: Follow up would be can that be an indication of the declining spawning stock biomass; in that there are less legal fish available to catch?

MR. CELESTINO: The short answer is I'm not sure. I think it's hard for us to know all the reasons why fish might be discarded; so I'm not going to have a great answer for you. But I think a combination of cohort younger fish moving through. But I don't have a clear answer for you, I apologize.

CHAIRMAN ARMSTRONG: Jay.

DR. JASON McNAMEE: Mike, great job, you know really detailed report for something you weren't able to detail very much; so I really appreciate all the work that you guys did on that. I'm getting back to what new information we might get at the next meeting. One thing I was wondering about is did we get any guidance? I know you guys looked at the suite of different reference points. Did you get any guidance from the peer reviewers as to – I know they wouldn't pick them for you – but did you get anything that we are going to be able to use when we start thinking about the reference points as they are now, or what they should be?

MR. CELESTINO: Our plan was initially to bring, like I mentioned earlier, the suite of reference points to the Review Panel, and exactly as you indicated not have them select. But we wanted to engage in a dialogue with them on range and possibly methods. We reached out to the Northeast Science Center. I won't necessarily say they discouraged us from doing that; but it wasn't an explicit term of reference to have a dialogue on that. My personal expectation would not be to receive guidance in the documents that come forward.

CHAIRMAN ARMSTRONG: Mike.

MR. LUISI: Thanks for the second opportunity for a question. I think it's important for the Board to get a sense as to what's coming. I don't know can you put up your composite recruitment graph? Mike, you did a nice job of early in the time series recruitment was very poor. We had spikes in recruitment in I guess it was the mid-2000s; late '90s, 2000s, and now we have a time period where we've had some poor years, but also some strong years classes.

The 2011, the 2015 and I guess that's '15/'16. Could you provide the Board with, as far as inclusion of those fish in the SSB estimate, are there a proportions of those classes that are part of the SSB that we're evaluating now? I can imagine the 2011s are getting very close; if not all the way recruited to the SSB. But the other two year classes I think are going to play a significant role in boosting, to some degree, the SSB in future years. If you can give the Board some perspective on that it would be great.

MR. CELESTINO: Sure, thank you for that question. Our maturity schedule does allow for maturity of some of those smaller fish. But we see very few mature fish at younger ages. As an example, up through Age 4 or 5, we're only at about 20 to 25 percent maturity, so a small proportion in those early years. Those larger two year classes I wouldn't expect a lot of SSB to be reflected from those year classes.

CHAIRMAN ARMSTSRONG: Emerson.

MR. HASBROUCK: Thank you Mr. Chairman for coming back to me. But just based on the question that Mike asked, is there any discussion or projection in the assessment about what's going to happen with SSB when the 2011, when that year class becomes fully mature, which is going to happen fairly soon, and similar question for 2015 year class?

MR. CELESTINO: Yes I think the projections, we did a limited number of projections, but I think that those are exactly the year classes that we're seeing sort of coming through; and we see this upswing in SSB. I'm looking to try to get that slide up in just a second. But I think those are those year classes, we're sort of under these status quo fishing mortalities. We still see SSB increasing, and our suspicion is those year classes moving through.

CHAIRMAN ARMSTRONG: Jay.

DR. McNAMEE: I'll stay on this theme as well. It's important to keep in mind that the recruitment plot and you don't have to sweat. The recruitment plot we just looked at is a model generated recruitment plot. There is a retrospective pattern in recruitment that was one of the more good retrospective in general for the model; but that was of all of the things you looked at.

One of the worse ones, I guess the comment I'm making is we should be careful about how many chickens out of those we count. The other thing that we'll need to pay close attention to when we get to this point, are the recruitment assumptions that go into these projections. Mike, I thought you said you guys used the spline Beverton-Holt model here. We'll have to think about that in relation to some of that recruitment information as well. I think it's good to think forward a little bit; but we should do so cautiously.

CHAIRMAN ARMSTRONG: Rob.

MR. O'REILLY: Mike, I guess this is going to be asked out of just a falling out of the technical world a while back. I don't know how the statistical-catch-at-age model behaves; in terms of past information. But it seemed one of those figures you had up, not the catch composition picture, but the earlier one which showed that a lot of the change from MRIP.

Where it was 140 percent overall, and I think you commented it went from 40 to 400 percent, depending on where we were looking. A lot of the elevation was before 1993, it seemed, compared to years after that on the harvest. The B-2s looked a little bit different. They didn't have exactly that same pattern. But I guess what I was wondering is does the model, is the impact from those earlier years with the changes of MRIP as substantial as in the later years? In other words, does it carry through? Then I might have a little follow up.

MR. CELESTINO: I think I understand your question. In the statistical-catch-at-age model, our earlier years are our most uncertain years in the model. The plot that I'm looking at, I don't know if we can put this one up. I just want to make sure I'm thinking of the same plot that you are. We're going to try to get it up in just a second. Is this the figure you were thinking of?

MR. O'REILLY: That was the second one. There was one where you had prior to that I thought, where at the top it had the harvest, at the bottom it had the B-2s, and it showed the changes from MRIP.

MR. CELESTINO: This plot.

MR. O'REILLY: Yes that is it.

MR. CELESTINO: Maybe the reason I was thinking of the following plot was I mentioned earlier that the percentages are much larger. I'm going to make sure I understand you. I'll try to answer your question. If I'm misunderstanding it please just let me know, I'll try again. When I think of the subsequent plot the largest differences are happening, the lines are getting farther apart after 1995 or 2000 or so. The model is making adjustments for all of those. Our estimates of abundance are going to be most uncertain earlier in the time period. But all the catch estimates are making the way through the model. That sort of smaller difference increase, at least in the part of the time period that I'm thinking about is of course reflected in the model. I don't feel like I'm answering your question.

MR. O'REILLY: Let me try to help, because you're nice to give it a shot here. In the upper graph, the before 1993 you have the average line, but then you have what the changes in MRIP caused I think, right in the brown bars?

MR. CELESTINO: Correct.

MR. O'REILLY: It seems to me that it's above average quite a bit in the early years. I was wondering, does that have equal influence in the model as the later years? It seems that you said it's all considered, it does since it's a forward projection model. But where I was thinking was did the, and is it sort of heresy, but do you always have to look at a starting point of data?

You looked at 1982, so for example what would a run look like if you didn't have those higher years, which are clustered more towards the early time series? Do you look at that in any way? I say that because I remember when we started with striped bass there was a DPA in 1996. This is a different model, I understand that. There were probably 13 years of data. We're talking now about 37 years of data.

Are there ways if we know, and I suspect this is the case, if there is also variability from what I've heard presented by Dave Van Voorhees about certain years; that there is still variability that is there some way to look at this differently that if all of a sudden you get beyond 1993. There is somewhat a better representation. Although I think you could say well in the mid years you're low. Is that something that was even talked about?

MR. CELESTINO: Thank you for clarifying that question. I apologize for getting it wrong the first time. We did talk about as one sensitivity run, rather than doing a retrospective, kind of doing a reverse retrospective. Regrettably we just sort of ran out of time and weren't able to do that. One way that now that I understand your question better, one way that we are accounting for some of this information in the current model is we do have CVs on different years of the catch, so some years of the catch that we're more certain of than others.

We can give the model a little more leeway early in the time series when we may not be quite as certain of catch. That is one way that that can be incorporated into the model. But the more explicit sort of shading off early years was discussed explicitly; and it was part of our table of sensitivity runs. We just weren't able to complete that.

CHAIRMAN ARMSTRONG: John.

MR. McMURRAY: I'm sorry I'm having a hard time following a lot of this. The 2011s, they are fully recruited?

MR. CELESTINO: The 2011s, they would be about seven or eight now, so yes we would expect to see that year class working its way through.

MR. McMURRAY: I could tell you one thing both personally and speaking on behalf of the recreational fishing community. They are not available. I mean certainly there are flashes here and there of those fish. But they are not the panacea everybody thinks that they are. I mean that seems to be pretty clear in the stock assessment; but it's also very clear to those of us that are out there targeting them. They're not around.

MR. CELESTINO: Yes and forgive me, so our selectivity curves in the Atlantic coast, we do assume full selectivity at Age 13, 14, or 15, and so those would not be fully selectable. That should generally jive with your observation, not fully selectable but partially selectable.

CHAIRMAN ARMSTRONG: Mike, to that point. Can you see the 2011 year class moving through the catch-at-age as a strong year class?

DR. DREW: I actually was just looking at this before. Yes you can, if we can go back to that figure actually. I think what we see in the catch at age lines up with what John was saying; which is that you can see, so you see the bigger bubbles are more fish in those age classes than in those years.

You can see on the ocean side you can see the 2011 is a bigger set of bubbles moving through, relative to what is around them. However, I think it is for sure not as abundant as I think that's the 2003 year class above that is much larger. Yes we do see them. They are more abundant than some of the other year classes, but they are not as you were saying the panacea for SSB.

CHAIRMAN ARMSTRONG: Are there any more questions to the assessment? That is a lot of information.

DISCUSS NEXT STEPS FOR STRIPED BASS MANAGEMENT

CHAIRMAN ARMSTRONG: We move to the next item, which is discussing the next step. Clearly there are next steps needed; but I'm uncertain which way we go here. Do we charge the TC with some more projections? Under all the projections they provided, under all the scenarios through '23, we don't come close to the reference points that are proposed.

Do we charge them with looking at some other things? What F do we actually need to think about achieving to get the SSB? Are these the right SSBs that we want going forward? Are we looking at an addendum, are we looking at an amendment? But if we don't ask for something now and get it started, we've lost three months already. We really need whatever we do to be in place by the next fishing season. I would suggest we move on something today and open to suggestions. Ritchie.

MR. WHITE: Actually I'll start with a question for Max. What is the wording in the plan that requires us to take action when the stock is overfished and overfishing is occurring? What is the wording?

MR. MAX APPELMAN: I don't have the exact wording in front of me; but if we were in a position to accept the results that would trigger four of the management triggers, two of which are related to fishing mortality, two of which are related to SSB. Those that are related to fishing mortality require reducing F to the target within a year. Those related to SSB charge the Board to increase SSB to a timeline that they need to choose. There are some restrictions on that timeline length.

CHAIRMAN ARMSTRONG: Follow up.

MR. WHITE: A management action can accomplish both those by addendum?

MR. APPELMAN: Yes.

CHAIRMAN ARMSTRONG: John.

MR. CLARK: Also a clarification. On the amendment, if I understand it, if we were to change the reference points at that point we would have to go to a new amendment, right? The actual 1995 SSB is part of the Amendment 6.

MR. APPELMAN: Actually there is a lot of flexibility in the Adaptive Management Section of Amendment 6. I was just reviewing this prior to the Board meeting. Almost everything is covered in the addendum process; except for management objectives and goals. Just about everything else can be done through an addendum; including reference points.

CHAIRMAN ARMSTRONG: In regard to timelines, we are in such a different spot that was never covered in any addendum or amendment. As of last assessment the stock was doing okay. We had some concerns. With brand new data the entire assessment has changed; to no one's fault, but we've pulled back the curtain and the Wizard looks quite different now. The timelines, you know we need to think about that. Mike.

MR. LUISI: The Wizard is old and tired now. I think Ritchie, I think his back and forth with Max was exactly what we should task the TC in evaluating; which is let's take the current amendment framework that we have. Determine whether or not if we were to accept the terms that were just reported to us; did triggers get triggered?

If so what is the consequence of that before the Board? I think that is completely acceptable; as far as a tasking to come back before the Board, so that we can understand what the management implications are for those decisions that we'll have to make the next time we get together. I do want to just provide my opinion as a word of caution; to stepping back in time and kind of redoing Addendum IV, which I wasn't on the Board at the time, but across the board states were required to take reductions through a paper and pencil exercise.

Five years later, it doesn't seem as if what we did a whole lot of good as far as recovering the stock. I feel as if we're in a different place and time right now. Amendment 6 was developed back in the time period when we had a super abundance of stripers in the ocean. We no longer have that based on this assessment.

I would be supportive of a more comprehensive look at all of the elements that are in Amendment 6 for potential change; which would be goals and objectives, trigger mechanisms, reference points, time periods. All those elements, I think we need to reconsider them. You know we did a survey a year or two ago; I don't remember when that was. But there was a clear indication that the Board was kind of split; as far as do we want to have a super abundance of large striped bass in the ocean, or do we want to have harvest as part of that as well?

I do think that we would be foolish to go back; and this is kind of to Russ's point and Ritchie's point earlier. If you look at the last five years, it's the last five years where our dead discards have been greater than the actual harvest in the recreational fishery. That is a really big problem. We can say all day that we want to reduce F.

Let's reduce F. But if we don't succeed by solving a problem, we're going to be right back here again five years from now when the next assessment is done, because we have exacerbated the problem by increasing size limits, creating situations where fishermen have to cull through 20, 30, 40 fish before they can keep one.

We did that and I hope we don't do that

again. I would think that through an amendment or an addendum process, we could be more creative in our approach; to try to solve the problem, which is kind of the focus of that problem would be on dead discards. Ultimately we're taking down removals to accomplish what it is we need to accomplish.

I foresee a little bit of a longer time period. Maybe it can get done before the beginning of next season. I hope that we don't act as a Board swiftly, and find ourselves making the same mistakes we made five years ago. Based on the review of this assessment we really accomplished very little.

CHAIRMAN ARMSTRONG: Doug.

MR. GROUT: Obviously one of the issues we have here is we don't have the final peer reviewed stock assessment here. But we're anticipating getting that shortly, hopefully. What I would like to do is make a motion that will propose to task the TC with some very basic tasks; just to start getting information of what the impacts are from this assessment, what we could potentially need to do just as a minimum with this assessment, based on what's currently in the management plan.

Not start an addendum at this point or an amendment, but let's get some information so that we can see what the impact of this is and maybe a single idea what we might need to do. I agree discards is an issue. I don't see that discards have exceeded harvest in the last five years, but certainly in 2017 it was very evident that we were heading in that direction.

With that said I have a motion; and I want to caveat it that this tasking of the TC, the work is only to begin after we receive the final benchmark assessment, the report and the peer review of it. But to task the TC with providing the Board with a report that shows the reductions in harvest needed to reduce F to F threshold and F target.

When I'm referring to that I'm referring to the ones I saw up there based on the 2015 SSB, was it 0.24 for the threshold and 0.197 for the target. Then I would also, I don't want to over task the SSC with providing a suite of seasons, size limits. But I would like to see an example, just a single example for each, what it would take to reduce the harvest by that amount. My motion goes on to say also provide one example of recreational bag and size limit combination, and in parentheses say if necessary, seasonal restrictions needed to achieve these reductions a; on the coast, and b; in Chesapeake Bay, and to report back to the Board in May.

CHAIRMAN ARMSTRONG: Is there a second? Justin Davis, second. Discussion, Doug. Ritchie.

MR. WHITE: Question, would it make sense to also add the appropriate percent reduction in the commercial quota? That is a question to Max or the Chair.

MR. APPELMAN: I'm sorry; I was talking with my crew over here. Could you please repeat the question?

MR. WHITE: Sure, does it make sense to add to this the appropriate reduction in commercial quota, corresponding to the motion?

MR. APPELMAN: If you wanted to add that I'm sure you could. What I was just talking about with my group, if you will, was when it comes to providing one example of a bag and size-limit combination. I mean as we know right now there are a plethora of different regulations implemented across the coast; especially Bay versus the rest of the coastal fisheries.

I don't know; I mean they could certainly put an example together, but I fear that that comes in front of the Board and you guys look at it and say that's nothing what we wanted to see or there are a million combinations that they could put together. I'm looking for a little more direction for them.

MR. GROUT: I'm not saying that this is something we're going to put in a plan. All I'm trying to do is show the Board and show the public about an example of what kind of changes might be needed to accomplish those reductions in F to the threshold and target. You can pick anything, I don't car; you know I prefer bag/size limit.

But if you need to go to a seasonal restriction coastwide and this would be like a coastwide because we have different regulations in the Chesapeake Bay than we do along the coast. Just give us one example. I know this Board can come up with hundreds of different combinations we want them to look at. But that is not the point right now. The point is for us to visualize, and the public to visualize what kind of things it is going to take to accomplish this, just one example.

MS. NICOLE LENGYEL: Doug, a couple other things that would be helpful for the Technical Committee. One is a timeline, so the triggers in Amendment 6 specify F to the target within one year. If we could add a timeline to the motion, perhaps, and also probabilities, if you recall back in Addendum IV that 25 percent reduction in Addendum IV had a 50 percent probability of achieving F to the target. Does the Board have a certain probability they're comfortable with?

MR. GROUT: Two thousand twenty, 50 percent probability, just to get you going.

CHAIRMAN ARMSTRONG: Doug, would you anticipate SSB projections associated with those?

MR. GROUT: It could. I mean we could pile on them. But my goal is what's it going to take to end overfishing in a year?

CHAIRMAN ARMSTRONG: In a year. Okay so that's where we get to 0.197 may not be enough to get us back very quickly. There may be a restoration F we need to move to; as horrendous as that sounds.

MR. GROUT: That may be a further thing that we would have to, a restoration for SSB may be in the future; but let's get the first thing on the table, at least from my perspective.

CHAIRMAN ARMSTRONG: Okay and this is going sort of how I thought it would be. We only planned on three hours, and this is an eight hour meeting we're leading up to, so we do have to watch the time a little bit. But we have a second, so comments on Doug's motion. I have a couple already; Justin, good, Emerson.

MR. HASBROUCK: In Mike's presentation, did I understand it correctly that there were a couple of different sets of reference points that were suggested and we're waiting for feedback from the peer review about those suggested reference points, or did I misunderstand?

MR. CELESTINO: There are two reference points that we brought forward. We brought a 1993 and 1995 SSB and 125 percent of 1995. But we don't anticipate getting any feedback on alternate reference points, only on stock status determination relative to 1995 SSB.

CHAIRMAN ARMSTRONG: Go ahead, Emerson.

MR. HASBROUCK: I could probably answer my own question by looking through the reference documents here; but I'm going to ask it. Might that F threshold and F target change based on the peer review, or are they probably going to remain the same, because if there is a chance of them changing, then we may want to change this motion.

MR. CELESTINO: Our expectation is that the numbers won't change.

CHAIRMAN ARMSTRONG: Jay.

DR. McNAMEE: You've already covered part. I was going to also suggest we needed a risk probability, and so we got that the 50 percent is a good starting point. I also feel a sense of urgency and a sense to kind of get moving here; but I thought Mike's comments were good as well. I think we want to really think this through.

I think what Doug has offered is a good start; to kind of get a sense of this. The one concern I have is about the one regulation example. I'm kind of thinking about what that might look like; and I think it's just going to be alarming. I don't know what value we get out of that. I can see just the discussion to get to that one example. We're saying TC, give us one. They're going to have a battle at the TC to figure out what that one is going to be that comes to us. I'm not pushing this too strongly at this point; but that might be something we might think about peeling out of this motion. Just getting this very basic information of what is it going to take to get us back to the reference points that we have already?

Then I think at our next meeting we'll have a lot more information with which to offer more guidance; because that's what I'm truly struggling with. I feel a need to get moving on this; but I have no idea what guidance to provide the Technical Committee at this point, because we don't have a lot to work with.

CHAIRMAN ARMSTRONG: Doug, would you consider an amendment?

MR. GROUT: I would be more than willing if someone wants to make an amendment. My goal, clearly on the coast we're at one fish, so it's going to be difficult to change the bag limit. Can you raise the size limit high enough to accomplish this or not? I have no idea. That would be a very simple thing for them to do. Okay, how far up on the size limit do we have to go; the coast or in the Bay, just as an example?

Then my concern is saying, okay we've got to take a 25 or a 30 percent reduction in F to get to this point or we need to reduce harvest by this million fish. The public and we are not going to have any concept at all about what it takes to do that. That is my purpose in trying to see if there is a possibility that they could give us a simple example, even if it's just changing the size limit in the Bay and the coast to get to these things.

But if you can't do it, you know I gave them the second option of well maybe we need to put in additional seasonal restrictions. I know we're going to be having lots of discussions about this in the future; but you can tell me we've got to cut it by two million fish, and that means nothing to the public.

CHAIRMAN ARMSTRONG: It sounds like change is not in the works. Would you like to make a motion like that to change it? Okay. John Clark.

MR. CLARK: I'm opposed to this. I think we know what this will turn out. It's going to be drastic, it's going to be alarming, and it's going to really create expectations in the public that things are so terrible we have to take drastic action now. I think this is the time, we know we're going to have to take action. This is the time to start an amendment process; where we rethink our management options, we look at different reference points.

We kind of go back to the drawing board, as Mike said. We've had five years of a 25 percent cutback. It hasn't done the trick so far, so maybe we just need to rethink the whole process. I think without having the TC report, we know it's going to be pretty drastic, especially if we're going to try to get to that target F in one year.

CHAIRMAN ARMSTRONG: Roy.

MR. MILLER: I just wanted to potentially add something to the mix that this motion might cover. We're putting all of the reduction in harvest. We're using the reduction in harvest to achieve the targets and the threshold. What if, I'm harking back to the comment that Russ Allen made regarding recreational discard mortality being higher than harvest mortality.

What if we were to attempt to reduce recreational discard mortality, and make that part of the mix? How much could we expect to reduce recreational discard mortality? Is it enough to even consider trying to do? I'm thinking of Maryland's proposal over the past couple years to reduce recreational discard mortality using innovations like circle hooks and educational awareness; that kind of thing.

CHAIRMAN ARMSTRONG: Katie or Mike to that point. I know it gets really complicated; because a million Age 2 fish is a lot less fishing mortality than a million Age 8 fish. I'm not saying this now. I think it's something we need to look at. Do we know the age structure of the discard?

DR. DREW: We do have information on that. We rely on some MRIP sampling for that. They do have observers on headboats measuring the size of fish that are thrown back alive. We do have information from angler logbook programs; where people tell us measure the fish they would throw back versus the fish they keep.

We do have information on the size structure of the discards. I would also say we definitely, when we do this analysis we look at we assume when we do the bag and size limit analysis for striped bass that if we raise that size limit from 28 to 30, then those fish that will be thrown back, and a certain amount of them will die.

That goes back into we account for that recreational discard when we count for the total mortality of the removals that those regulation changes will accomplish. But I think the question of how do we reduce. The other thing to keep in mind with striped bass is we release about ten times as many fish as we actually harvest.

Even if you convert 50 percent of those releases to harvest that is more than the recreational dead discards, because only about on the average over the coast 10 percent of them die when they're thrown back alive. But I think the question of how do you balance that out, especially with strong year classes moving through, is something that the TC would consider when looking at these bag and size limit analyses.

CHAIRMAN ARMSTRONG: Ray, did you have a comment? Okay, Mike.

MR. LUISI: I'm going to need to get a privacy screen on my iPad; Roy I think is reading my notes directly that I'm typing to myself. But I wanted to make a similar point to Roy's, and maybe change the wording Roy in such a way. I understand the interest in actually converting the dead discards into harvestable fish. But what if through this TC process we get a sense as to what effect discards would have by increasing size limits. If we're going to have one example on the coast and one example in the Chesapeake Bay of increasing size limits.

Is there a way technically to estimate how many more fish you're now going to have to interact with and have as part of your B-2s, so that stakeholders can understand that by increasing size limits you're ultimately just creating more dead discards and exacerbating the problem. I think if we can add it to that.

I don't know where it fits in there; perhaps after providing one example of recreational bag and size limit combination, if necessary seasonal restrictions, and effect on B-2s or effect on live releases. I think it would be helpful for the public to know what those estimates look like, what those scary estimates look like.

CHAIRMAN ARMSTRONG: This is kind of like a David Pierce motion at this point. Should it be a separate motion? Doug, would you be amenable to adding that?

MR. GROUT: Someone can gracefully add that into the motion without violating the Pierce Rule, I would be glad to. It sounds like, by what Katie just said that is going to be part of the analysis anyways. As long as in the report you can explicitly bring that out. That's what I thought it was. Yes, I agree we should see that kind of information too.

CHAIRMAN ARMSTRONG: Mike, do you see some language you could add to this that would satisfy you?

MR. LUISI: If it's going to be part of what's reported as it's already stated; that's well beyond technically what I understand what we're going to get back, what the feedback we're going to get. But if we're able to see where the 32 inch, 1-fish bag limit in the ocean under this scenario. If that is the scenario we have.

If we're able to see based on an estimate of how many new live releases that we're going to have as an effect of that that would be ideally what I would like to see, as well as in the Bay. If it's already packaged in there then there is no reason to complicate this anymore than it already is. If it's in there then fine; I'll absolutely support the motion moving forward. But I have to ask Katie or Nicole or somebody.

CHAIRMAN ARMSTRONG: There is a piece, and I'll ask Katie to comment. The piece about how many are you going to have to discard to get to the new size one. That's not what you're talking about.

DR. DREW: That is obviously much harder to do; because it depends on the size and age structure of the population. I think it is something the TC is interested in pursuing; and has been talking about internally when we do these kinds of calculations. I think the fact that we know you're interested in that means that we will try to provide some analysis that can address that question. Obviously we can't guarantee that this is the exact number that you have to go through; but I think we can sort of take that into consideration as we do these calculations.

CHAIRMAN ARMSTRONG: John.

MR. McMURRAY: A question and then a comment. I want to be clear before I support this that this puts us on track for on the ground potential management action in 2021, I'm sorry, 2020.

MR. APPELMAN: That all depends on what kind of document we're initiating down the road; amendment or addenda. An addendum is obviously more streamlined, an amendment takes a little bit longer, and it also depends on the time of the year that actual final approval of that document would be if that's at the beginning of the year versus more mid-season. Some fisheries could already be operating.

MR. McMURRAY: You could have just said yes. This does put us on track should we go the addenda route, and that is good to hear and I can support it. But I also wanted to respond to some of the comments around the table; particularly the fear that this is going to be drastic. I would just add that this is a really important fishery.

It is to a large extent driven by availability, not necessarily how many you could put in a cooler, but how many fish are around. With that said; in the grand scheme of things, I'm pretty sure that if we have to go up several inches in size and not mess with the bag limit that is not going to be catastrophic.

What is going to be catastrophic is if that availability continues to decline; particularly for the part of the recreational fishing community that targets these fish from the beach, which is both culturally and economically important. If we continue down this road, and if we don't keep the promises that we made in Amendment 6 that is what's going to happen. We're going to be in a really bad situation. I would encourage the Board to go this route, but to try to take action expediently.

CHAIRMAN ARMSTRONG: Rob.

MR. O'REILLY: I've heard two board members talk about, and if maybe necessary a seasonal closure. Since Amendment 5 there hasn't been a lot about seasonality in this fishery, about truncating seasons when there has been problems with the stock. I just hope that that gets a pretty good look, because we're hearing about discards; raising size limits all the time in my mind is really not that effective.

I hope that the use of seasons gets a pretty good characterization, because if your seasons close you may have catch and release that's about it. You may have recruitment once your season opens; because everyone is in fervor to go out and fish. We understand that as well. But that's nothing such as always having as much season as possible.

I understand that that is what the fishing public wants; they want the longest season possible, no matter what the species is. But at the same time we have some testimony through this last Addendum IV that size limits may not be the way to go all the time. Yes it went to one fish, but in a lot of cases I remember the information from some of the coastal states were one fish would be okay. You know there is certainly a lot of catch and release too. I hope that's not an add-on, I hope that's right up there in the front row with size limit changes and bag limit changes. I hope the Technical Committee can advise us just how much that's been used in the past since 1995. I don't think a whole lot. But I mean if we're truly going to be conservation minded it may be that size limits aren't the way to go.

MS. LENGYEL: Seasons is something that we have not looked at before; and it's not specified in Amendment 6. It is something that we can look at; if the Board wants us to look at it, but that is something that will be more work and more detailed. It will have to be done on a state-by-state basis, because the seasons in all the states do vary quite a bit right now. I'm not sure we will have that ready by the May meeting; but it's definitely something that we can look at if the Board desires us to.

MR. O'REILLY: May I respond?

CHAIRMAN ARMSTRONG: Go ahead, Rob.

MR. O'REILLY: I'm aligned with Doug's idea that we just want to get some glimpse here. We want the public to know that this is something being taken seriously; no expectation for any final results or anything else likes that. I just don't want it to be neglected by the time we really start to work on this.

CHAIRMAN ARMSTRONG: Justin, then Dennis.

MR. JUSTIN DAVIS: This is a question for the Technical folks. I'm wondering if this motion would be more appropriately worded reductions and removals; because what we're really trying to capture here is how many fewer fish we will need to remove to get down to that F threshold, and obviously as we change size limits we might be increasing discards. There is mortality associated with that. There has been concern expressed about that around the table. I'm just wondering if that little change in wording might help sort of capture that dynamic better.

DR. DREW: I think the Technical Committee would have interpreted that at harvest as removals; but if the Board wants to be more specific, it certainly wouldn't hurt us.

CHAIRMAN ARMSTRONG: Dennis.

MR. DENNIS ABBOTT: Not assuming, but with the importance of this issue and assuming that we come back in May and make a decision to start an addendum. In order to get regulations in place by 2020, that gives us maybe eight months. Is it possible that we can get that done in that time, and would it be necessary or a good idea to consider having additional meetings to expedite this, in order to have a finished product by the end of this calendar year?

MR. APPELMAN: Talking about an addendum here? Assuming the Board initiates an addendum in May. That timeline would have no hiccups along the road. Final approval would be in October of this year.

CHAIRMAN ARMSTRONG: Question Max. If time and area closures were part of it, can that be an addendum, since they don't seem to be in the toolbox yet?

MR. APPELMAN: Yes, but I'm going to check right now just to verify that response.

CHAIRMAN ARMSTRONG: Okay to the motion; anymore discussion? All right hang on just a second.

MR. APPELMAN: Yes.

CHAIRMAN ARMSTRONG: All right let's vote on it, all in favor raise your right hand; sorry, yes please caucus. All right are we ready? All in favor of the motion raise your hand; keep them up please. Okay, against, nulls, abstention. The motion carries 15 to 1. All right, well we've got the ball in motion. Does anyone have any other discussion of next step for striped bass management? Jay.

DR. McNAMEE: Just real quick a question for Nicole or Mike or Katie, one of you guys. Does the Technical Committee need any guidance at this point as to what your recruitment assumption should be; or are you just going to roll forward with what you've used to this point? You're going to have to run a projection to do this, right? Do you need guidance on that assumption, or any other?

MR. CELESTINO: I guess the answer depends. We would probably move forward with what we've presented as our preferred recruitment scenario as part of the peer review. Unless there is interest from the Board in an alternate scenario; because I should mention for completeness that we did actually bring two recruitment scenarios, one random draws of recruitment and one with the hockey stick recruitment that we showed.

We did the random draws of recruitment as a sensitivity analysis; not as our preferred run. Unless the Board was interested in something different we would move forward with our Plan A, hockey stick recruitment relationship that we showed earlier.

CHAIRMAN ARMSTRONG: Andy.

MR. ANDREW L. SHIELS: Just before we leave this, perhaps the most disturbing thing that I think a number of people around the table agreed to was the dead discards to the recreational side. I am asking, expecting, hoping that the stock assessment, the final report will include the what, when, where and what sector those dead discards occurred in. Is that expected to be in the report?

MR. CELESTINO: We would expect the plots that we showed will be in the report; the table that are in the briefing materials, unless you're referring to something different.

MR. SHIELS: What I want to be able to know, when we get to this question is I want to know where along the coast in what fishery, whether it's in the ocean or in the bay, the discards occur so that we can have an understanding. Doug was indicating we need to understand what this means to the public. I think that would be very helpful to know which part of which sector and geographically, and whether it's on the coast or in the Bay these discards are occurring, so we can kind of wrap our head around that which is the most disturbing of all the issues I think that we have been presented with today. That's what I'm requesting.

MR. CELESTINO: We believe that most of that is in the report; and if it's not we'll make sure it's included as part of the report from this motion.

CHAIRMAN ARMSTRONG: Anything else before we leave this agenda item?

MR. APPELMAN: Yes, so I just wanted to highlight that it's pretty clear that there is going to be a management document soon being developed. We have a development team; and I would appreciate the Board to look back at those members and just verify that those are the right folks for this management document. There could be any range of issues considered in there. Please look back and let me know if there should be any changes.

CHAIRMAN ARMSTRONG: Do we need to do anything to reenergize them, or charge them to reorganize at this point or they're just sitting dormant waiting for our orders? Excellent, can you send out an e-mail perhaps and remind us to look at our PDT members. Ritchie.

MR. WHITE: This is a suggestion to the formation of the meeting for May. I would leave a big chunk of time for this meeting in May.

CONSIDER PROVIDING COMMENTS TO NOAA FISHERIES REGARDING THE PROPOSED MEASURE TO LIFT THE BAN ON RECREATIONAL FISHING IN THE FEDERAL BLOCK ISLAND SOUND TRANSIT ZONE

CHAIRMAN ARMSTRONG: So noted. Our next agenda item is revisiting Providing comments to NOAA Fisheries Regarding the Proposed Measure to Lift the Ban on Recreational Fishing in the Federal Block Island Sound Transit Zone. The question is, it was originally, I think, we would kick the can down until the official review is out. Given what we've seen as a Board, do we know enough to provide comments to NOAA at this point? Mike.

MR. LUISI: To answer your question directly, I think we know enough. But I think that it's a more strongly worded message once it's been committed to by the Board, and we're on solid ground. It's my understanding and this again. Maybe we should have a two-day meeting in May. It's my understanding that everything is on the table still; and even the model that Gary Nelson had worked on is something that we're going to get a report on and have to debate.

I think the Board needs to select its preferred path, and then based on putting some solid ground under any further actions then I think that message is just more strongly worded from the Board rather than on an updated however it was worded in the agenda, an updated preliminary review of a stock assessment report.

CHAIRMAN ARMSTRONG: Sure. I wonder if we can short circuit it by having a motion or consensus for staff to craft a strongly, if we have consensus of the Board saying, and I don't know we do, saying no you shouldn't open that; some letter to that effect rather than spending here wordsmithing. Can staff do that?

MR. APPELMAN: I'll just remind the Board that when we looked at that ANPR that came out last fall, the Board decided to write a letter to NOAA Fisheries stating just that; that we're going to wait until the final results come out to provide a formal comment or recommendation regarding Block Island Sound. The Board essentially has already done that and I think what Mike was just saying is we're still in that boat, we're waiting for those final results to come out. I think that has already been checked off the list, from my seat at least.

CHAIRMAN ARMSTRONG: Well I'm not sure. We just said hang on don't do anything. We haven't provided a letter saying hell no, or yes sure go ahead with it, right? That's what Derek maybe you could advise us. That's what you're looking for, a letter from this board?

MR. DEREK ORNER: I guess in the ideal world, yes. I think we were planning back in the annual meeting in October, the assessment would be final for this Board, we would have heard the presentation. We can provide comment from the Board back to NOAA, so we could go forward and make some decisions on directions to go. I guess the hesitation and waiting until May now puts another three months into that process.

I'm not sure if that timeline still fits or how we would move forward; considering the fact that as Katie mentioned the numbers and the trends, everything in the assessment aren't necessarily going to change. We'll get more detail in the assessment reports come May, but the trends and the status are there. As a Board can we have that discussion? Maybe provide and get that off the table now, understanding that come May it's going to be a long meeting.

CHAIRMAN ARMSTRONG: I think I would prefer to get it off the table now. Ritchie.

MR. WHITE: Question, then follow up if I may. This proposal would increase mortality; is that correct?

MR. APPELMAN: I can't answer that. The proposal is to consider opening up recreational fishing in Block Island Sound in that transit zone. How that translates to F, I don't know.

CHAIRMAN ARMSTRONG: Generally if someone wants to get an area more than they are at now, there is going to be more availability and larger harvest, I think we could probably assume.

MR. WHITE: Any increase of mortality at this point, I would be opposed to until after we figure out where we're going, so I would oppose it at this point. If they want to wait, May when we kind of figure where we're headed the answer might be different. But right now if they're looking for an answer I would oppose it.

CHAIRMAN ARMSTRONG: Justin, I'm sorry Jay, one of the J's.

DR. McNAMEE: That's okay, I've been called worse. It is interesting. I thought Mike originally was saying let's wait, maybe. I'm having a little trouble following. But I would be in the camp of waiting to May. It's closed now, so waiting doesn't impact that part of it. The difficulty that we have is we've also been saying in Rhode Island; let's wait to see the outcome of the stock assessment.

We have not had an opportunity to say hey the stock assessment is out; here is what it said. I think we have a general sense of what it's going to say. I don't disagree with that. But I also don't see the harm in waiting until May. I think it's probably going to be a pretty quick agenda item. I don't see us laboring over this too much; based on what we learned today. But what we've not been able to do is kind of go back out and say the stock assessment did not look good, you know in our area. I would like an opportunity to be able to do that.

CHAIRMAN ARMSTRONG: Okay how about a hybrid to save a little time. If we have consensus with this Board, we'll charge the staff to put a letter together that it can bring forward for the next meeting, so it will be a five minute discussion. Then we can put it to bed. Is anyone for opening up that area? Emerson.

MR. HASBROUCK: Yes, and the reason I'm supporting that at least as of now is that the information I have is that it's likely not to increase fishing effort. But what's going to happen is there is going to be the same number of boats. This is primarily charterboat fleet, oh and also private boats. The same number of boats fishing in that area that are fishing there now, it's just that right now they are densely congregated on either the New York side of that transit line or the

Rhode Island side of that transit line.

This will allow that fleet to just disperse and not be fishing right on top of each other. It may not or likely will not increase fishing effort. Relative to that I am wondering if anyone has any information; or if the TC could provide it to us. Was there a reduction in recreational fishing effort when the EEZ was closed, and if so by how much, and that's for the whole EEZ.

DR. DREW: To the question about did closing the EEZ reduce fishing effort. I think that is something the TC could look at for the MRIP data; recognizing it's not perfect, but we do have some information on total number of trips, as well as directed trips and where those trips happen in the ocean. We could look at that if that is something the Board was interested in.

CHAIRMAN ARMSTRONG: Emerson.

MR. HASBROUCK: I think it might be interesting to see that; because we're looking at kind of the reverse of that now. The entire EEZ was closed, so what impact did that have on recreational fishing effort? That might give us some indication; in terms of might there be an increase in fishing effort if we open up this very tiny little sliver of the EEZ, which is probably equal to less than I don't know, 100th of 1 percent of the area that was closed.

CHAIRMAN ARMSTRONG: Okay, we're a little bit at loggerheads then. **I would propose we entertain a motion to write a letter opposing opening it.** If it wins by a majority, staff moves forward with that. We see it in May and the states can also offer up individual opinions by letters, either supporting that or opposing it. Would anyone like to make a motion? Pat Keliher.

MR. PATRICK C. KELIHER: I move we do what you just said, Mr. Chairman. Would you like clarity?

CHAIRMAN ARMSTRONG: Would anyone like to second what I said? All right, we have a motion by Pat Keliher, do we have a second, Ray Kane, discussion, Emerson.

MR. HASBROUCK: I'm not going to support this motion for the reasons I just previously stated, as well as for the fact that whatever the outcome is of our future discussions based on a new stock assessment, harvest is going to be constrained by whatever it is that we come up with.

We're going to constrain recreational harvest by size, season, bag, a whole variety of things that might come out of the final discussion here. That effort is going to be constrained, and it's probably going to be lowered anyhow. I don't see how this is going to increase overall fishing effort on the resource.

CHAIRMAN ARMSTRONG: David and then Dennis.

MR. DAVID V. BORDEN: Just a question. I mean the directive is to compose a letter. It does not say submit a letter to NOAA so is the intent to compose a letter and then circulate it to the Board to bring it back at the May meeting? At the May meeting, review at May meeting, okay, all right sorry about that I missed that.

CHAIRMAN ARMSTRONG: I believe our intent is to compose and we'll vote again at the May meeting. Dennis.

MR. ABBOTT: Conversations we had at the last Board meeting and this Board meeting is the whole exercise is simply to legalize an illegal fishery. It's been brought out quite clearly that there is a fishery going on there; and we want to legitimize it. Therefore, I don't think that's a good thing, and therefore I support the motion.

CHAIRMAN ARMSTRONG: John.

MR. McMURRAY: I support the motion too

for obvious reasons; but it shouldn't be lost on the Board that Congress also issued another directive to open up the entire EEZ. I'm not sure where we are on that; maybe Derek can provide some insight there. But we may want to kill two birds here, and include our opposition in the letter.

CHAIRMAN ARMSTRONG: Derek, would you care to weigh in on that?

MR. ORNER: No. Yes the second item moved forward in that language, well the first one the Block Island Sound was to move forward and consider it at that point. The second one was upon completion of the stock assessment to work with the Commission to consider opening the EEZ, so the entire coastwide EEZ. That will be coming at some point.

I figure that is something that we can pick up after we have review of the assessment itself in May, so we may even push it out a little bit further. Whether that goes through the whole AMPR Rule Process, or if we can all consider it here, and based on the results we don't go forward. That is I think up for the discussion and consideration at that point.

CHAIRMAN ARMSTRONG: Andy then Emerson.

MR. SHIELS: After the October meeting when we heard this news that there was two parts to this, the transit zone and then the wider discussion of opening the EEZ. I felt the need to pen a letter on behalf of the Pennsylvania Fish and Boat Commission, and the Pennsylvania delegation, and I did meet the deadline and it did show up online on the Federal Register, I guess that's what it is.

There is no reason why you can't send two letters. You can send a letter now. You sent one already, you can send another letter. You can send three letters. I sent a letter and I reserved my own opportunity to send an additional letter later if I like. I'm concerned. You know we don't necessarily have a dog in the fight on the transit zone.

But we do have a dog in a fight on the EEZ as a whole; and I'm concerned about the way this is moving along kind of almost discreetly and covertly that well, we'll address this part, and then maybe we'll address the larger part later some time. None of us could predict that the Federal shutdown was going to occur not long after those comments were registered. We've lost the opportunity for the stock assessment to be ready today; which also has put back our opportunity to comment, by having the stock assessment in our hand.

My recommendation is if it's the will of the Board, or the majority of the Board at this time is to send a letter now re-expressing your concerns about the transit zone, and what else might be on deck, and then reinforce that with information on the stock assessment when it comes available, where you can hone in and make it a more finely tuned letter. My concern is that this is kind of by being stretched out; maybe the importance of it might be lost by a little bit.

CHAIRMAN ARMSTRONG: Emerson.

MR. HASBROUCK: With your permission, a question through you to Derek if possible.

CHAIRMAN ARMSTRONG: Please.

MR. HASBROUCK: I'm just wondering where NMFS is with the issue of the transit zone, opening up the transit zone. Is NMFS just waiting for a response from this Commission before they move forward; or is NMFS at some other point in their consideration?

MR. ORNER: Looking back in the audience I'm not quite sure how to answer that one, Emerson, mainly because with the lapse in appropriation we haven't been in the office for a month and a half, basically since this all started. I personally have not had conversations to see exactly where NMFS is or NOAA, you know Secretary level is in making any decisions, which is kind of my push when I was talking to Mike before was to try and get something moving here, so when that does come we have a response from the Commission.

CHAIRMAN ARMSTRONG: Any more discussion on the motion? Caucus needed, okay take a minute to caucus. Is everyone ready? Again the motion is to just compose the letter. We will vote on sending it in May. New York, are you good, all right all in favor raise your hand. Okay opposed, abstain, null. All right it passes 15, 0, 0, 1. Mike, I guess you are up.

REVIEW OF MARYLAND'S CONSERVATION EQUIVALENCY EFFECTIVENESS REPORT OF 2018 RECREATIONAL MEASURES FOR THE CHESAPEAKE BAY SUMMER AND FALL FISHERY

MR. LUISI: Is it okay if I say on the side of the table here? Okay, I did prepare a presentation; a few slides, so we can wait until that comes up. What I'm going to present to you are some of the highlights for our Conservation Equivalency Effectiveness Report that the state of Maryland committed to last year; upon approval of a Conservation Equivalency Plan.

If you all remember, we had an issue in Maryland as a result of increasing the size limit from 18 to 20 inches as a result of Addendum IV; exactly what we were talking about before we were experiencing huge numbers of discards. We wanted to address that concern through proposing to the Board a plan which established a 19 inch minimum size; and required that non-offset circle hooks be used with bait fishing.

We also committed to providing this report here at the winter meeting; and trying to gather relevant information on compliance and other things that we were working on as part of our program for this meeting in 2019. It's hard to believe a year has passed since we were here discussing that.

What I'm going to cover, and I'll do it very quickly, and I want to also thank Max for putting this on the agenda for only ten minutes. I'll probably go about nine, and then answer any questions that you have, so thank you, Max. I want to talk to you a little bit about what our current gear regulations are.

I'm pointing that out because they differed just a bit from the discussion that we had at the Board meeting last year. I'm going to go over some outreach and education efforts, enforcement and compliance, and then we did a little bit of an analysis, 2018s MRIP data were preliminary at the point when we were working on this still.

I do want to go over an analysis that we conducted; which I think you'll appreciate the results. Okay so the current gear regulations in Maryland apply to fishermen that are chumming or live-lining. A person engaging in this activity during the periods of May 16 through December 15, and May 16 through December 15 of 2019, shall only use a circle hook.

A circle hook is defined as a non-offset hook at the point turned perpendicularly back to the shank. You'll see the examples of what a circle hook isn't and is as it applies to the regulation. Where things changed slightly, and we discussed this I think back in maybe at the annual meeting.

We talked a little bit about this. But when we went to implement the rule, bait fishermen kind of pushed back a little bit. Folks that were fishing for other species that were not striped bass thought that implementing a circle hook across the board was going to impact them; not only the fishermen but the tackle shops.

Those of you who are in the business of implementing new regulations in your state, sometimes we have to consider the gains versus some things that you might not be able to accomplish. We would have lost the whole program had we tried to push requiring for all bait fishing the use of circle hooks. You'll see the rule there. I don't need to read it to you.

We are allowing for the use of J hooks for bait fishermen. However, we did describe the prohibition on treble hooks through this process; so treble hooks are no longer allowed in Maryland. Moving on to education and outreach, we conducted, you know we phased in a series of education and outreach programs consisting of e-mails to hundreds of thousands of e-mail addresses. We had staff doing industry seminars.

We were all over Facebook and Twitter, radio interviews were conducted throughout the year, and we produced a large amount of just hand-out material that we were giving to folks that were working through the APAIS program, as well as the tackle shops and other places of interest, state parks and places where people were going to be engaging and fishing to kind of get the word out that the rule was going to change for next year.

Moving on to enforcement and compliance, our Natural Resources Police Office in Maryland conducted saturation patrols over the summer. Those saturation patrols were mostly focused on the charterboat fishing activity; and the report from NRP was that it was nearly 100 percent compliance with the use of circle hooks during those patrols.

Field Officers also reported at the end of the season that they had no real issues throughout the year. It wasn’t quantified in any way; but reports through their superiors indicated that they did not have a problem with compliance for the use of circle hooks when chumming and live-lining in 2018. Through the ACCSP program and our APAIS program, we also were able to acquire some information throughout the year.

We had 872 anglers, provided answers to extra questions that we asked as a part of that program. We worked with the folks at MRIP and through ACCSP to develop a technique; so that extra questions that you ask were asked, they were not added to the federal form, and we made sure staff weren’t slowing down the acquiring angler interviews.

When things were a little slow and people had a little extra time at the end of the interview, we had staff asking additional questions about the use of circle hooks in your fishing activity. Four hundred of those 872 anglers were not chumming or live-lining or using bait; so they were using some form of an artificial lure.

Those individuals for the remaining anglers that were chumming, we had 94 percent compliance rate based on their answers. Live-liners had a 97 compliance rate based on the answers that they gave during this interview. Others that used baited hooks, 30 percent were using circle hooks, but they were not chumming and live-lining.

Because of that J hook requirement we were just assuming that the rest of those anglers were using J hooks. The numbers and more detail about those interviews you can certainly find in your report. Here is the last thing I want to go over with you. What we did was we did an updated.

Our original proposal had an analysis; and that analysis indicated that there were going to be no additional removals as part of the program. We were going to be converting dead discards into harvest; and overall the total removals were going to be around zero, with a range which was all part of the calculation. In order to do that we had to make some assumptions based on the use of artificial lures and bait throughout the waves from Waves 3 through 6. On the left hand side of that table you’ll see what our guess was. We guessed that in Wave 3, 42 percent of individuals would be using artificial, and 58 percent of anglers would be using bait. Based on the information we were able to obtain from the APAIS program, the actual values are on the updated side.

In Wave 3 we guessed 42, we determined 41. We guessed 58, and we determined 59. You can see that table as you go down. That was the one that was right on point; but we were close. However, we wanted to go back to the original analysis, and rerun the analysis with the updated values. We also had to update the proportion of bait anglers using circle hooks. Our original proposal assumed 100 percent; because we had started the program and started the rulemaking process expecting not to allow for J hooks at all with the use of bait.

Because we did not go forward like that we had to change our proportion to reflect that change in our rules. Those are the new values that went into the analysis; and I think the next slide is the last one, which shows the results. What you'll see is that under the original proposal the proportional change in dead discards was expected to be reduced by 28 percent; with a range of minus 31 to minus 24.

The updated analysis with all the new values indicated that we didn't get there. We didn't get as far as we wanted to, as far as the proportional change in dead discards. The new analysis would indicate that we reduced the dead discards by 12 percent, with a range of reduction of 14 to 10. As you read across the table, we get to total removals. This was a large portion of our analysis.

You know we came to the Board and said, you know there is a range of total removals being minus 8 percent, or it could be anywhere from minus 8 to 7 percent increase in total removals as part of our original analysis, with an average of zero. What the update in analysis would indicate is that we now have a new range anywhere from minus 1 to 13 percent increase in total removals, with the average being 6.

Looking at that I think that since that 6 percent increase in our updated analysis falls within the range that was presented in the original analysis, I would say that we got as close as we could with our program. With that said, we felt that the program was successful. We have rules in place to continue with this program for 2019.

It will start on May 15, and carry on through December 15. That regulation has a sunset provision; which would require us to go back and resubmit new rules for the future. Our expectation right now is to continue on in 2019; as I'm discussing here with you. Unless I can think of something else that comes up through maybe a question that is all I have. Maybe one more slide, yes that's it. I'll take any questions, Mr. Chairman.

CHAIRMAN ARMSTRONG: Per the motion this was an informational presentation. It doesn't have an action associated with it; as always if the discussion leads to an actionable thing or whatever, so discussion or questions. Ritchie.

MR. WHITE: Questions for Max. Could you read the language that the Technical Committee reviewed, and what the Board passed for the conservation equivalency, and how that compares to what was implemented?

MR. APPELMAN: Read the language from the motion that the Board passed for the conservation equivalency measures?

MR. WHITE: The proposal that the Technical Committee reviewed and then the motion that was passed.

MR. APPELMAN: You'll have to give me a second to look that up. Thank you, Jess. That is the motion that was approved by the Board at the February, 2018 meeting, if I'm correct. I see you're reading it. Do you want me to read it?

MR. WHITE: Follow up. The Technical Committee did not review including J hooks for bait fishing; would that be correct?

MR. APPELMAN: Correct.

MR. WHITE: We don't know whether the Technical Committee I believe told us they couldn't say whether this met the conservation equivalency or did not. I believe that was the report; if I'm not wrong. If that is correct then adding J hooks to bait fishing, could that have changed the Technical Committee's response?

MR. APPELMAN: I'll try to remind the Board of the debate that took place in February. Let me back up and say that I believe the recommendation from the Technical Committee is they did not endorse any of the measures that were proposed in that conservation equivalency proposal; primarily because they couldn't figure out that baseline for conservation equivalency, due to the measures that are listed in Addendum IV, specifically that there is no base measure in Addendum IV for the Chesapeake Bay fisheries.

It is simply to achieve a particular reduction from 2013 levels. I would have to look back. The point is that there was no default measure to compare these changes to. It was more of a reduction that had to be implemented through Addendum IV. There is a lot there, but does that clarify?

CHAIRMAN ARMSTRONG: Chris then Loren.

MR. CHRIS BATSAVAGE: Thanks for the report, Mike. Mike, in your presentation it showed that 30 percent of the anglers using natural bait were using circle hooks. Were you able to figure out from those surveys what those anglers were targeting; since it was the APAIS surveyors? I didn't see it in the report right away. I didn't know if that information was available.

MR. LUISI: Because we, no, the answer is no. Some of the reasoning behind that had to do with the actual federal survey itself and the responses that we got from people that were out just fishing. Staff told me that they could only provide this level of detail; and so that 30 percent that is in the report, so of 390 anglers, 119 reported using circle hooks. The others were expected to be using baited hooks. There is really no way to break that down into any other level.

CHAIRMAN ARMSTRONG: Loren.

MR. LOREN W. LUSTIG: Thank you Mike for a very interesting report, I really appreciate it. You had mentioned that the Maryland DNR Police had analyzed only those charterboats, and not private recreational boats for the data, is that correct?

MR. LUISI: That is close to correct. During these patrols where they left both sides of the Bay and kind of hit the fleet all at once so people couldn't leave, most of the boats fishing those days were charterboats. However, there were recreational boats also inspected; but it was much fewer than the charterboat fleet.

MR. LUSTIG: Just a follow up. Certainly when you approach a hundred percent compliance that is very gratifying. I would love to see what the data would show if your officers had a chance perhaps this summer to analyze more thoroughly private boats. That would be very interesting data. I would presume that a law breaker would be disinclined to submit feedback in a questionnaire. Only those who are complying with the law would do that I believe. Additional data would be very helpful, and I do thank you.

MR. LUISI: Yes as I mentioned, the plan is to continue with this in 2019, and expand upon it. One of the things we would like to expand upon is the distribution of circle hooks throughout the interactions that we have during our outreach and education campaign; as well as continuing to work with NRP to get feedback from them from the field. That is all part of what we expect, information we'll expect this year.

CHAIRMAN ARMSTRONG: Pat.

MR. KELIHER: I feel like there was an agreement to do one thing and something else was done here. They did not meet the intent; and did not meet the intent of what the original proposal was, which is troubling to me. I'm not sure where to go from here, if they are only really affecting about 50 percent of where they were supposed to be going.

They're not in compliance with what we agreed to. I don't want to pick on Maryland; because I thought this was a good thing that they were doing. I still applaud that they're moving in the direction of using circle hooks. But it seems to me if we're going to do it you've got to go all the way.

CHAIRMAN ARMSTRONG: Mike.

MR. LUISI: I appreciate the concern. We, I, those of us at the Department also talked about this a lot as we went forward. I know that I've mentioned this to the Board before. The chumming and live-lining fleet was the focus of our attention. That was where we wanted the action to happen. We can't specify to the species level; if you're fishing for striped bass. We don't have the authority to do that so we tried to craft it in the best way we could; knowing that we would get an enormous number of anglers who participate through the portion of the year to catch striped bass in Maryland's Chesapeake Bay. You're likely going to be chumming and live-lining. Bait fishing, there are a lot of other things that people are bait fishing for, and they're not overlapped.

We felt like we really accomplished what our attempt was; which was to get on the chumming and the live-lining fleet, and make the requirement for circle hooks. If we were to try to do, and I understand the concern, we said one thing and we modified that as we promulgated regulations.

We were going to lose the entire package. It wasn't going to happen in time. We weren't going to get it in place for the time period when we needed it; and we felt that the conservation effort that we would accomplish by modifying it so that the rule would go into place by May, was the tradeoff that we felt was needed. We still feel that we were successful in that attempt.

CHAIRMAN ARMSTRONG: Adam.

MR. ADAM NOWALSKY: I think we need as a Board to think about what it was we were asking Maryland to achieve; and that was a conservationally-equivalent proposal. I understand the concern that there is a line here that says required when fishing with bait, and Maryland had to deviate slightly.

But, at some point in time we've got to step back and think about the gains of what we achieved. The mass educational outreach of discards and the harm of them, the extreme level of compliance that we were able to achieve in Maryland and fishermen, greater than 90 percent compliance with those, and despite all that at the end of the day using recreational data and analysis, which we know are fraught with all kinds of concerns.

The proposal still landed in the bounds of a 0 percent increase. I think the state should be applauded. I think it is fine to sit here and think about okay, what can we recommend to Maryland to continue to approve it? But I hope we don't lose sight of the bigger pictures with this issue, and in similar issues the states may bring forward.

CHAIRMAN ARMSTRONG: Further discussion, actions, motions. Eric.

MR. ERIC REID: Yes, I guess everybody in Maryland should go buy lottery tickets; because they got lucky on this one. That's the way it worked out. Pat, I appreciate your comments; and I'm right with you. I appreciate Adam's comments, so he accomplished the task more or less. But the reality of it is if the numbers were different, or perhaps maybe the survey was conducted differently, we may be looking at a different set of results, in which case the conversation would be totally different.

I don't know if you improve your tackle shop sales for circle hooks, and it's more convenient for you to do more surveys with full questions, and you get more private anglers to actually fill out a survey they are required to do. Then you find out a little bit more about it. We might be having a different conversation maybe this time next year. But you got lucky that's it. It's good for the resource, but necessarily good for the long term.

CHAIRMAN ARMSTRONG: Further conversation. Mike, would it be your intent to present again next year with the 2019 data?

MR. LUISI: I don't see anything in that motion that would ask me to do that. I'm making light of it. I don't plan to. We're going to have to review this anyway; and I think that we're onboard with what we talked about for two and a half hours earlier today. I think that we're going to all find ourselves having to do something for the future; especially in the recreational fishery.

Changing our program right now would not be a good thing mid-season. It wouldn't be effective until August, probably. Our intent is to go forward, work with this Board on future management issues that arise through this benchmark assessment and analysis.

TECHNICAL COMMITTEE REPORT OF CHANGES TO VIRGINIA'S STRIPED BASS MONITORING PROGRAM

CHAIRMAN ARMSTRONG: All right, enough. Next item is to Review Changes to Virginia's Striped Bass Monitoring Program. Nicole.

MS. LENGYEL: Today I'll be presenting a Technical Committee report on Changes to Virginia's Striped Bass Monitoring and Tagging Programs. I'll start off by giving some background information, review the rationale for the program changes, and then present what those changes were and the comments provided by the Technical Committee.

The Virginia programs began in 1992; and they have been primarily conducted on the Rappahannock River using commercial pound nets. They have been supplemented with fyke net and/or gill net samples from the James and York Rivers during certain periods; but the only long term consistent sampling is from the Rappahannock pound nets.

There were a few things that led to Virginia implementing these changes in 2018; one was that the Virginia pound net data was previously used as an abundance index in the assessment, and it was dropped from the benchmark stock assessment in 2018, due to some concerns about the survey. Recent staffing changes in Virginia, as well as funding reductions in Virginia, were the other reasons for these changes in 2018.

The changes implemented were pound net sampling was completely replaced with multi panel anchored gill net sampling. Tagging was conducted through electrofishing, and sampling and tagging in both the James and Rappahannock Rivers was done, and both programs were deemed successful in 2018, in terms of establishing protocols and the number of specimens sampled and tagged.

As Amendment 6 requires, all spawning stock survey changes to be reviewed and approved by the Technical Committee. The TC reviewed the changes via conference call on January 10. They unanimously approved all of the program changes. The TC did have a few comments on the proposed changes; specifically that reducing the soak time may reduce unnecessarily high sample sizes and gear saturation. That the program only samples the Rappahannock and James Rivers, not the York, so it is missing information on one of the spawning grounds.

This was because the FMP only specifies that the Rappahannock and James Rivers are to be sampled. The monitoring program requirements listed in the fishery management plan may not support the future data and assessment needs. The Technical Committee is recommending that the Board consider changes to the FMP to update and improve those requirements, in consultation with the Technical Committee, and I'll take any questions.

CHAIRMAN ARMSTRONG: Questions for Nicole. I have one, the last item. Will we be getting a report or a letter regarding things you would like to see updated for monitoring?

MS. LENGYEL: I think what the Technical Committee was expecting was just a charge from the Board to revisit those program requirements; and then we're hoping that once the Peer Review Report comes out, some of the elements that are needed for future assessment and future development, specifically of the two-stock model will be in that report, and we can inform the Board as to some changes for the program requirements.

CHAIRMAN ARMSTRONG: Those requirements, would that have to be an amendment or an addendum, an addendum okay. We should keep that in mind as we move forward that this may be an item that we need to include. Rob, while you've got your hand up. The Commonwealth has the resources to continue with the new monitoring?

MR. O'REILLY: Yes, and I would like to make just a couple of comments in that if you go back in time, maybe the 1940s, 1950s, the Rappahannock was sort of the area with the most abundance for striped bass. I think for that reason, when VIMS, which has been doing this work really since 1990, and I followed every year.

Eventually there were spatial problems with the tagging. There were not pound nets in the James River. The York River pound nets disappeared, probably in the early 2000s. But it was the reliance on the pound nets which was the downfall. I think what is offered now is a really good program.

It's taking advantage of different techniques, not new techniques. The electrofishing is used elsewhere, the variable mesh gill net, which Maryland has had a successful spawning stock survey for years is something to look forward to. I think that Nicole putting up the idea of 2018 dropping the pound net index; that really started in 2005.

It's been some trials and errors. I think now looking forward for the future, we can keep supporting it. We have supported it. We do support it through Wallop-Breaux Funding. That was what was indicated by Nicole with the comment about funding issues. But the way that VIMS is situated, they also have ChesMMAP, and so there is the same investigators working on striped bass, and they have more of a compartmentalized approach, rather than having different sectors of VIMS doing different things.

I'm really, really pleased at what has happened, and I think the Board will too as we go in the future, because there have been very few occasions where either the spawning stock information was able to be used, and the tagging information after a certain amount of years. It also suffered from spatial constraints of getting the tagging. Thank you for the time, and I think this will be good.

CHAIRMAN ARMSTRONG: Any questions for Rob or Nicole? Rob, would you like to make a motion?

MR. O'REILLY: I would. I would move that the Board consider the changes that have been made to Virginia's two monitoring programs be approved, both for the Spawning Stock Survey, and for the Tagging Program; if you want to shorten that that's okay.

CHAIRMAN ARMSTRONG: Is there a second, John Clark second, discussion. All right we'll wait until it's up on the board. I need to read it first. I haven't read one yet today. **The motion is: move to approve changes to Virginia's Striped Bass Monitoring Program, seconded by John Clark. I'm going to go out**

on a limb and say is this approved by consensus. Is anyone opposed? So approved.

**OTHER BUSINESS:
UPDATE ON THE STRIPED BASS
COOPERATIVE TAGGING PROGRAM**

CHAIRMAN ARMSTRONG: Next up is Update on the Tagging Program, Toni.

MS. KERNS: We have conducted 10 out of the 13 tagging trips through the Cooperative Striped Bass Hook and Line Tagging Trips, and unfortunately this year we have not been as successful as we have been in years past. I believe we have tagged 50 fish in total. In some cases Captain Ryan is doing an excellent job, and they're finding fish. But the fish just don't seem to be biting.

There have been, I think a couple of days where when the weather shifted they weren't able to locate the fish as well. We have three more trips left; so we're hoping that we will have some bang up days on those days, and get a bunch of fish tagged. I just wanted to thank North Carolina.

Greg Reger stepped in and did a lot of the tagging, and led the trips when the Federal Government shut down. He has been a wonderful help, since Josh Newhard hadn't been working, since he is an employee of the Fish and Wildlife Service. Thank you to North Carolina for giving us Greg.

CHAIRMAN ARMSTRONG: Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: I've got one other introduction that I should have done at the very outset of the beginning; and I apologize for not doing that. If you notice in the Pennsylvania delegation there is a new face between Loren and Andy; and that's Tim Schaeffer.

Tim was recently appointed as the Executive Director of the Pennsylvania Fish and Boat Commission. He's technically our Administrative Commissioner, and Andy is his proxy at the Commission. But Tim came by just to observe the meeting for a couple days, and feel free to reach out and say hello to Tim in your downtime between meetings. Welcome, Tim. We're glad you're here (applause).

CHAIRMAN ARMSTRONG: Welcome, Tim. Are there any questions for Toni regarding the tagging program? Seeing none; any business before this Board? Yes, Ray.

MR. RAYMOND W. KANE: Yes it's a question to the Technical Committee, the Assessment Committee. We've seen a lot of graphs and charts, and probably I'm going to be told there is no way it can be done. But this Commission went through a painstaking a while back about a tagging program, which was implemented coastwise. Does anybody remember the numbers of fish that were poached that drove this Commission to a tagging program; you know at point of sale?

How would that reflect in these retrospective graphs that you put up, you know in layman's terms? Is there any way of looking at the number of poached fish; and where the biomass would be today if you didn't have, what were the numbers two or three million pounds of fish in that sting operation? This goes back a few years ago, but just a question.

MR. CELESTINO: I'll try. I'm not familiar with those numbers. But your point about the retrospective is a good one. The sort of classical ideas about what's driving retrospective is missing catch, change in natural mortality, or change in catchability over time. If we were missing catch, my understanding from work at the Northeast Science Center is that we would actually see the opposite retrospective pattern. We would see increases in SSB over time, and we see the opposite. It's hard to say. I don't have a great answer for you I'm sorry to say.

MR. KANE: Thank you.

ADJOURNMENT

CHAIRMAN ARMSTRONG: Other business. Seeing none; we are adjourned.

(Whereupon the meeting adjourned at 5:16 o'clock p.m. on February 6, 2019)

66th Northeast Regional Stock Assessment Workshop (66th SAW)

Assessment Summary Report

U.S DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

February 8, 2019

Table of Contents

SAW-66 ASSESSMENT SUMMARY REPORT

Introduction

The 66th SAW Assessment Summary Report contains summary and detailed technical information on stock assessments reviewed during November 27-30, 2018 at the Stock Assessment Workshop (SAW) by the 66th Stock Assessment Review Committee (SARC-66): Summer flounder and Striped bass. The SARC-66 consisted of three external, independent reviewers appointed by the Center for Independent Experts [CIE], and an external SARC chairman from the MAFMC SSC. The SARC evaluated whether each Term of Reference (listed in the Appendix) was completed successfully based on whether the work provided a scientifically credible basis for developing fishery management advice. The reviewers' reports for SAW/SARC-66 are available on the Northeast Fisheries Science Center SAW website under the heading "SARC 66 Panelist Reports."

An important aspect of any assessment is the determination of current stock status. The status of the stock relates to both the rate of removal of fish from the population – the exploitation rate – and the current stock size. The exploitation rate is the proportion of the stock alive at the beginning of the year that is caught during the year. When that proportion exceeds the amount specified in an overfishing definition, overfishing is occurring. Fishery removal rates are usually expressed in terms of the instantaneous fishing mortality rate, F, and the maximum removal rate is denoted as $F_{THRESHOLD}$.

Another important factor for classifying the status of a resource is the current stock level, for example, spawning stock biomass (SSB) or total stock biomass (TSB). Overfishing definitions, therefore, characteristically include specification of a minimum biomass threshold as well as a maximum fishing threshold. If the biomass of a stock falls below the biomass threshold ($B_{THRESHOLD}$) the stock is in an overfished condition. The Sustainable Fisheries Act mandates that a stock rebuilding plan be developed should this situation arise.

As there are two dimensions to stock status – the rate of removal and the biomass level – it is possible that a stock not currently subject to overfishing in terms of exploitation rates is in an overfished condition; that is, has a biomass level less than the threshold level. This may be due to heavy exploitation in the past, or a result of other factors such as unfavorable environmental conditions. In this case, future recruitment to the stock is very important and the probability of improvement may increase greatly by increasing the stock size. Conversely, fishing down a stock that is at a high biomass level should generally increase the long-term sustainable yield. Stocks under federal jurisdiction are managed on the basis of maximum sustainable yield (MSY). The biomass that produces this yield is called B_{MSY} and the fishing mortality rate that produces MSY is called F_{MSY}.

Given this, federally managed stocks under review are classified with respect to current overfishing definitions. A stock is overfished if its current biomass is below $B_{THRESHOLD}$ and overfishing is occurring if current F is greater than $F_{THRESHOLD}$. The table below depicts status criteria.

		BIOMASS		
		B <$B_{THRESHOLD}$	$B_{THRESHOLD}$ < B < B_{MSY}	B > B_{MSY}
EXPLOITATION RATE	F>$F_{THRESHOLD}$	Overfished, overfishing is occurring; reduce F, adopt and follow rebuilding plan	Not overfished, overfishing is occurring; reduce F, rebuild stock	F = F_{TARGET} <= F_{MSY}
	F<$F_{THRESHOLD}$	Overfished, overfishing is not occurring; adopt and follow rebuilding plan	Not overfished, overfishing is not occurring; rebuild stock	F = F_{TARGET} <= F_{MSY}

Fisheries management may take into account scientific and management uncertainty, and overfishing guidelines often include a control rule in the overfishing definition. Generically, the control rules suggest actions at various levels of stock biomass and incorporate an assessment of risk, in that F targets are set so as to avoid exceeding F thresholds.

Outcome of Stock Assessment Review Meeting

Text in this section is based on SARC-66 Review Panel reports (available on the Northeast Fisheries Science Center SAW website under the heading “SARC-66 Panelist Reports”).

SARC-66 concluded that the summer flounder stock is neither overfished nor did it experience overfishing in 2017. The Panel concluded that the SAW WG had reasonably and satisfactorily completed its tasks. Estimates of recreational catch came from newly calibrated MRIP time-series that reflected a revision of both the intercept and effort surveys. The Bigelow indices take account of trawl efficiency estimates at length from ‘sweep-study’ experiments. No factor was identified as strongly influencing the spatial shift in spawner biomass or the level of recruitment. The assessment shows that current mortality from all sources is greater than recent recruitment inputs to the stock, which has resulted in a declining stock trend.

SARC-66 concluded that the striped bass stock is overfished and experienced overfishing in 2017. The SARC Panel accepted the single stock, non-migration SCA model for management, and concluded that all ToRs were met for that model In addition, the Panel reviewed a new two stock model developed by the SAW WG. This model represents an innovative advance and the SARC panel recommends continued development and refinement for possible use in the future.

Glossary

ADAPT. A commonly used form of computer program used to optimally fit a Virtual Population Assessment (VPA) to abundance data.

ASAP. The Age Structured Assessment Program is an age-structured model that uses forward computations assuming separability of fishing mortality into year and age components to estimate population sizes given observed catches, catch-at-age, and indices of abundance. Discards can be treated explicitly. The separability assumption is relaxed by allowing for fleet-specific computations and by allowing the selectivity at age to change smoothly over time or in blocks of years. The software can also allow the catchability associated with each abundance index to vary smoothly with time. The problem's dimensions (number of ages, years, fleets and abundance indices) are defined at input and limited by hardware only. The input is arranged assuming data is available for most years, but missing years are allowed. The model currently does not allow use of length data nor indices of survival rates. Diagnostics include index fits, residuals in catch and catch-at-age, and effective sample size calculations. Weights are input for different components of the objective function and allow for relatively simple age-structured production model type models up to fully parameterized models.

ASPM. Age-structured production models, also known as statistical catch-at-age (SCAA) models, are a technique of stock assessment that integrate fishery catch and fishery-independent sampling information. The procedures are flexible, allowing for uncertainty in the absolute magnitudes of catches as part of the estimation. Unlike virtual population analysis (VPA) that tracks the cumulative catches of various year classes as they age, ASPM is a forward projection simulation of the exploited population. ASPM is similar to the NOAA Fishery Toolbox applications ASAP (Age Structured Assessment Program) and SS2 (Stock Synthesis 2).

Availability. Refers to the distribution of fish of different ages or sizes relative to that taken in the fishery.

Biological reference points. Specific values for the variables that describe the state of a fishery system which are used to evaluate its status. Reference points are most often specified in terms of fishing mortality rate and/or spawning stock biomass. The reference points may indicate 1) a desired state of the fishery, such as a fishing mortality rate that will achieve a high level of sustainable yield, or 2) a state of the fishery that should be avoided, such as a high fishing mortality rate which risks a stock collapse and long-term loss of potential yield. The former type of reference points are referred to as "target reference points" and the latter are referred to as "limit reference points" or "thresholds." Some common examples of reference points are $F_{0.1}$, F_{MAX}, and F_{MSY}, which are defined later in this glossary.

B_0. Virgin stock biomass, i.e., the long-term average biomass value expected in the absence of fishing mortality.

B_{MSY}. Long-term average biomass that would be achieved if fishing at a constant fishing mortality rate equal to F_{MSY}.

Biomass Dynamics Model. A simple stock assessment model that tracks changes in stock using assumptions about growth and can be tuned to abundance data such as commercial catch rates, research survey trends or biomass estimates.

Catchability. Proportion of the stock removed by one unit of effective fishing effort (typically age-specific due to differences in selectivity and availability by age).

Control Rule. Describes a plan for pre-agreed management actions as a function of variables related to the status of the stock. For example, a control rule can specify how F or yield should vary with biomass. In the National Standard Guidelines (NSG), the "MSY control rule" is used to determine the limit fishing mortality, or Maximum Fishing Mortality Threshold (MFMT). Control rules are also known as "decision rules" or "harvest control laws."

Catch per Unit of Effort (CPUE). Measures the relative success of fishing operations, but also can be used as a proxy for relative abundance based on the assumption that CPUE is linearly related to stock size. The use of CPUE that has not been properly standardized for temporal-spatial changes in catchability should be avoided.

Exploitation pattern. The fishing mortality on each age (or group of adjacent ages) of a stock relative to the highest mortality on any age. The exploitation pattern is expressed as a series of values ranging from 0.0 to 1.0. The pattern is referred to as "flat-topped" when the values for all the oldest ages are about 1.0, and "dome-shaped" when the values for some intermediate ages are about 1.0 and those for the oldest ages are significantly lower. This pattern often varies by type of fishing gear, area, and seasonal distribution of fishing, and the growth and migration of the fish. The pattern can be changed by modifications to fishing gear, for example, increasing mesh or hook size, or by changing the proportion of harvest by gear type.

Mortality rates. Populations of animals decline exponentially. This means that the number of animals that die in an "instant" is at all times proportional to the number present. The decline is defined by survival curves such as: $N_{t+1} = N_t e^{-z}$

where N_t is the number of animals in the population at time t and N_{t+1} is the number present in the next time period; Z is the total instantaneous mortality rate which can be separated into deaths due to fishing (fishing mortality or F) and deaths due to all other causes (natural mortality or M) and e is the base of the natural logarithm (2.71828). To better understand the concept of an instantaneous mortality rate, consider the following example. Suppose the instantaneous total mortality rate is 2 (i.e., Z = 2) and we want to know how many animals out of an initial population of 1 million fish will be alive at the end of one year. If the year is apportioned into 365 days (that is, the 'instant' of time is one day), then 2/365 or 0.548% of the population will die each day. On the first day of the year, 5,480 fish will die (1,000,000 x 0.00548), leaving 994,520 alive. On day 2, another 5,450 fish die (994,520 x 0.00548) leaving 989,070 alive. At the end of the year, 134,593 fish $[1{,}000{,}000 \times (1 - 0.00548)^{365}]$ remain alive. If we had instead selected a smaller 'instant' of time, say an hour, 0.0228% of the population would have died by the end of the first time interval (an hour), leaving 135,304 fish alive at the end of the year $[1{,}000{,}000 \times (1 - 0.00228)^{8760}]$. As the instant of time becomes shorter and shorter, the exact answer to the number of animals surviving is given by the survival curve mentioned above, or, in this example:

$N_{t+1} = 1{,}000{,}000e^{-2} = 135{,}335$ fish

Exploitation rate. The proportion of a population alive at the beginning of the year that is caught during the year. That is, if 1 million fish were alive on January 1 and 200,000 were caught during the year, the exploitation rate is 0.20 (200,000 / 1,000,000) or 20%.

F_{MAX}. The rate of fishing mortality that produces the maximum level of yield per recruit. This is the point beyond which growth overfishing begins.

$F_{0.1}$. The fishing mortality rate where the increase in yield per recruit for an increase in a unit of effort is only 10% of the yield per recruit produced by the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ rate is only one-tenth the slope of the curve at its origin).

$F_{10\%}$. The fishing mortality rate which reduces the spawning stock biomass per recruit (SSB/R) to 10% of the amount present in the absence of fishing. More generally, Fx%, is the fishing mortality rate that reduces the SSB/R to x% of the level that would exist in the absence of fishing.

F_{MSY}. The fishing mortality rate that produces the maximum sustainable yield.

Fishery Management Plan (FMP). Plan containing conservation and management measures for fishery resources, and other provisions required by the MSFCMA, developed by Fishery Management Councils or the Secretary of Commerce.

Generation Time. In the context of the National Standard Guidelines, generation time is a measure of the time required for a female to produce a reproductively-active female offspring for use in setting maximum allowable rebuilding time periods.

Growth overfishing. The situation existing when the rate of fishing mortality is above F_{MAX} and when fish are harvested before they reach their growth potential.

Limit Reference Points. Benchmarks used to indicate when harvests should be constrained substantially so that the stock remains within safe biological limits. The probability of exceeding limits should be low. In the National Standard Guidelines, limits are referred to as thresholds. In much of the international literature (e.g., FAO documents), "thresholds" are used as buffer points that signal when a limit is being approached.

Landings per Unit of Effort (LPUE). Analogous to CPUE and measures the relative success of fishing operations, but is also sometimes used a proxy for relative abundance based on the assumption that CPUE is linearly related to stock size.

MSFCMA. Magnuson-Stevens Fishery Conservation and Management Act. U.S. Public Law 94-265, as amended through October 11, 1996. Available as NOAA Technical Memorandum NMFS-F/SPO-23, 1996.

Maximum Fishing Mortality Threshold (MFMT, $F_{THRESHOLD}$). One of the Status Determination Criteria (SDC) for determining if overfishing is occurring. It will usually be equivalent to the F corresponding to the MSY Control Rule. If current fishing mortality rates are above $F_{THRESHOLD}$, overfishing is occurring.

Minimum Stock Size Threshold (MSST, $B_{THRESHOLD}$). Another of the Status Determination Criteria. The greater of (a) ½B_{MSY}, or (b) the minimum stock size at which rebuilding to B_{MSY} will occur within 10 years of fishing at the MFMT. MSST should be measured in terms of spawning biomass or other appropriate measures of productive capacity. If current stock size is below $B_{THRESHOLD}$, the stock is overfished.

Maximum Spawning Potential (MSP). This type of reference point is used in some fishery management plans to define overfishing. The MSP is the spawning stock biomass per recruit (SSB/R) when fishing mortality is zero. The degree to which fishing reduces the SSB/R is expressed as a percentage of the MSP (i.e., %MSP). A stock is considered overfished when the fishery reduces the %MSP below the level specified in the overfishing definition. The values of %MSP used to define overfishing can be derived from stock-recruitment data or chosen by analogy using available information on the level required to sustain the stock.

Maximum Sustainable Yield (MSY). The largest average catch that can be taken from a stock under existing environmental conditions.

Overfishing. According to the National Standard Guidelines, "overfishing occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis." Overfishing is occurring if the MFMT is exceeded for 1 year or more.

Optimum Yield (OY). The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems. MSY constitutes a "ceiling" for OY. OY may be lower than MSY, depending on relevant economic, social, or ecological factors. In the case of an overfished fishery, OY should provide for rebuilding to B_{MSY}.

Partial Recruitment. Patterns of relative vulnerability of fish of different sizes or ages due to the combined effects of selectivity and availability.

Rebuilding Plan. A plan that must be designed to recover stocks to the B_{MSY} level within 10 years when they are overfished (i.e. when B < MSST). Normally, the 10 years would refer to an expected time to rebuild in a probabilistic sense.

Recruitment. This is the number of young fish that survive (from birth) to a specific age or grow to a specific size. The specific age or size at which recruitment is measured may correspond to when the young fish become vulnerable to capture in a fishery or when the number of fish in a cohort can be reliably estimated by a stock assessment.

Recruitment overfishing. The situation existing when the fishing mortality rate is so high as to cause a reduction in spawning stock which causes recruitment to become impaired.

Recruitment per spawning stock biomass (R/SSB). The number of fishery recruits (usually age 1 or 2) produced from a given weight of spawners, usually expressed as numbers of recruits per kilogram of mature fish in the stock. This ratio can be computed for each year class and is often used as an index of pre-recruit survival, since a high R/SSB ratio in one year indicates above-average numbers resulting from a given spawning biomass for a particular year class, and vice versa.

Reference Points. Values of parameters (e.g. B_{MSY}, F_{MSY}, $F_{0.1}$) that are useful benchmarks for guiding management decisions. Biological reference points are typically limits that should not be exceeded with significant probability (e.g., MSST) or targets for management (e.g., OY).

Risk. The probability of an event times the cost associated with the event (loss function). Sometimes "risk" is simply used to denote the probability of an undesirable result (e.g. the risk of biomass falling below MSST).

Status Determination Criteria (SDC). Objective and measurable criteria used to determine if a stock is being overfished or is in an overfished state according to the National Standard Guidelines.

Selectivity. Measures the relative vulnerability of different age (size) classes to the fishing gears(s).

Spawning Stock Biomass (SSB). The total weight of all sexually mature fish in a stock.

Spawning stock biomass per recruit (SSB/R or SBR). The expected lifetime contribution to the spawning stock biomass for each recruit. SSB/R is calculated assuming that F is constant over the life span of a year class. The calculated value is also dependent on the exploitation pattern and rates of growth and natural mortality, all of which are also assumed to be constant.

Stock Synthesis (SS). This application provides a statistical framework for calibration of a population dynamics model using a diversity of fishery and survey data. SS is designed to accommodate both age and size structure and with multiple stock sub-areas. Selectivity can be cast as age specific only, size-specific in the observations only, or size-specific with the ability to capture the major effect of size-specific survivorship. The overall model contains subcomponents which simulate the population dynamics of the stock and fisheries, derive the expected values for the various observed data, and quantify the magnitude of difference between observed and expected data. Parameters are sought which will maximize the goodness-of-fit. A management layer is also included in the model allowing uncertainty in estimated parameters to be propagated to the management quantities, thus facilitating a description of the risk of various possible management scenarios. The structure of SS allows for building of simple to complex models depending upon the data available.

Survival Ratios. Ratios of recruits to spawners (or spawning biomass) in a stock-recruitment analysis. The same as the recruitment per spawning stock biomass (R/SSB).

TAC. Total allowable catch is the total regulated catch from a stock in a given time period, usually a year.

Target Reference Points. Benchmarks used to guide management objectives for achieving a desirable outcome (e.g., OY). Target reference points should not be exceeded on average.

Uncertainty. Uncertainty results from a lack of perfect knowledge of many factors that affect stock assessments, estimation of reference points, and management. Rosenberg and Restrepo (1994) identify five types: measurement error (in observed quantities), process error (or natural population variability), model error (mis-specification of assumed values or model structure), estimation error (in population parameters or reference points, due to any of the preceding types of errors), and implementation error (or the inability to achieve targets exactly for whatever reason)

Virtual Population Analysis (VPA) (or cohort analysis). A retrospective analysis of the catches from a given year class which provides estimates of fishing mortality and stock size at each age over its life in the fishery. This technique is used extensively in fishery assessments.

Year class (or cohort). Fish born in a given year. For example, the 1987 year class of cod includes all cod born in 1987. This year class would be age 1 in 1988, age 2 in 1989, and so on.

Yield per recruit (Y/R or YPR). The average expected yield in weight from a single recruit. Y/R is calculated assuming that F is constant over the life span of a year class. The calculated value is also dependent on the exploitation pattern, rate of growth, and natural mortality rate, all of which are assumed to be constant.

Figures

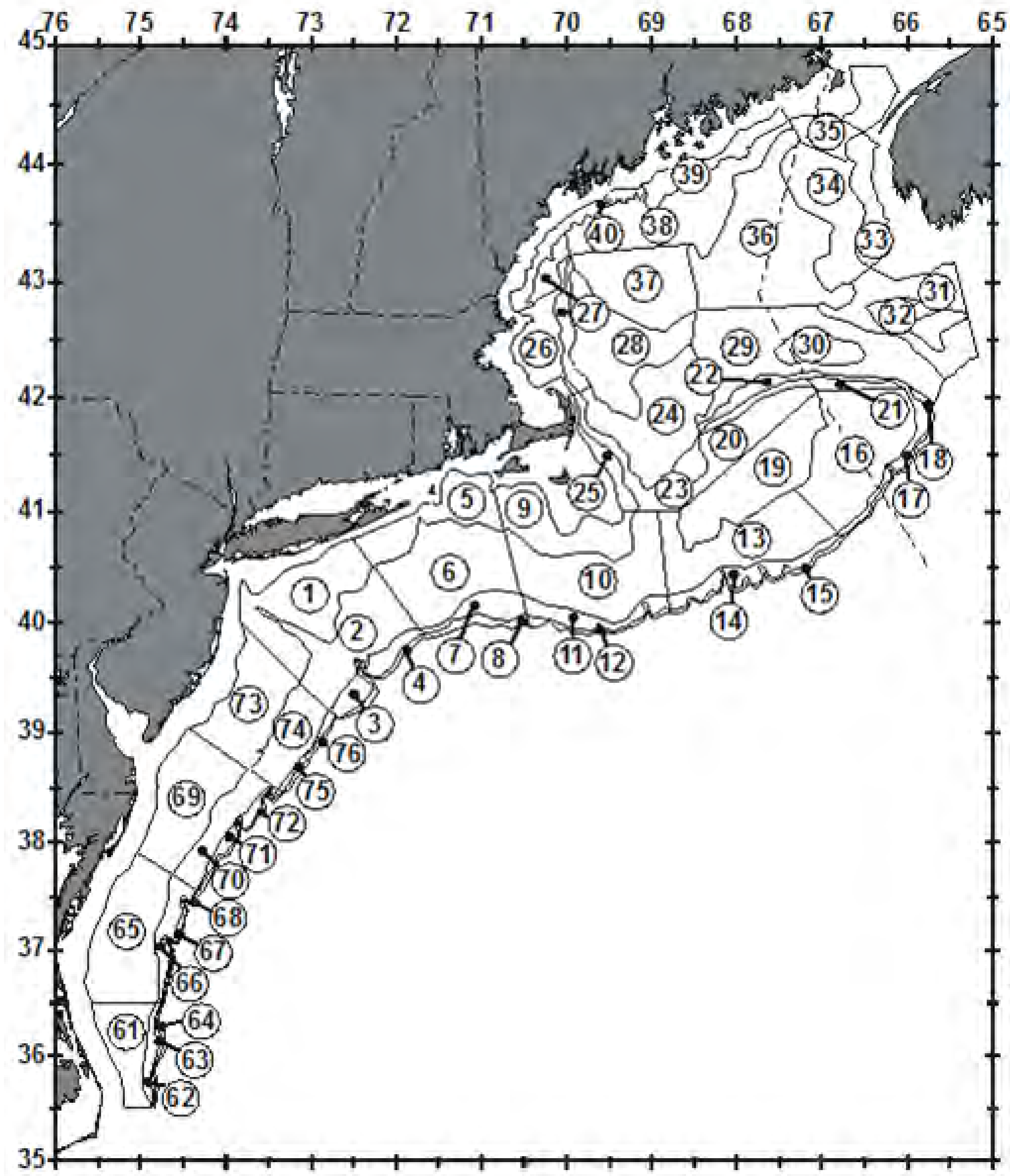


Figure 1. Offshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys. Some of these may not be sampled presently.

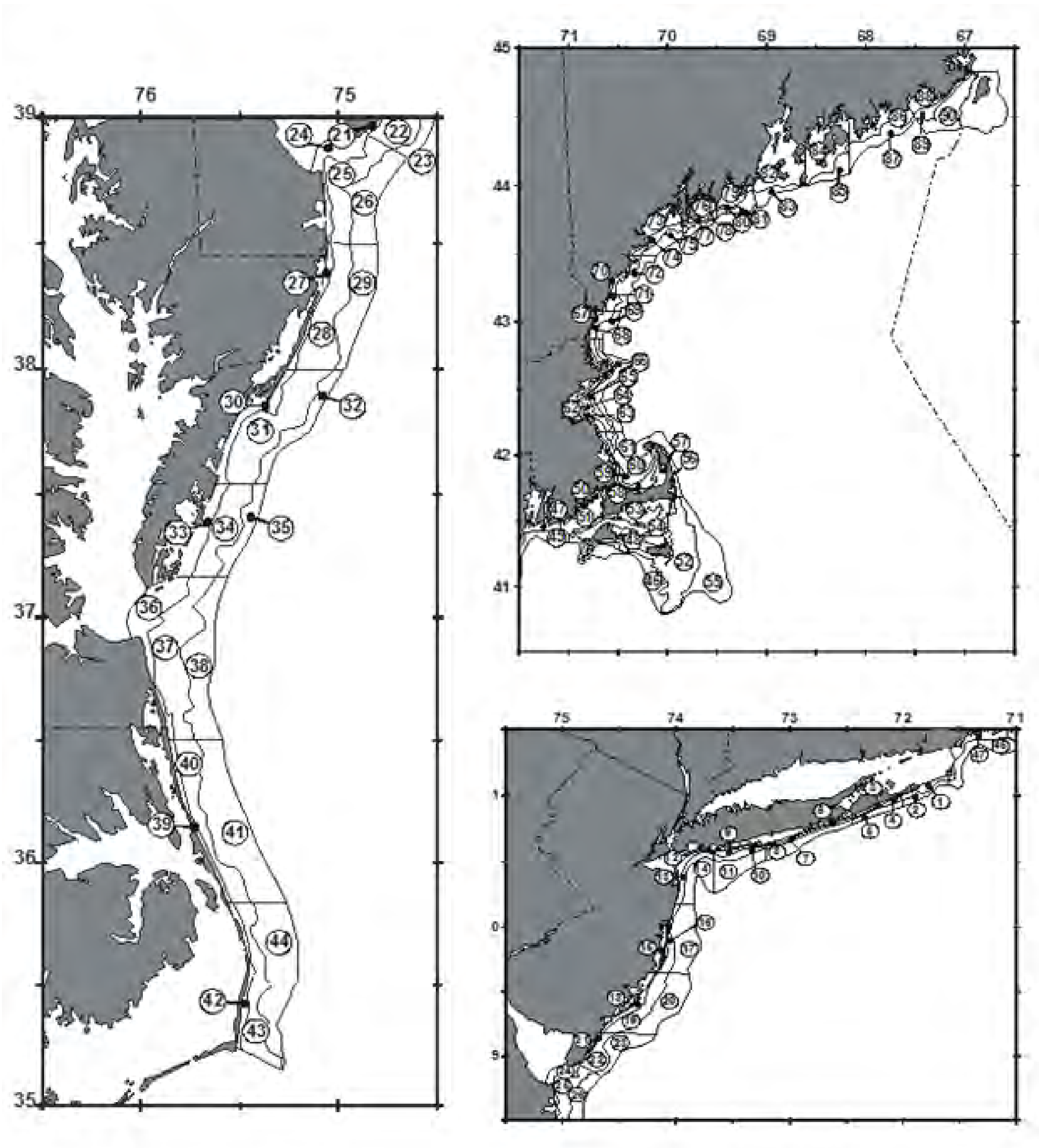
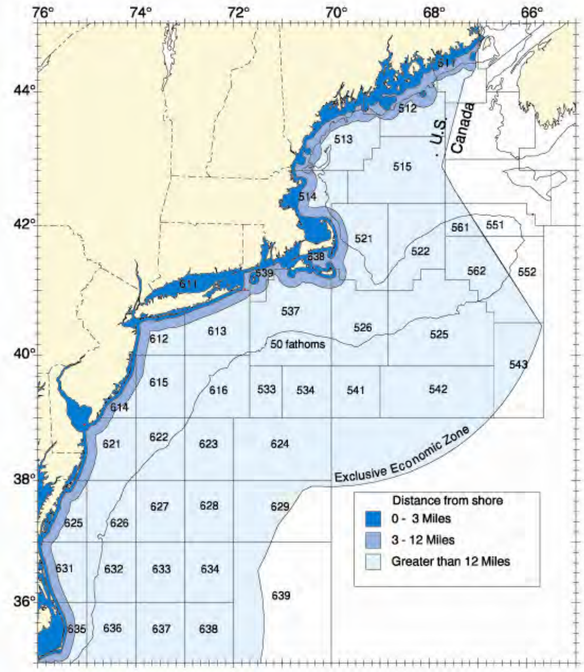


Figure 2. Inshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys. Some of these may not be sampled presently.



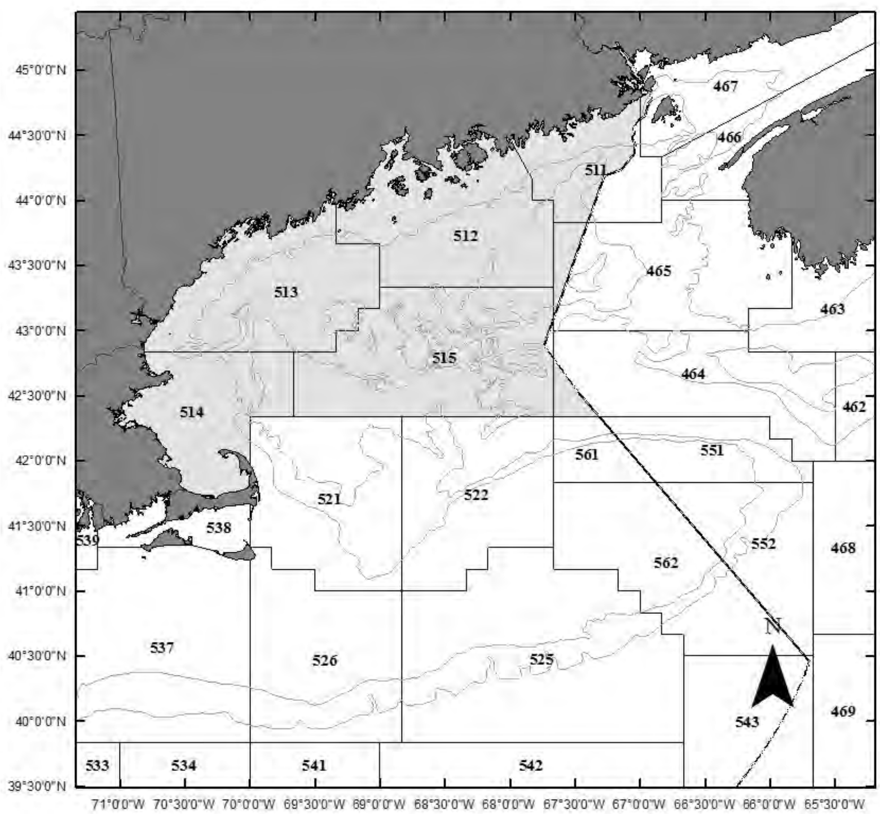


Figure 3. Statistical areas used for reporting commercial catches.

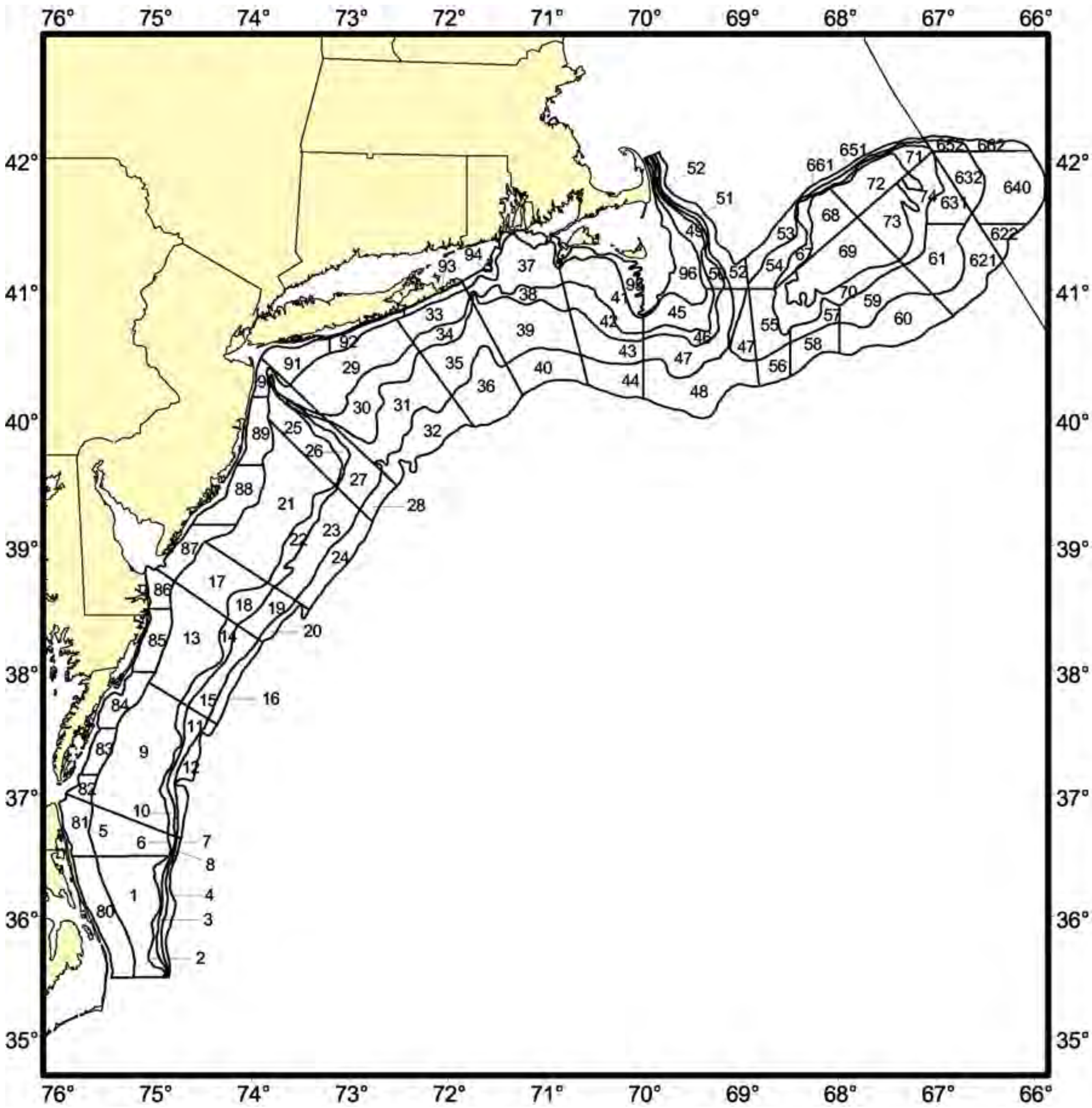


Figure 4. Northeast Fisheries Science Center shellfish resource survey strata, along the east coast of the US.

B. ATLANTIC STRIPED BASS ASSESSMENT SUMMARY FOR 2018

State of Stock

The biomass threshold for Atlantic striped bass is the estimate of female spawning stock biomass (SSB) for year 1995. The F threshold is the F value that allows the stock to achieve the SSB threshold under long-term equilibrium conditions.

Female SSB for Atlantic striped bass in 2017 was 68,476 mt, which is less than the $SSB_{threshold}$ of 91,436 mt, indicating the stock is overfished (Figure B1). F_{2017} was 0.307, which is greater than the associated $F_{threshold}$ of 0.240, indicating the stock is experiencing overfishing (Figure B1).

Projections

Stock projections of female SSB were made by using the same population dynamics equations used in the assessment model. Four scenarios of constant catch or F are provided here.

The model projection began in year 2018 and ran for a total of 6 years. A composite selectivity pattern was calculated as the geometric mean of 2013-2017 of total F-at-age, scaled to the highest F. Residuals from the stock-recruitment fit from 1982-2017 were randomly re-sampled and added to the deterministic predictions of recruitment from the hockey-stick recruitment function to produce stochastic estimates of age-1 recruitment for each year of the projection. Projections were done using: constant 2017 catch; constant 2017 F; F equal to $F_{threshold}$; and F equal the F required to achieve the 1993 estimate of female SSB in the long term. Female SSB in 1993 was lower than the SSB threshold, but was still capable of producing a very strong year class, and so fishing mortality required to achieve the 1993 estimate of female SSB was explored as a sensitivity run to understand projected population dynamics under an F in between F in 2017 and the F threshold.

Under the projection with status quo F ($F=F_{2017}$), the population trajectory remained relatively flat from 2018-2023; reducing F to $F_{threshold}$ resulted in an increasing trend in SSB (Figure B2). However, under all four scenarios, the probability of female SSB being above $SSB_{threshold}$ in 2023 was very low (Figure B3). In addition, although the probability of F being above $F_{threshold}$ declined in the constant catch scenario, there was still a 60% chance of F being above $F_{threshold}$ in 2023 (Figure B4).

Catch and Status Table: Atlantic striped bass

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Commercial landings (mt)	3,974	3,584	3,655	3,557	3,403	3,069	2,898	2,504	2,531	2,450
Commercial discards (mt)	432	488	418	367	640	409	530	468	492	504
Recreational catch† (mt)	32,949	31,692	32,944	29,190	28,127	34,403	23,982	22,063	24,962	21,797
Catch used in assessment (mt)	37,355	35,764	37,016	33,114	32,170	37,881	27,409	25,035	27,985	24,751
Female spawning stock biomass (mt)	106,656	106,094	106,261	99,768	98,798	88,864	78,999	70,858	73,924	68,476
Recruitment (Millions of age 1 fish)	129.2	77.5	104.9	147.9	214.4	65.4	92.6	186.9	239.6	108.8
Full F	0.241	0.233	0.273	0.276	0.272	0.368	0.283	0.243	0.278	0.307

†: MRIP 2018 calibrated landings plus 9% release mortality on fish released alive.

	Min	Max	Mean
Commercial landings (mt)	29	3,974	2,296
Commercial discards (mt)	24	1,458	470
Recreational catch† (mt)	1,031	34,403	18,256
Catch used in assessment (mt)	1,144	37,881	21,022
Female spawning stock biomass (mt)	15,369	113,602	74,920
Recruitment (Millions of age 1 fish)	37.9	312.2	140.9
Full F	0.030	0.368	0.195

Min, max, and mean values calculated for the assessment time series, 1982 - 2017

†: MRIP 2018 calibrated landings plus 9% release mortality on fish released alive.

	ASMFC 2014		Updated (SARC 66, 2018)	
Reference Point	Definition	Value	Definition	Value
SSB threshold	Estimate of 1995 female SSB	57,626 mt	Estimate of 1995 female SSB	91,436 mt
SSB target	125% SSB threshold	72,032 mt	125% SSB threshold	114,295 mt
F threshold	F projected to achieve SSB threshold	0.22	F projected to achieve SSB threshold	0.240
F target	F projected to achieve SSB target	0.18	F projected to achieve SSB target	0.197

Stock Distribution and Identification

The Atlantic coastal striped bass management unit includes the coastal and estuarine areas of all states and jurisdictions from Maine through North Carolina. The Albemarle-Roanoke stock is currently managed as a non- migratory stock by the state of North Carolina under the auspices of ASFMC. Coastal migratory striped bass are assessed and managed as a single stock, although the population is known to be comprised of multiple biologically distinct stocks, predominantly the Chesapeake Bay stock, the Delaware Bay stock, and the Hudson River stock.

Atlantic coastal migratory striped bass live along the eastern coast of North America from the St. Lawrence River in Canada to the Roanoke River and other tributaries of Albemarle Sound in North Carolina (ASMFC 1990). Atlantic striped bass are anadromous, meaning they return to their natal rivers to spawn.

Stocks which occupy coastal rivers from the Tar-Pamlico River in North Carolina south to the St. Johns River in Florida are believed to be primarily endemic and riverine, as historical tagging data suggest they do not presently undertake extensive Atlantic Ocean migrations, as the more northern stocks do. These areas are not considered part of the coastal striped bass management unit.

Catches

Annual commercial harvest of striped bass peaked at approximately 5,888 mt (13 million pounds) in 1973, but due to stock declines and subsequent management actions, landings decreased by 99 percent to 68 mt (151,000 pounds) in 1986 (Figure B5). Commercial landings gradually increased through the early 1990s as the stock recovered and management measures were liberalized. The quota system has kept the commercial landings relatively stable from 2004 – 2014, with average landings of 2,935 mt (6.5 million pounds). In response to the 2013 benchmark assessment, the commercial quota was reduced beginning in 2015 through Addendum IV. Landings averaged 2,133 mt (4.7 million pounds) from 2015 – 2017.

Commercial discards increased from the early 1980s to a peak of nearly 350,000 fish in 1998, and have been declining since then (Figure B5). Commercial discards averaged 105,000 fish from 2015 – 2017. Commercial landings have generally exceeded discards since the early 1990s; discards made up approximately 15% of total commercial removals coastwide from 2015 – 2017.

This assessment incorporated the newly calibrated MRIP estimates of recreational catch and length frequencies. The calibrated MRIP estimates of harvest were approximately 150% higher than uncalibrated estimates in recent years; calibrated estimates of live releases were approximately 200% higher than uncalibrated estimates (Figure B6). The calibration did not change the overall trend of the recreational catch.

Recreational harvest of striped bass increased from a low of 264,000 fish in 1984 to a high of 5.4 million fish in 2010. Harvest averaged 3.2 million fish for 2015 – 2017 (Figure B5).

The annual Atlantic coast harvest (in numbers) has been a small fraction of the total catch (harvest and releases, combined) since the 1980s because the live releases have accounted for 85 to 90% of the annual catch in most years; in 2015 – 2017, only 9% of the total catch was landed.

Recreational harvest and live releases showed different patterns after 2006, with releases declining faster initially and then increasing, and harvest staying relatively steady through 2013 before beginning to decline.

A recreational release mortality of 9% was applied to the total number of live releases to calculate the numbers of fish that died after being released alive. Recreational release mortalities increased from 79,660 fish in 1984 to a peak of 4.8 million fish in 2006 before declining through 2011 to 1.5 million fish (Figure B5). Live releases increased after that, with the number release mortalities averaging 2.9 million fish from 2015 – 2017.

Over the entire time series, about one third of the total removals (commercial landings, commercial discards, recreational landings, and recreational release mortalities combined) were taken in the Chesapeake Bay, with the rest coming from the ocean and other areas such as Delaware Bay and Long Island Sound (Figure B5). In 2017, the Chesapeake Bay accounted for 35% of total removals; from 2014-2016, it was closer to 50%.

Data and Assessment

The assessment used total catch (commercial landings, commercial discards, recreational landings, and recreational release mortalities) and catch-at-age from 1982-2017, split into two regions (Chesapeake Bay and the ocean/other areas). The assessment used seven fishery-independent indices of abundance for age-1+ striped bass, and one fishery-dependent index: the CT Long Island Sound trawl survey, the NJ ocean bottom trawl survey, the NY ocean haul seine survey, the MD spawning stock survey, ChesMMAP, the DE 30' trawl, the DE spawning stock electrofishing surveys, and an MRIP CPUE. Five recruitment indices for young-of-year (YOY) and age-1 fish were also used: a composite YOY index based on YOY surveys from MD and VA, a MD age-1 survey, a NY YOY survey, a NY Age-1 survey, and a NJ YOY survey. Two surveys used in the 2013 assessment were dropped due to either concerns about the design and long-term future of the survey (VA poundnet survey) or low catch rates of striped bass (NEFSC bottom trawl survey). The ChesMMAP survey was added to provide additional information on striped bass abundance in the Chesapeake Bay, and the DE 30' trawl survey was added to provide a longer time series of data on striped bass abundance in the Delaware Bay.

The SARC-66 accepted model for striped bass is a forward projecting statistical catch-at-age (SCA) model, specifically a single stock, non-migration SCA model. This SCA model estimates annual recruitment, annual full F by fleet, and selectivity parameters for indices and fleets in order to calculate abundance and female spawning stock biomass. Recruitment was estimated as deviations from mean recruitment. This model was approved for management use at SARC-57 in 2013, and several improvements to the input data were made for the 2018 assessment. In 2013, three fleets were used: a Chesapeake Bay fleet, an ocean fleet, and a commercial discard fleet. For the SARC-66 assessment in 2018, commercial discards were estimated by region, so the model used only two fleets: a Chesapeake Bay fleet and an ocean fleet. This allowed the model to better represent the regional dynamics of the fisheries and differences in selectivity patterns. In addition, proportions at age for the CT trawl survey and the MRIP CPUE were developed for the 2018 assessment based on length frequency information, so that neither of those indices had to be treated as age-aggregated indices as was done in the 2013 assessment; all age-1+ indices in the 2018 assessment had age-structure information for the model fitting.

As a complement to the SCA, Jiang et al.'s (2007) instantaneous rates tagging model (IRCR) was run on data from the USFWS coast-wide striped bass tagging program through the 2017 tagging year to estimate abundance, survival, fishing mortality, and natural mortality.

Fishing Mortality

Fishing mortality (F) in both Chesapeake Bay and the ocean has been increasing since 1990. The combined full F was 0.307 in 2017, above the current $F_{threshold}$ of 0.240. The combined full F has been at or above the threshold for 13 of the last 15 years (Figure B1).

Biomass

Total biomass was low at the beginning of the time series. Total biomass increased through the 1980s and 1990, peaking in 1999 before declining again. The total biomass of Atlantic coastal migratory stock striped bass was 173,663 mt (383 million pounds) in 2017. Total biomass peaked at 334,661 mt (738 million pounds) in 1999.

Female SSB showed a pattern similar to that of total biomass. Female SSB started out low and increased through the late-1980s and 1990s, peaking at 113,602 mt (250 million pounds) in 2003 before beginning to gradually decline; the decline became sharper in 2012 (Figure B1). Female SSB was estimated at 68,476 mt (151 million pounds) in 2017, which is below the SSB threshold of 91,436 mt (202 million pounds); female SSB has been below $SSB_{threshold}$ since 2013 (Figure B1).

Recruitment

The stock appears to have experienced low recruitment at the beginning of the time series. Mean recruitment through the early 1990s to the present has been higher.

The 2015 year class was strong, as was the 2011 year class. But the 2016 year class was below average (Figure B7). Recruitment in 2017 was estimated at 108.8 million age-1 fish, below the time series mean of 140.9 million fish.

Biological Reference Points

Biological reference points for Atlantic striped bass are based on the condition of the stock in 1995, the year the stock was declared recovered. The SSB threshold is the estimate of female SSB in 1995, and the SSB target is 125% of the estimate of 1995 female SSB. The F threshold and F target are the F rates that will maintain the stock at the SSB threshold and SSB target, respectively, under long term equilibrium recruitment conditions. The previous benchmark assessment (2013) estimated $SSB_{threshold}$ at 57,626 mt (127 million pounds) and the associated $F_{threshold}$ at 0.22. SSB_{target} was estimated at 72,032 mt (159 million pounds) and the associated F_{target} was 0.18. These reference points were for the total coastal migratory stock complex of Atlantic striped bass.

For the SARC-66 benchmark assessment in 2018, the definition of the targets and thresholds were kept the same as the previous assessment, but the values were re-estimated. $SSB_{threshold}$ was estimated at 91,436 mt (202 million pounds), with SSB_{target} equal to 114,295 mt (252 million pounds). $F_{threshold}$ was estimated at 0.240, and the associated F_{target} was 0.197.

Model-based estimates of MSY were not calculated for this assessment. An empirically-based proxy for MSY derived from the SSB target or threshold could be an area for future development, depending on management goals.

The new F reference points are similar to the values currently used in management, but the SSB reference points are significantly higher, primarily due to the inclusion of the new, calibrated MRIP values.

Special Comments

The new estimates of recreational catch resulted in higher estimates of recruitment and biomass compared to the 2016 assessment update that used uncalibrated estimates. However, it did not significantly change the overall population trend, which has been declining since about 2003.

An impressive amount of work went into developing the two stock model presented by the working group. This model represents an innovative advancement, and the SARC panel recommends continued development and refinement of that model.

References

ASMFC. 1990. Source document for the supplement to the Striped Bass FMP - Amendment #4. Washington (DC): ASMFC. Fisheries Management Report No. 16. 244 p.

ASMFC. 2014. Addendum IV to Amendment 6 to the Atlantic Striped Bass Interstate Fishery Management Plan. Arlington (VA): ASMFC. 20 p.

Jiang H, Pollock KH, Brownie C, Hoenig JM, Latour RJ, Wells BK, Hightower JE. 2007. Tag return models allowing for harvest and catch and release: evidence of environmental and management impacts on striped bass fishing and natural mortality rates. North American Journal of Fisheries Management 27:387-396.

Figures

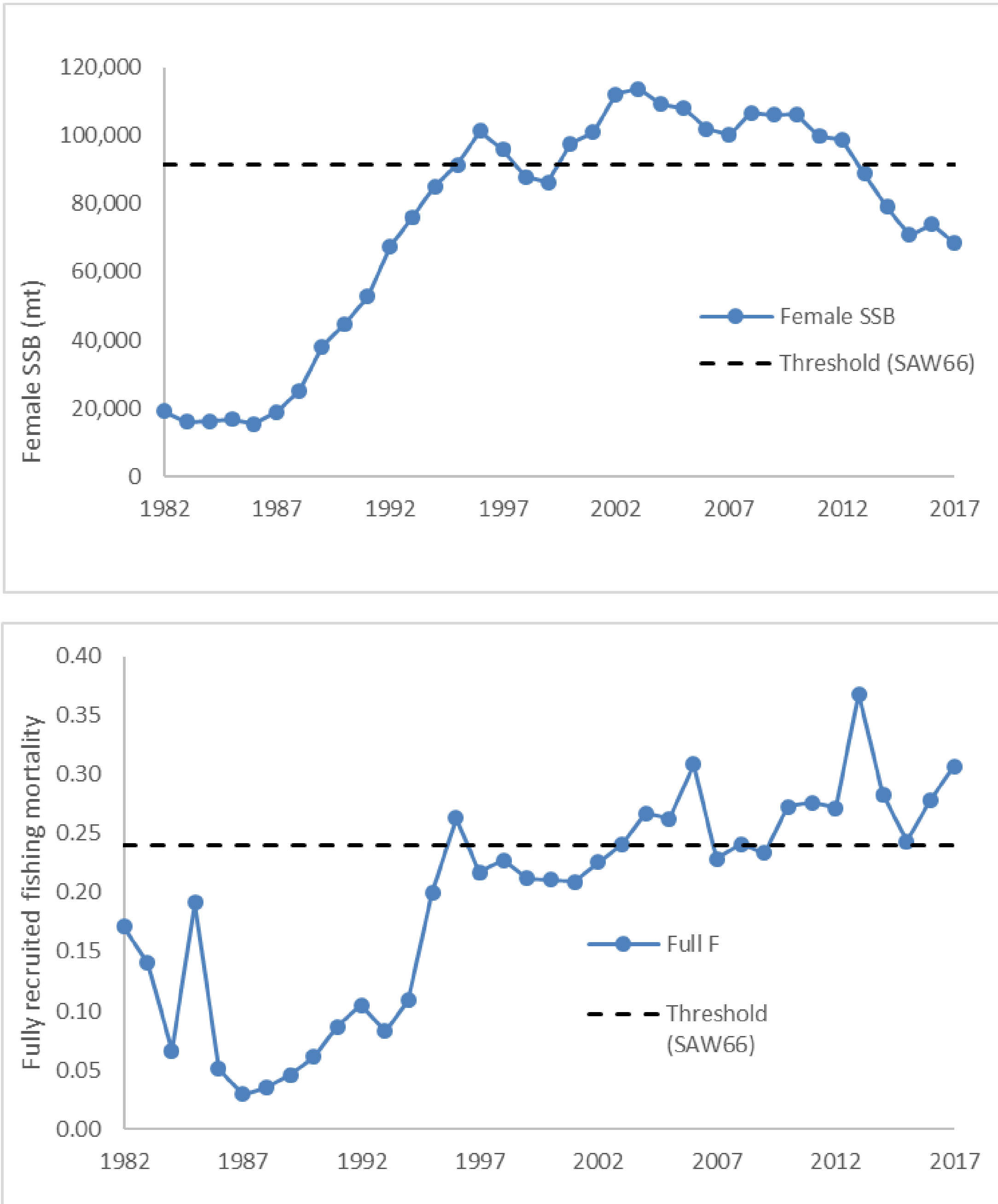


Figure B1. Female spawning stock biomass (SSB; top) and fishing mortality (F; bottom) for Atlantic striped bass through 2017, plotted with the respective SSB and F thresholds.

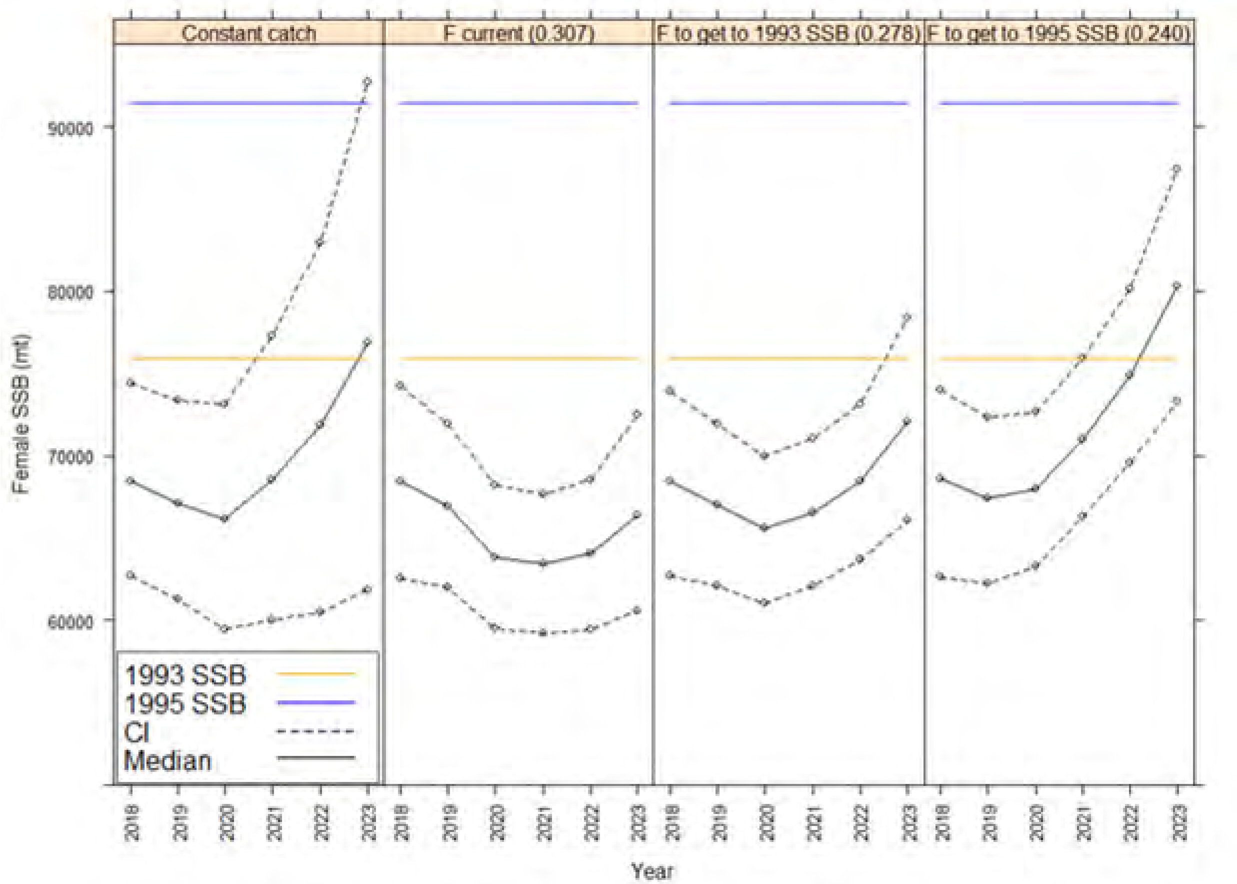


Figure B2. Trajectories of female Atlantic striped bass spawning stock biomass (SSB), with 95% confidence intervals, under different harvest scenarios. Projections were done using: constant 2017 catch; constant 2017 F; F equal the F required to achieve the 1993 estimate of female SSB in the long term; and F equal to $F_{threshold}$.

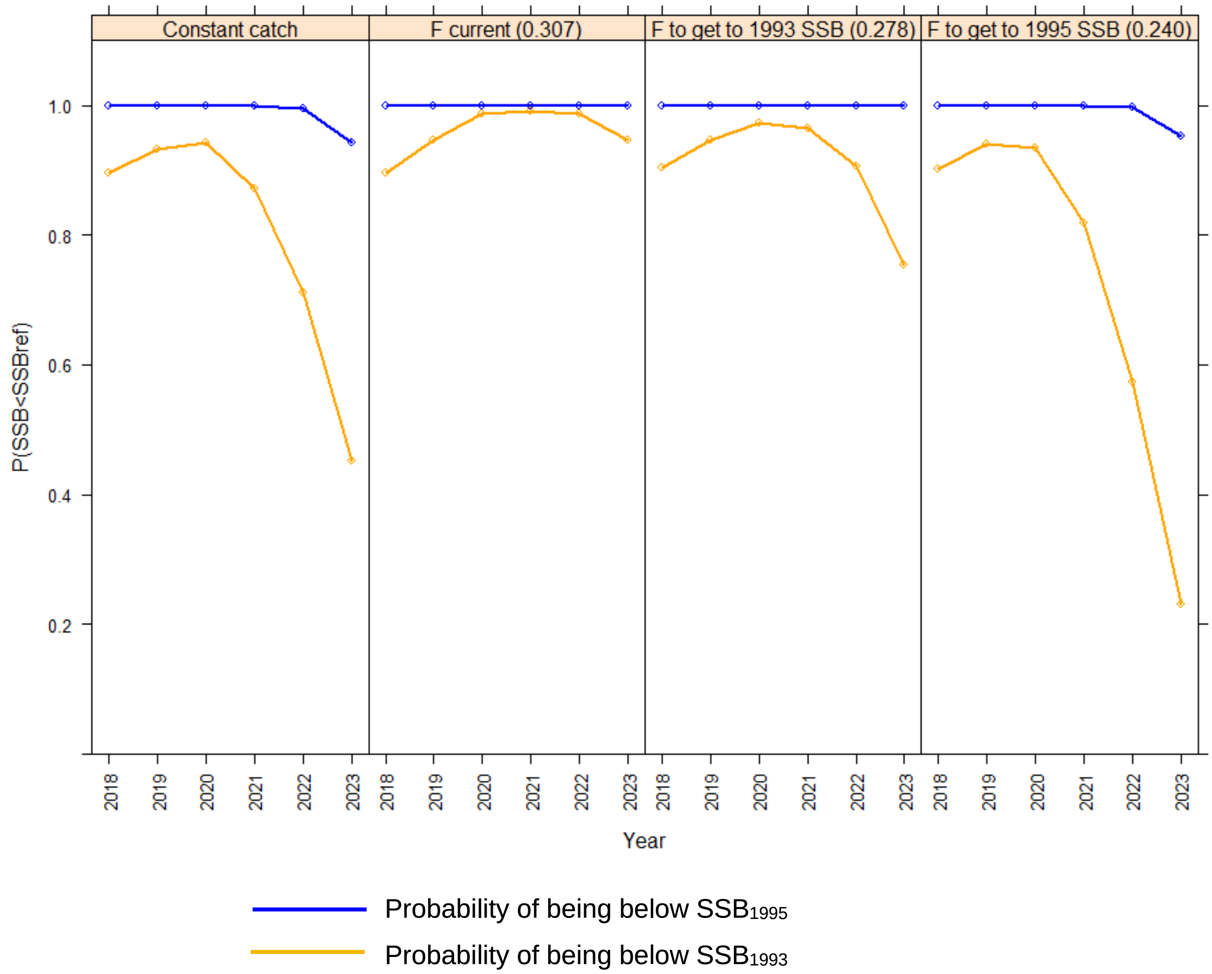


Figure B3. Probability of female Atlantic striped bass spawning stock biomass (SSB) being below the SSB threshold under different harvest scenarios. Projections were done using: constant 2017 catch; constant 2017 F; F equal the F required to achieve the 1993 estimate of female SSB in the long term; and F equal to $F_{threshold}$.

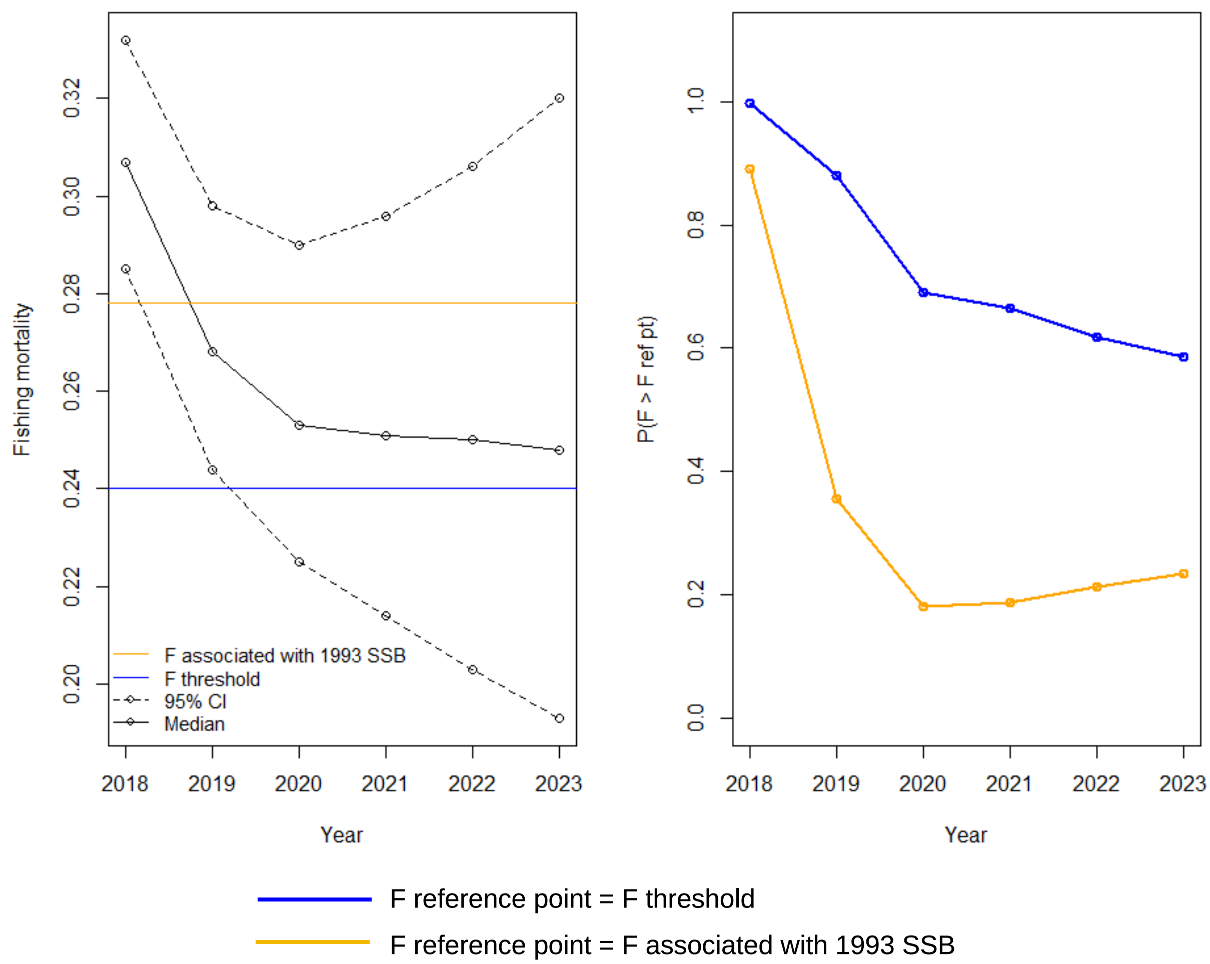


Figure B4. Atlantic striped bass. Trajectory of combined full fishing mortality (F) for the population (left) and the probability of F being above F threshold (right) under the constant 2017 catch scenario.

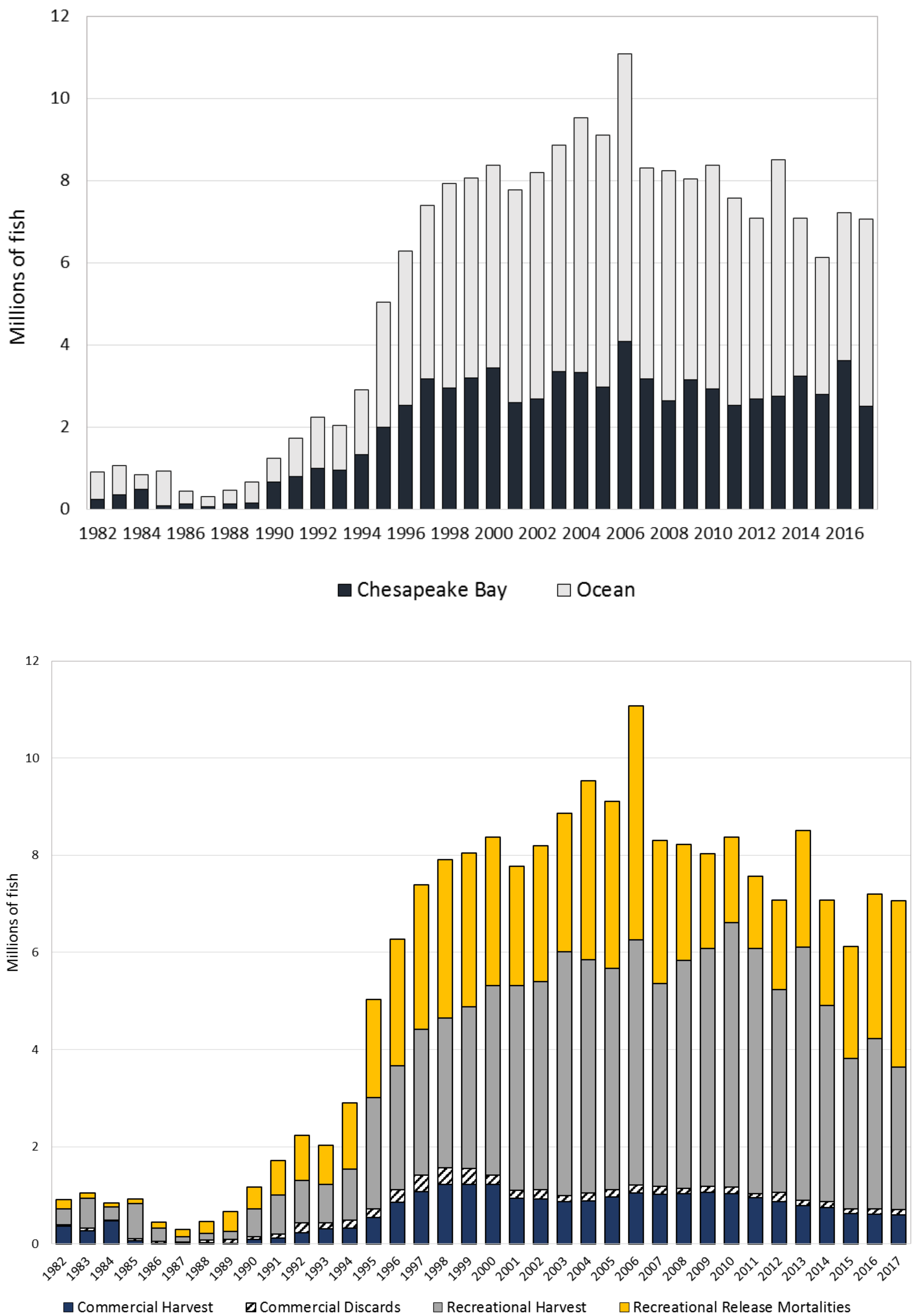


Figure B5. Total removals of Atlantic striped bass by region (top) and sector (bottom) through 2017.

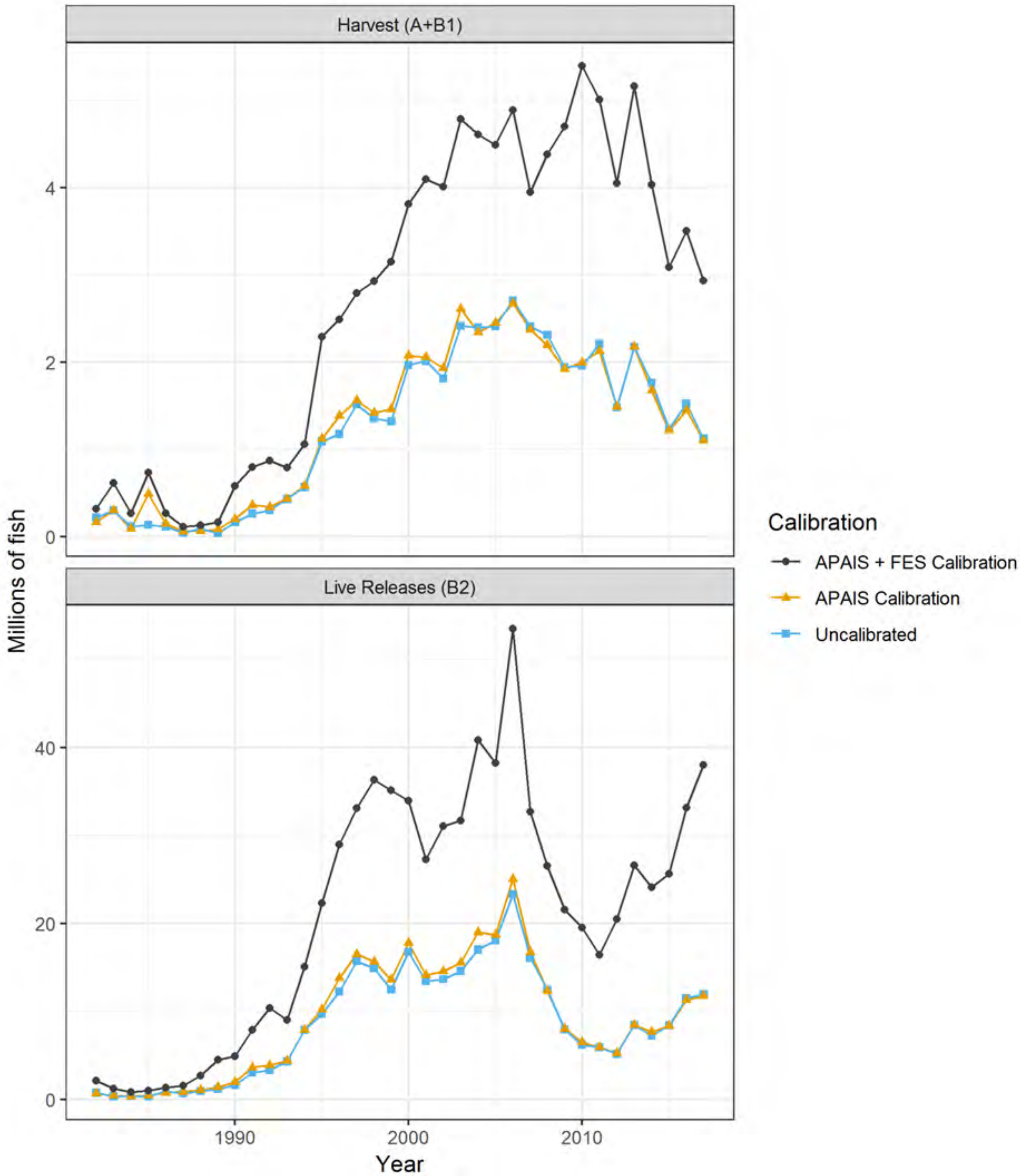


Figure B6. Comparison of calibrated and uncalibrated MRIP estimates of recreational harvest (top) and live releases (bottom) for Atlantic striped bass through 2017. Uncalibrated = original MRIP estimates; APAIS calibration = MRIP estimates after calibration to account for changes in the Access Point Angler Intercept Survey (APAIS). APAIS + FES calibration = MRIP estimates after calibration to account for APAIS changes and the change in effort estimation from the coastal household telephone survey to a mail-based fishing effort survey (FES).

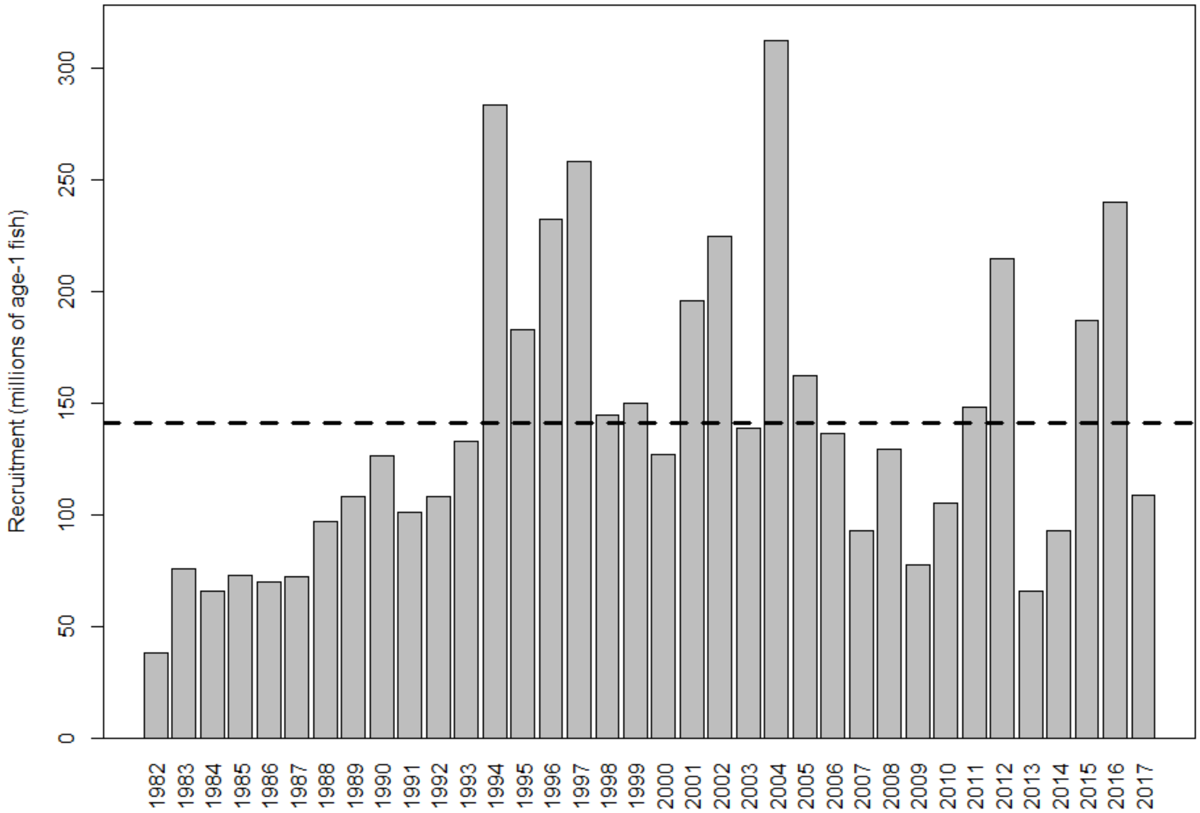


Figure B7. Annual estimates of recruitment for Atlantic striped bass through 2017. Dashed black line indicates time-series average for the stock.

B. Striped bass

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method, if available.

3. Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.

4. Use tagging data to estimate mortality and abundance, and provide suggestions for further development.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for BMSY, SSBMSY, FMSY, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

Appendix to the SAW Assessment TORs:

Clarification of Terms used in the SAW/SARC Terms of Reference

On "Acceptable Biological Catch" (DOC Nat. Stand. Guidel. Fed. Reg., v. 74, no. 11, 1-16-2009):

Acceptable biological catch (ABC) is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of Overfishing Limit (OFL) and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*

ABC for overfished stocks. For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*

NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)

ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, Optimal Yield (OY) does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

On "Vulnerability" (DOC Natl. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

"Vulnerability. A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce Maximum Sustainable Yield (MSY) and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality)." (p. 3205)

Participation among members of a Stock Assessment Working Group:

Anyone participating in SAW meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with the proposed configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models.

Guidance to SAW WG about "Number of Models to include in the Assessment Report":

In general, for any TOR in which one or more models are explored by the WG, give a detailed presentation of the "best" model, including inputs, outputs, diagnostics of model adequacy, and sensitivity analyses that evaluate robustness of model results to the assumptions. In less detail, describe other models that were evaluated by the WG and explain their strengths, weaknesses and results in relation to the "best" model. If selection of a "best" model is not possible, present alternative models in detail, and summarize the relative utility each model, including a comparison of results. It should be highlighted whether any models represent a minority opinion.

The 2018 Atlantic Striped Bass Benchmark Stock Assessment, conducted through the Northeast Regional SAW/SARC, can be obtained at

https://tinyurl.com/y452cxk6

Final Report

Summary Report of the 66th Northeast Regional Stock Assessment Review Committee (SARC 66)

Members of SARC 66
Robert J. Latour, Chair
John Casey
Robin Cook
Yan Jiao

Prepared for the Northeast Regional Stock Assessment Workshop
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Woods Hole, Massachusetts

Meeting dates: 27 November – 30 November, 2018
Report date: 21 December, 2018

Contents

1. Introduction

1.1 Background

The 66th Stock Assessment Review Committee (SARC) met in Woods Hole, MA from 27 November – 30 November, 2018 to review the most recent stock assessments for summer flounder, *Paralichthys dentatus*, and striped bass, *Morone saxatilis* (Attachment 1). The review committee was composed of Robert J. Latour (MAFMC SSC and Virginia Institute of Marine Science, SARC Chair) and three scientists affiliated with the Center for Independent Experts: John Casey (Consultant), Robin Cook (University of Strathclyde), and Yan Jiao (Virginia Polytechnic Institute and State University).

The SARC was assisted by the Stock Assessment Workshop (SAW) Chairman, James Weinberg (NEFSC). Supporting documentation for the summer flounder assessment was prepared by the NEFSC Summer Flounder Working Group (SFWG) and presentation of the assessment was made by Mark Terceiro (lead analyst) with support from Jessica Coakley (MAFMC, Chair SFWG). Technical documents for the striped bass assessment were prepared by the Striped Bass Working Group (SBWG) and presentations were made by Katie Drew (ASMFC), Gary Nelson (MADMF), and Michael Celestino (NJDFW, Chair SBWG). Tony Wood, Toni Chute, Alicia Miller, Brian Linton, and Chris Legault (all NEFSC) served as rapporteurs. A total of 39 individuals attended the SARC 66 meeting, representing NEFSC, MAFMC, ASMFC, MADMF, NJDFW, DEFW, RIDMF, various academic institutions, non-governmental organizations, and fisheries stakeholder organizations (Attachment 2). The contributions of all associated with the SARC 66 process are gratefully acknowledged.

1.2 Review of Activities

Approximately two weeks before the meeting, assessment documents and supporting materials were made available to the SARC Panel electronically. On the morning of 27 November, the Panel met with James Weinberg and Russell Brown to discuss the meeting agenda, reporting requirements, and meeting logistics. The meeting opened on the morning of 27 November with welcoming remarks by James Weinberg and Robert Latour. Following introductions, the remainder of day was devoted to presentations of the summer flounder assessment. Most all of 28 November was spent on presentations of the striped bass assessment, with the latter part of the day dedicated to follow-up discussion of the summer flounder assessment and editing of the summer flounder Assessment Summary Report. Virtually all of 29 November focused on discussion associated with the striped bass assessment and editing of the striped bass Assessment Summary Report. The final day of the meeting was restricted to only the SARC Panelists for report writing.

The presentations given during the meeting for each assessment followed the Terms of Reference (ToRs) which allowed the Panel to gain a deeper understanding of each assessment. The Panel asked each working group for additional model runs to explore sensitivities and alternative model configurations, and the efforts by working group members to quickly generate those model runs were greatly appreciated. The tone of the meeting was collegial, and considerable time was devoted to facilitate dialog among Panelists, working group members, and MAFMC and ASMFC staff. The SARC Panel was able to conduct a thorough review of both assessments.

The assessments were effective in providing current stock status information and the SARC Panel was able to reach consensus on both assessments, although the accepted model configuration for striped bass differed considerably from the base model put forth by the SBWG. Since the last peer-reviewed assessments of each species (2013 SAW/SARC 57 for both species), considerable research advancements have been made for each assessment. The assessments conducted by the SFWG and SBWG were very thorough, and it was apparent that each working group devoted significant time and effort to data analysis, model fitting, evaluation of uncertainty, and report preparation.

<u>Special Comment, summer flounder:</u> The SARC Panel acknowledged the public comment submitted by Save the Summer Flounder Fishery Fund regarding past efforts and future plans to develop a sex-structured assessment model for summer flounder. This comment was read into the record by Patrick Sullivan.

3. Review of Striped Bass

3.1 General Comments

The stock assessment model for striped bass was last peer-reviewed in 2013 (SAW/SARC 57) and the model put forth by the SBWG at that time was a fairly traditional single-stock statistical catch-age-age model (referred herein as the 'SCA model'). However, it has been well documented in the primary literature that the coastal striped bass population is of mixed stock origin, and that striped bass exhibit differential habitat utilization among estuarine and coastal areas based on season of the year and ontogeny. Therefore, in an effort to build a stock assessment model that more closely represented the biology and ecology of striped bass, the SBWG introduced new assessment model formulation in 2018 that was stock-specific (two-stocks: Chesapeake Bay and Delaware/Hudson), seasonally-explicit (three periods: Jan-Feb, Mar-Jun, Jul-Dec), and spatially-explicit (two regions: Chesapeake Bay, coastal ocean). The SARC Panel was supportive of this very innovative modeling effort (referred herein as the '2SCA model'), but ultimately did not accept this model as a tool for the basis of striped bass management. Several technical issues regarding configuration of the 2SCA model were raised by the SARC Panel (see ToR 3 for more details) along with a conceptual concern pertaining to BRPs. Historically, the BRPs for striped bass were based on the estimated female SSB for 1995 ($SSB_{Threshold}$ = SSB_{1995}), which was regarded as the biomass achieved when the stock had recovered from a period of being overfished. Associated fishing mortality reference points were estimated from long-term stochastic projections by finding F values that corresponded to the median $SSB_{Threshold}$ and SSB_{Target} values (see ToR 5 for more details). In developing the 2SCA model, the SBWG attempted to redefine the BRPs to be both stock- and area-specific, which resulted in two SSB reference points (one for the Chesapeake Bay stock and one for the Delaware/Hudson stock) and three F reference points (two for the Chesapeake Bay stock and one for the Delaware/Hudson stock). Specific to the Chesapeake Bay stock, this structure yielded a bay F reference point and a coastal F reference point. If accepted, this would imply that the Chesapeake Bay stock could be, for example, experiencing overfishing in the ocean but not experiencing overfishing in the bay. The SARC Panel regarded this as not biologically meaningful since the cumulative F on a stock should determine status as opposed to a single spatially-specific component. Imposing the constraint of a single, stock-wide F reference point is necessary to ensure a unique solution because there is an infinite number of ways of partitioning F between fleets or areas. Despite these concerns, the SARC Panel strongly recommended continued development of the 2SCA model and was optimistic that the model could become the basis for management in the future following more extensive testing and refinement.

In light of the SARC Panel's decision to not accept the 2SCA model, the SBWG brought forward an updated configuration of the SCA model (2013 assessment model – SAW/SARC 57). Available time for the SARC Panel to evaluation this model was abbreviated due to discussions associated with the 2SCA model, but the SBWG was able to present the key elements of the model structure, data inputs, model diagnostics with some sensitivity runs, results, and recommended stock status information. The SARC Panel accepted the SCA model for management, concluded that all ToRs were met for that model, and noted that the aforementioned discussion of area-specific reference points (e.g., bay vs. coastal ocean, Section 3.1) also pertains to the SCA model.

3.2 Evaluation of the Terms of Reference for Striped Bass

ToR 1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.

This ToR was met. The SBWG provided detailed summaries of the available fisheries-independent and fisheries-dependent data. Rich datasets supported estimation of life history parameters such as growth and maturity. Published literature provided insight into potential population effects of mycobacteriosis, particularly disease-associated mortality. In total, over a dozen research survey datasets were analyzed to generate estimates of relative abundance. Indices were estimated for YOY and aggregated age-1+ fish. Age-specific indices were available from a few sampling programs. A wealth of tag-return data were available from producer areas (stock-specific tagged fish on/near spawning grounds) and coastal areas (mixed stock fish tagged in coastal zone). These data were used to aid fit and scaling of the SCA model, support estimation of natural mortality (M), and provide information on stock composition of the coastal population (needed only for the 2SCA model). The SARC Panel concluded that the SBWG satisfactorily assembled the necessary life history and relative abundance information needed for the SCA model.

ToR 2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method, if available.

This ToR was met. Strict quota monitoring is conducted by individual states through various state and federal reporting systems, and annual landings are compiled by state biologists. Directed commercial landings were assumed to be a census. The 2013 SCA model was structured to include three fleets: Chesapeake Bay, coastal ocean, and commercial discards. However, for the 2018 SCA model, commercial discards were separated regionally (Chesapeake Bay, coastal ocean) such that only two regional fleets were needed.   Although some empirical estimates of commercial discards were available (e.g., Delaware Bay), discard estimation was largely based on tagging data. Specifically, a ratio approach was used that involved the ratio of tags report from discarded (or released) fish in the commercial fishery to tags reported from discarded fish in the recreational fishery, scaled by total recreational releases/discards. Corrections were made for differences among tag-reporting rates between sectors and gear-specific release mortality rates were applied to total discards to estimate dead discards. Directed commercial landings have generally exceeded discards since the 1990s with discards comprising roughly 15% of the total commercial removals from 2015-2017. Commercial catch-at-age summaries were based on regional age-length keys.

Estimates of annual recreational harvest and total catch (harvested+released) came from the newly calibrated MRIP, and were 140% and 160% higher than previous estimates, respectively. A 9% release mortality rate was applied to live releases (catch type B2). Temporal trends of catch and harvest statistics were similar among uncalibrated and calibrated MRIP data despite significant differences in magnitude. Recreational catch-at-age was based on state-specific age-length keys developed from fisheries-dependent (MRIP, state logbook programs, volunteer angler surveys, creel sampling, and the American Littoral Society volunteer angler tagging program) and fisheries-independent sources. The SARC Panel concluded that the assembled landings and discard data were suitable for the assessment.

ToR 3. Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.

This ToR was met. As noted above (section 3.1), the SARC Panel did not accept the 2SCA model for use as the basis of striped bass management. Specific research needs raised by the SARC Panel for the 2SCA model are as follows:

- More extensive simulation testing
    - Exploration of parameter estimability
    - Testing of the effects of various emigration rate assumptions
    - Alternative methods (e.g., multi-state tagging models) to estimate emigration rates from existing tagging data
    - Development of a method to estimate numbers-at-age for the first year
- Further examination of tagging data after 1995 (including developing ways of assigning ages to NY data) to examine potential time-varying emigration rates
- Further exploration of appropriate BRPs for a two-stock population with mixing
    - Can the model detect changes in stock status with different emigration rates/exploitation patterns/etc?
- Evaluation of why model output for the two stocks show such similar patterns over time
- Further exploration of the assumption of constant selectivity across periods within a region & year
- Identify weaknesses in the existing data that can be improved to support the further development of this model

- Develop more robust estimates of stock composition

However, as noted above (section 3.1) the updated and slightly modified SCA model was accepted by the SARC Panel for striped bass management. The SCA model included two fleets (Chesapeake Bay, coastal ocean), four selectivity blocks in each area that corresponded to notable changes in management, and the aforementioned YOY and aggregated age 1+ indices of relative abundance. Likelihood weights favored the age-composition data which led to poor model fits to some survey indices.

Estimates of fully-recruited instantaneous fishing mortality (F) in Chesapeake Bay were low (≈ 0.05-0.10) across the time-series with comparably higher values estimated for the coastal ocean (≈ 0.03-0.26). CVs associated with estimates of fishing mortality in both areas were low and indicative of good precision (≈ 0.10-0.37). Estimates of female SSB were low in the 1980s (as expected given the depressed condition of the stock at the time) but increased through the 1990s to a peak in 2003. Since 2010, estimated female SSB has declined steadily such that the 2017 SSB estimate is commensurate to that of 1991-1992.

A retrospective analysis of the SCA model (seven year peels) showed very little trend (+/- 2%) in the more recent estimates of fully-recruited total fishing mortality, female SSB, and age-8+ abundance. Notable patterns did not emerge until five years of data were peeled (> 10% change). The SBWG indicated that fishing mortality is likely slightly overestimated with female SSB being slightly underestimated. The retrospective analysis of age-1 recruits indicated that the terminal year estimate of age-1 abundance was most uncertain.

ToR 4. Use tagging data to estimate mortality and abundance, and provide suggestions for further development.

This ToR was met. Tagging data are available for striped bass from both coastal areas (MA, NY, NJ, and NC) and producer/spawning areas (Hudson, DE/PA, MD upper Chesapeake Bay, and VA Rappahannock River). These tagging data represent a rich source of information since most all programs have been operating continuously since the late 1980s. Age-invariant instantaneous rates catch and release models that allow for the release of tagged fish were applied to provide estimates of survival (S), instantaneous total mortality (Z), F and M for two size-classes of fish (≥ 457 mm and ≥ 711 mm). For each tagging dataset, a suite of candidate model parameterizations was fitted and information theoretic approaches were used to obtain final weighted parameter estimates across the hypothesized models (multi-model inference). Stock sizes were estimated using the annual exploitation rates averaged across all tagging program in concert with total catch (recreational and commercial harvest and dead discards; average stock size = catch/exploitation).

The SARC Panel accepted the analyses of the tagging data for comparative purposes to the mortality rates and stock sizes derived from the SCA model. As noted above (ToR 3), the

SBWG did make use of the tagging data to make inferences about stock composition of the coastal population and emigration rates, both of which were needed for the 2SCA model. The SARC Panel recommended continued work in this area for future assessments.

ToR 5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.

SPR-based reference points were explored with the SCA model but ultimately not used for recommendations of stock status because estimates of SSB associated with various SPR fishing mortality rates were unrealistic. For example, long term (100 yr) projections at $F_{40\%}$ resulted in an equilibrium female SSB value that was approximately twice the highest estimated female SSB value in the time-series. Although the SBWG was unable to fully explain the stock dynamics associated with SPR-based reference points, it is possible that the SCA model did not adequately capture sex-specific dynamics associated with regional fisheries, particularly those operating in Chesapeake Bay. Sex ratio data from the bay showed high proportions of males, which is consistent with the notion that young females migrate to coastal areas earlier than males. Lower fisheries selectivity of young fish in coastal areas compared to that in the bay implies that female SSB could be elevated due differential habitat utilization among sexes.

For stock status determination from the SCA model, the SBWG put forth the empirical reference points used in previous assessments. Specifically, the $SSB_{Threshold}$ was defined as the estimated female SSB for 1995 (SSB_{1995}) and the SSB_{Target} was defined as 125% of the female SSB_{1995} value. Fishing mortality reference points associated with the $SSB_{Threshold}$ and SSB_{Target} were generated using projections based on randomly selected 2017 estimates of January 1 abundance-at-age from a normal distribution, and geometric means of recent (2013-2017) selectivity, spawning stock weights-at-age, and age-1 recruitment stochastically obtained from the 'hockey-stick' approach (Beverton-Holt stock-recruitment up to median female SSB followed by the median recruitment thereafter). As a sensitivity run, projections were also generated where recruitment was 'empirical' and simply obtained as random selections from estimates spanning 1990-2017. In both cases, the input F was manually adjusted to obtain the median female SSB values closest to the female $SSB_{Threshold}$ and SSB_{Target} in year 100.

The SCA model yielded the following stock status output: $SSB_{Threshold}$ = 91,436 mt, SSB_{2017} = 68,476 mt; $F_{Threshold\text{-}HockeyStick}$ = 0.240, $F_{Threshold\text{-}Empirical}$ = 0.248, F_{2017} = 0.307. Thus, the recommended stock status is overfished with overfishing occurring. Fleet-specific F reference points indicated the Chesapeake Bay fleet was equal to its $F_{Threshold}$ while the ocean fleet was above its $F_{Threshold}$. The BRPs and recommended stock status determination were accepted by the SARC Panel.

ToR 6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

This ToR was met. Short-term, six-year projections of the SCA model (2018-2023) were configured similarly to the projections used to estimate fishing mortality reference points (see ToR 5 for more details). Four scenarios were examined: (i) constant catch equal to 2017 catch, (ii) constant F equal to 2017 F, (iii) constant F equal to $F_{Threshold}$ (F_{1995}), (iv) and constant F equal to F_{1993}. Recruitment was modeled using both the 'hockey-stick' and 'empirical' approaches. Projection results showed very high probabilities (≈0.95-1.0) of remaining overfished and for overfishing to continue (≈0.6-1.0) assuming 'hockey-stick' recruitment. For 'empirical' recruitment, the probabilities of staying overfished in the short term were similar to the 'hockey-stick' projection results, but the probabilities of maintaining overfishing were lower (≈0.4-1.0). The SARC Panel accepted the projection analysis conducted by the SBWG for the SCA model.

ToR 7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

This ToR was met. Progress has been made on several of the research recommendations stemming from the 2013 assessment (SAW/SARC 57). The SARC Panel recommended continued efforts on high priority research topics from this list along with advancements associated with testing and refining the 2SCA model (see ToR 3 for details).

4. Description of SAW Supporting Materials

References

Working paper	Title	Author(s)/Publisher
Summer Flounder		
A1	The effect of ocean environmental conditions on the relative abundance of summer flounder (*Paralichthys dentatus*): spatio-temporal analysis and model comparison using R-INLA	S. Deen et al.
A2	Summer flounder CPUE derived from cooperative research study fleet self-reported data	B.J. Gervelis
A3	Evaluating summer flounder (*Paralichthys dentatus)* spatial sex-segregation in a southern New England estuary	Langan et al.
A4	Stock Synthesis Implementation of a Sex-Structured Virtual Population Analysis Applied to Summer Flounder	M.N. Maunder
A5	Dynamic reference points for summer flounder	M.N. Maunder
A6	Developing an aggregated summer flounder fishery independent index from multiple noisy indices using a Bayesian hierarchical modeling approach	J.E. McNamee
A7	Spatial distribution of summer flounder captured in the commercial and recreational fisheries	A. Miller & M. Terceiro
A8	Spatial distribution of summer flounder sampled by the NEFSC trawl survey	A. Miller & M. Terceiro
A9	Accounting for sex in equilibrium per-recruit biological reference points for summer flounder	T.J. Miller
A10	A state-space, sex-specific, age-structured assessment model for summer flounder	T.J. Miller & M. Terceiro
A11	Even more state-space, sex-specific, age-structured assessment models for summer flounder	T.J. Miller & M. Terceiro
A12	An analysis of summer flounder (*Paralichthys dentatus*) distribution on the Northeast U.S. Shelf using a spatio-temporal model	C.T. Perretti
A13	A sex-age-length based fisheries stock assessment model with analysis and application to summer flounder (*Paralichthys dentatus*) in the mid-Atlantic	P.J. Sullivan
A14	57^{th} SAW/SARC Summer Flounder Assessment Report	Summer Flounder Working Group

A15	Stock Assessment of Summer Flounder for 2016	M. Terceiro
A16	The summer flounder ASAP statistical catch at age model by sex	M. Terceiro
B1	Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass	ASMFC
B2	57th SAW/SARC Striped Bass Assessment Report	Striped Bass Working Group
B3	57th SAW/SARC Striped Bass Assessment Report Appendices	Striped Bass Working Group
B4	57th SAW/SARC Striped Bass Assessment Summary Report	SARC 57 Panel
B5	Summary Report of the 57th Northeast Regional Stock Assessment Review Committee (SARC 57)	C.M. Jones
B6	Tag recovery estimates of migration of striped bass from spawning areas of the Chesapeake Bay	R. Dorazio et al.
B7	Tag return models allowing for harvest and catch and release: evidence of environmental and management impacts on striped bass fishing and natural mortality rates	H. Jiang et al.
B8	Movement patterns and stock composition of adult striped bass tagged in Massachusetts coastal waters	J. Kneebone et al.
B9	Chronicle of striped bass population restoration and conservation in the northwest Atlantic, 1979-2016	G. Shepherd et al.

5. Appendices

Performance Work Statement

Performance Work Statement (PWS)
National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Center for Independent Experts (CIE) Program
External Independent Peer Review

66th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC)
Benchmark stock assessment for Summer flounder and Striped bass

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[1]. Further information on the Center for Independent Experts (CIE) program may be obtained from www.ciereviews.org.

Scope

The Northeast Regional Stock Assessment Review Committee (SARC) meeting is a formal, multiple-day meeting of stock assessment experts who serve as a panel to peer-review tabled

[1] http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf

stock assessments and models. The SARC peer review is the cornerstone of the Northeast Stock Assessment Workshop (SAW) process, which includes assessment development, and report preparation (which is done by SAW Working Groups or Atlantic States Marine Fisheries Commission (ASMFC) technical committees), assessment peer review (by the SARC), public presentations, and document publication. This review determines whether or not the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results provide the scientific basis for fisheries within the jurisdiction of NOAA's Greater Atlantic Regional Fisheries Office (GARFO).

The purpose of this meeting will be to provide an external peer review of a benchmark stock assessment **Summer flounder and Striped bass**. The requirements for the peer review follow. This Statement of Work (PWS) also includes: **Appendix 1**: TORs for the stock assessment, which are the responsibility of the analysts; **Appendix 2:** a draft meeting agenda; **Appendix 3:** Individual Independent Review Report Requirements; and **Appendix 4:** SARC Summary Report Requirements.

Requirements
NMFS requires three reviewers under this contract (i.e. subject to CIE standards for reviewers) to participate in the panel review. The SARC chair, who is in addition to the three reviewers, will be provided by either the New England or Mid-Atlantic Fishery Management Council's Science and Statistical Committee; although the SARC chair will be participating in this review, the chair's participation (i.e. labor and travel) is not covered by this contract.

Each reviewer will write an individual review report in accordance with the PWS, OMB Guidelines, and the TORs below. All TORs must be addressed in each reviewer's report. No more than one of the reviewers selected for this review is permitted to have served on a SARC panel that reviewed this same species in the past. The reviewers shall have working knowledge and recent experience in the application of modern fishery stock assessment models. Expertise should include forward projecting statistical catch-at-age (SCAA) models. Reviewers should also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting. Reviewers should have experience in development of Biological Reference Points (BRPs) that includes an appreciation for the varying quality and quantity of data available to support estimation of BRPs. For summer flounder, knowledge of flatfish biology and population dynamics would be useful. For striped bass, knowledge of anadromous species and SCAA models with spatial considerations would be useful.

Tasks for Reviewers
- Review the background materials and reports prior to the review meeting
- Attend and participate in the panel review meeting
    - The meeting will consist of presentations by NOAA and other scientists, stock assessment authors and others to facilitate the review, to provide any additional

information required by the reviewers, and to answer any questions from reviewers

- Reviewers shall conduct an independent peer review in accordance with the requirements specified in this PWS and TORs, in adherence with the required formatting and content guidelines; reviewers are not required to reach a consensus.
- Each reviewer shall assist the SARC Chair with contributions to the SARC Summary Report
- Deliver individual Independent Review Reports to the Government according to the specified milestone dates
- This report should explain whether each stock assessment Term of Reference of the SAW was or was not completed successfully during the SARC meeting, using the criteria specified below in the "Tasks for SARC panel."
- If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRPs are the best available at this time.
- During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent Report produced by each reviewer.
- The Independent Report can also be used to provide greater detail than the SARC Summary Report on specific stock assessment Terms of Reference or on additional questions raised during the meeting.

Tasks for SARC panel

- During the SARC meeting, the panel is to determine whether each stock assessment Term of Reference (TOR) of the SAW was or was not completed successfully. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If alternative assessment models and model assumptions are presented, evaluate their strengths and weaknesses and then recommend which, if any, scientific approach should be adopted. Where possible, the SARC chair shall identify or facilitate agreement among the reviewers for each stock assessment TOR of the SAW.
- If the panel rejects any of the current BRP or BRP proxies (for BMSY and FMSY and MSY), the panel should explain why those particular BRPs or proxies are not suitable, and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs or BRP proxies are the best available at this time.
- Each reviewer shall complete the tasks in accordance with the PWS and Schedule of Milestones and Deliverables below.

Tasks for SARC chair and reviewers combined:
Review both the Assessment Report and the draft Assessment Summary Report. The draft Assessment Summary Report is reviewed and edited to assure that it is consistent with the outcome of the peer review, particularly statements about stock status recommendations and descriptions of assessment uncertainty.

The SARC Chair, with the assistance from the reviewers, will write the SARC Summary Report. Each reviewer and the chair will discuss whether they hold similar views on each stock assessment Term of Reference and whether their opinions can be summarized into a single conclusion for all or only for some of the Terms of Reference of the SAW. For terms where a similar view can be reached, the SARC Summary Report will contain a summary of such opinions. In cases where multiple and/or differing views exist on a given Term of Reference, the SARC Summary Report will note that there is no agreement and will specify - in a summary manner – what the different opinions are and the reason(s) for the difference in opinions.

The chair's objective during this SARC Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may express the chair's opinion on each Term of Reference of the SAW, either as part of the group opinion, or as a separate minority opinion. The SARC Summary Report will not be submitted, reviewed, or approved by the Contractor.

If any existing Biological Reference Points (BRP) or BRP proxies are considered inappropriate, the SARC Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRP proxies are the best available at this time.

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, country of birth, country of citizenship, country of permanent residence, country of current residence, dual citizenship (yes, no), passport number, country of passport, travel dates.) to the NEFSC SAW Chair for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website:
http://deemedexports.noaa.gov/ and
http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreignnational-

registration-system.html. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance
The place of performance shall be at the contractor's facilities, and at the Northeast Fisheries Science Center in Woods Hole, Massachusetts.

Period of Performance
The period of performance shall be from the time of award through January 31, 2019. Each reviewer's duties shall not exceed **16** days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

No later than Oct. 26, 2018	Contractor selects and confirms reviewers
No later than Nov. 13, 2018	NMFS Project Contact will provide reviewers the pre-review documents
Nov. 27-30, 2018	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
Nov. 30, 2018	SARC Chair and reviewers work at drafting reports during meeting at Woods Hole, MA, USA
Dec. 14, 2018	Reviewers submit draft independent peer review reports to the contractor's technical team for review
Dec. 14, 2018	Draft of SARC Summary Report, reviewed by all reviewers, due to the SARC Chair *
Dec. 21, 2018	SARC Chair sends Final SARC Summary Report, approved by reviewers, to NMFS Project contact (i.e., SAW Chairman)
Jan. 2, 2019	Contractor submits independent peer review reports to Government
Jan. 9, 2019	The COR and/or technical POC distributes the final reports to the NMFS Project Contact the NMFS Project Contact

* The SARC Summary Report will not be submitted to, reviewed, or approved by the Contractor.

Applicable Performance Standards

The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each TOR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (http://www.gsa.gov/portal/content/104790). International travel is authorized for this contract. Travel is not to exceed $12,000.

Restricted or Limited Use of Data

The contractors may be required to sign and adhere to a non-disclosure agreement.

NMFS Project Contact

Dr. James Weinberg, NEFSC SAW Chair
Northeast Fisheries Science Center
166 Water Street, Woods Hole, MA 02543
James.Weinberg@noaa.gov Phone: 508-495-2352

Appendix 1: Stock Assessment Terms of Reference for SAW/SARC-66

Appendix 1.

The SARC Review Panel shall assess whether or not the SAW Working Group has reasonably and satisfactorily completed the following actions.

The stock assessments for SAW/SARC66 require new calibrated catch and effort data from the Marine Recreational Information Program (MRIP). For these assessments to happen, the assessment scientists need the new MRIP data in a form ready for analysis by July 1, 2018.

A. Summer flounder

1. Estimate catch from all sources, including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data. Compare previous recreational data to re-estimated Marine Recreational Information Program (MRIP) data (if available).

2. Present the survey data available, and describe the basis for inclusion or exclusion of those data in the assessment (e.g., indices of relative or absolute abundance, recruitment, state surveys, age-length data, etc.). Investigate the utility of commercial or recreational LPUE as a measure of relative abundance. Characterize the uncertainty and any bias in these sources of data.

3. Describe life history characteristics and the stock's spatial distribution (for both juveniles and adults), including any changes over time. Describe factors related to productivity of the stock and any ecosystem factors influencing recruitment. If possible, integrate the results into the stock assessment.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and estimate their uncertainty. Include retrospective analyses (both historical and within-model) to allow a comparison with previous assessment results and projections, and to examine model fit. Examine sensitivity of model results to changes in re-estimated recreational data.

5. State the existing stock status definitions for "overfished" and "overfishing". Then update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, F_{MSY} and MSY) and provide estimates of their uncertainty. If analytic model-based estimates are unavailable, consider recommending alternative measurable proxies for BRPs. Comment on the scientific adequacy of existing BRPs and the "new" (i.e., updated, redefined, or alternative) BRPs.

6. Make a recommendation[1] about what stock status appears to be, based on the existing model (i.e., model from previous peer reviewed accepted assessment) and with respect to a new modeling approach(-es) developed for this peer review.

    a. Update the existing model with new data and make a stock status recommendation (about overfished and overfishing) with respect to the existing BRP estimates.
    b. Then use the newly proposed modeling approach(-es) and make a stock status recommendation with respect to "new" BRPs and their estimates (from TOR-5).
    c. Include descriptions of stock status based on simple indicators/metrics (e.g., age-and size-structure, temporal trends in population size or recruitment indices, etc).

7. Develop approaches and apply them to conduct stock projections.

    a. Provide numerical annual projections (5 years) and the statistical distribution (i.e., probability density function) of the catch at FMSY or an FMSY proxy (i.e. the overfishing level, OFL) (see Appendix to the SAW TORs). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. Use a sensitivity analysis approach in which a range of assumptions about the most important uncertainties in the assessment are considered (e.g., terminal year abundance, variability in recruitment).
    b. Comment on which projections seem most realistic. Consider the major uncertainties in the assessment as well as sensitivity of the projections to various assumptions. Identify reasonable projection parameters (recruitment, weight-at-age, retrospective adjustments, etc.) to use when setting specifications.
    c. Describe this stock's vulnerability (see "Appendix to the SAW TORs") to becoming overfished, and how this could affect the choice of ABC.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in most recent SARC reviewed assessment and review panel reports and MAFMC SSC reports. Identify new research recommendations.

---

[1]NOAA Fisheries has final responsibility for making the stock status determination for this stock based on best available scientific information.

B. Striped bass

1. Investigate all fisheries independent and dependent data sets, including life history, indices of abundance, and tagging data. Discuss strengths and weaknesses of the data sources.

2. Estimate commercial and recreational landings and discards. Characterize the uncertainty in the data and spatial distribution of the fisheries. Review new MRIP estimates of catch, effort and the calibration method, if available.

3. Use an age-based model to estimate annual fishing mortality, recruitment, total abundance and stock biomass (total and spawning stock) for the time series and estimate their uncertainty. Provide retrospective analysis of the model results and historical retrospective. Provide estimates of exploitation by stock component and sex, where possible, and for total stock complex.

4. Use tagging data to estimate mortality and abundance, and provide suggestions for further development.

5. Update or redefine biological reference points (BRPs; point estimates or proxies for B_{MSY}, SSB_{MSY}, F_{MSY}, MSY) for each stock component where possible and for the total stock complex. Make a stock status determination based on BRPs by stock component, where possible, and for the total stock complex.

6. Provide annual projections of catch and biomass under alternative harvest scenarios. Projections should estimate and report annual probabilities of exceeding threshold BRPs for F and probabilities of falling below threshold BRPs for biomass.

7. Review and evaluate the status of the Technical Committee research recommendations listed in the most recent SARC report. Identify new research recommendations. Recommend timing and frequency of future assessment updates and benchmark assessments.

__SAW Assessment TORs:__

Clarification of Terms
used in the Stock Assessment Terms of Reference

Guidance to SAW Working Group about "Number of Models to include in the Assessment Report":

In general, for any TOR in which one or more models are explored by the Working Group, give a detailed presentation of the "best" model, including inputs, outputs, diagnostics of model adequacy, and sensitivity analyses that evaluate robustness of model results to the assumptions. In less detail, describe other models that were evaluated by the Working Group and explain their strengths, weaknesses and results in relation to the "best" model. If selection of a "best" model is not possible, present alternative models in detail, and summarize the relative utility each model, including a comparison of results. It should be highlighted whether any models represent a minority opinion.

On "Acceptable Biological Catch" (DOC Nat. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16- 2009):

Acceptable biological catch (ABC) is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of Overfishing Limit (OFL) and any other scientific uncertainty..." (p. 3208) [In other words, OFL ≥ ABC.]

ABC for overfished stocks. For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. (p. 3209)

NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)

ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, Optimal Yield (OY) does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

On "Vulnerability" (DOC Natl. Stand. Guidelines. Fed. Reg., v. 74, no. 11, 1-16-2009):

"Vulnerability. A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce Maximum Sustainable Yield

(MSY) and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality).” (p. 3205)

Participation among members of a Stock Assessment Working Group:

Anyone participating in SAW meetings that will be running or presenting results from an assessment model is expected to supply the source code, a compiled executable, an input file with the proposed configuration, and a detailed model description in advance of the model meeting. Source code for NOAA Toolbox programs is available on request. These measures allow transparency and a fair evaluation of differences that emerge between models.

Appendix 2. Draft Review Meeting Agenda

Appendix 2.

66th Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC)
Benchmark stock assessment for A. Summer flounder and B. Striped bass

November 27-30, 2018

Stephen H. Clark Conference Room – Northeast Fisheries Science Center
Woods Hole, Massachusetts

DRAFT AGENDA* (version: Oct. 9, 2018)

TOPIC	PRESENTER(S)	RAPPORTEUR

Tuesday, Nov. 27

10 – 10:45 AM

Welcome/Description of Review Process	**James Weinberg**, SAW Chair	
Introductions/Agenda	**Robert Latour**, SARC Chair	
Conduct of Meeting		
10:45 – 12:45 PM	Assessment Presentation (A. Summer flounder) **Mark Terceiro**	**TBD**
12:45 – 1:45 PM	Lunch	
1:45 – 3:45 PM	Assesssment Presentation (A. Summer flounder) **Mark Terceiro**	**TBD**
3:45 – 4 PM	Break	
4 – 5:45 PM	SARC Discussion w/ Presenters (A. Summer flounder) **Robert Latour,** SARC Chair	**TBD**
5:45 – 6 PM	Public Comments	

TOPIC	PRESENTER(S)	RAPPORTEUR
Wednesday, Nov. 28		
8:30 – 10:30 AM	Assessment Presentation (B. Striped bass) **Katie Drew, Gary Nelson, Mike Celestino**	**TBD**
10:30 – 10:45 AM	Break	
10:45 – 12:30 PM	Assessment Presentation (B. Striped bass) **Katie Drew, Gary Nelson, Mike Celestino**	**TBD**
12:30 – 1:30 PM	Lunch	
1:30 – 3:30 PM	SARC Discussion w/presenters (B. Striped bass) **Robert Latour,** SARC Chair	**TBD**
3:30 – 3:45 PM	Public Comments	
3:45 -4 PM	Break	
4 – 6 PM	Revisit with Presenters (A. Summer flounder) **Robert Latour,** SARC Chair	**TBD**
7 PM	**(**Social Gathering**)**	

TOPIC	PRESENTER(S)	RAPPORTEUR
Thursday, Nov. 29		
8:30 – 10:30	Revisit with Presenters (B. Striped bass) **Robert Latour,** SARC Chair	**TBD**
10:30 – 10:45	Break	
10:45 – 12:15	Review/Edit Assessment Summary Report (A. Summer	

	flounder) **Robert Latour,** SARC Chair	**TBD**
12:15 – 1:15 PM	Lunch	
1:15 – 2:45 PM	(cont.) Edit Assessment Summary Report (A. Summer flounder) **Robert Latour,** SARC Chair	**TBD**
2:45 – 3 PM	Break	
3 – 6 PM	Review/edit Assessment Summary Report (B. Striped bass) **Robert Latour,** SARC Chair	**TBD**

Friday, Nov. 30

9:00 AM – 5:00 PM	SARC Report writing

*All times are approximate, and may be changed at the discretion of the SARC chair. The meeting is open to the public; however, during the Report Writing sessions we ask that the public refrain from engaging in discussion with the SARC.

Appendix 3. Individual Independent Peer Review Report Requirements

Appendix 3.

1. The independent peer review report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The report must contain a background section, description of the individual reviewers' role in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs. The independent report shall be an independent peer review, and shall not simply repeat the contents of the SARC Summary Report.

    a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.

    b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.

    c. Reviewers should elaborate on any points raised in the SARC Summary Report that they believe might require further clarification.

    d. The report may include recommendations on how to improve future assessments.

3. The report shall include the following appendices:

    Appendix 1: Bibliography of materials provided for review
    Appendix 2: A copy of this Statement of Work
    Appendix 3: Panel membership or other pertinent information from the panel review meeting.

Appendix 4. SARC Summary Report Requirements

Appendix 4.

1. The main body of the report shall consist of an introduction prepared by the SARC chair that will include the background and a review of activities and comments on the appropriateness of the process in reaching the goals of the SARC. Following the introduction, for each assessment reviewed, the report should address whether or not each Term of Reference of the SAW Working Group was completed successfully. For each Term of Reference, the SARC Summary Report should state why that Term of Reference was or was not completed successfully.

   To make this determination, the SARC chair and reviewers should consider whether or not the work provides a scientifically credible basis for developing fishery management advice. If the reviewers and SARC chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions. The report may include recommendations on how to improve future assessments.

2. If any existing Biological Reference Points (BRPs) or BRP proxies are considered inappropriate, include recommendations and justification for alternatives. If such alternatives cannot be identified, then indicate that the existing BRPs or BRP proxies are the best available at this time.

3. The report shall also include the bibliography of all materials provided during the SAW, and relevant papers cited in the SARC Summary Report, along with a copy of the CIE Statement of Work.

   The report shall also include as a separate appendix the assessment Terms of Reference used for the SAW, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

once on any calendar day, which is defined as the 24-hr period beginning at 0001 hours and ending at 2400 hours.

(ii) *Entire commercial fishery.* During a closure of the directed commercial Atlantic mackerel fishery pursuant to § 648.24(b)(1)(i), when 100 percent of the DAH is harvested, vessels issued an open or limited access Atlantic mackerel permit may not take and retain, possess, or land more than 5,000 lb (2.26 mt) of Atlantic mackerel per trip at any time, and may only land Atlantic mackerel once on any calendar day, which is defined as the 24-hr period beginning at 0001 hours and ending at 2400 hours.

* * * * *

[FR Doc. 2018–21616 Filed 10–3–18; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 697

[Docket No. 180709616–8616–01]

RIN 0648–BI07

Fisheries of the United States; Regulations for Striped Bass Fishing in the Block Island Transit Zone

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Advance notice of proposed rulemaking; request for comments.

SUMMARY: NMFS issues this advance notice of proposed rulemaking (ANPR) to provide background information and make the public aware of a proposal to remove the current prohibition on recreational Atlantic striped bass fishing in the Block Island Transit Zone (Transit Zone) within the Federal exclusive economic zone (EEZ). The ANPR is in response to the 2018 Omnibus Appropriations Act which included the provision directing NOAA, in consultation with the Atlantic States Marine Fisheries Commission, to consider lifting the ban on striped bass fishing in the Federal Block Island Transit Zone. NMFS communicated the intent to issue this ANPR at the Atlantic States Marine Fisheries Commission's August 2018 public meeting. By this action, NMFS is soliciting public comment on options presented to regulate fishing for striped bass in the Transit Zone. In addition, comments on other options to improve management of Atlantic striped bass in the Transit Zone are welcomed and encouraged.

DATES: Written comments regarding the issues in this ANPR must be received by 5 p.m., local time, on November 19, 2018.

ADDRESSES: You may submit comments on this document, identified by NOAA–NMFS–2018–0106, by any of the following methods:

- *Electronic Submission:* Submit all electronic public comments via the Federal e-Rulemaking Portal. Go to *www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2018-0106,* click the ''Comment Now!'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit written comments to Kelly Denit, Division Chief, Office of Sustainable Fisheries, 1315 East-West Highway, SSMC3, Silver Spring, MD 20910.
- *Fax:* 301–713–1193; Attn: Kelly Denit.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing on *www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address, etc.), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous).

FOR FURTHER INFORMATION CONTACT: Kelly Denit, Division Chief, Office of Sustainable Fisheries, National Marine Fisheries Service, 301–427–8517.

SUPPLEMENTARY INFORMATION:

Background

Atlantic striped bass occur predominately within 12 nautical miles from shore, an area which includes both waters (0–3 miles from shore) under state jurisdiction, as well as portions of the Exclusive Economic Zone (3–200 miles from shore) under Federal jurisdiction. Management responsibility for Atlantic striped bass resides primarily with the coastal states, and interstate management occurs through the Atlantic State Marine Fisheries Commission's (Commission) Interstate Fisheries Management Plan for the Atlantic Striped Bass (ISFMP), first adopted in 1981. In 1995, the Commission declared the Atlantic striped bass population fully restored and implemented Amendment 5 to the ISFMP to perpetuate the stock so as to allow a commercial and recreational harvest consistent with the long-term maintenance of the striped bass stock. The latest stock assessment update completed in 2016 determined that the Atlantic striped bass stock is not overfished or experiencing overfishing.

NMFS promulgates regulations in Federal waters that are compatible with the Commission's ISFMP. The Atlantic Striped Bass Conservation Act (Pub. L. 100–589, 16 U.S.C. 5151, *et seq.*) sets forth the basis for Federal striped bass regulatory authority. Under the act, Federal Atlantic striped bass regulations must comply with the following: (1) Be consistent with the national standards in Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1851); (2) be compatible with the fishery management plan for managing Atlantic striped bass and each Federal moratorium in effect on fishing for Atlantic striped bass within the coastal waters of a coastal state; (3) ensure the effectiveness of State regulations on fishing for Atlantic striped bass within the coastal waters of a coastal state; and (4) be sufficient to assure the long-term conservation of Atlantic striped bass populations. Further, in developing the regulations, the Secretary is to consult with the Commission, the appropriate Regional Fishery Management Councils (Councils), and each affected Federal, state, and local government entity.

Existing Federal regulations prohibit recreational and commercial fishing for Atlantic striped bass in the EEZ. The regulations do, however, allow fishers to transport Atlantic striped bass caught in adjoining state fisheries while transiting the Block Island Transit Zone (Transit Zone; 50 CFR 697.7). The Transit Zone is defined in NMFS regulations as the area of Federal waters within Block Island Sound, located between areas south of Montauk Point, New York, and Point Judith, Rhode Island. The Transit Zone area is unique because it is a small area of Federal waters (Block Island Sound) substantially bounded by state waters (Long Island, New York on one side, Block Island, Rhode Island on another, and the mainland of Connecticut and Rhode Island on a third side).

NMFS is considering revising current regulations to authorize recreational fishing in the Block Island Transit Zone. This would allow recreational fishermen to harvest, retain, and transport striped bass within the Block Island Transit Zone. The ANPR is in response to the 2018 Omnibus Appropriations Act (Pub. L. 115–141) which included the provision directing ''NOAA, in consultation with the Atlantic States Marine Fisheries

Commission, to consider lifting the ban on striped bass fishing in the Federal Block Island Transit Zone.'' NMFS communicated the intent to issue this ANPR to the Atlantic States Marine Fisheries Commission at the August 2018 meeting. NMFS is not proposing to allow commercial striped bass fishing in the Transit Zone, consistent with Executive Order 13449 (October 24, 2007; 72 FR 60531), ''Protection of Striped Bass and Red Drum Fish Populations,'' which declared it the policy of the United States to prohibit the sale of striped bass caught in the EEZ.

Public Comments

To help determine the scope of issues to be addressed and to identify significant issues related to this action, NMFS is requesting public comments on this ANPR. The public is encouraged to submit comments related to the potential regulatory revisions described in this ANPR, as well as additional ideas to improve management of striped bass in the Block Island Transit Zone.

Authority: 16 U.S.C. 1827a.

Dated: September 28, 2018.

Samuel D. Rauch, III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

[FR Doc. 2018–21613 Filed 10–3–18; 8:45 am]

BILLING CODE 3510–22–P

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

James J. Gilmore, Jr., Chair (NY) *Patrick Kelliher (ME), Vice-Chair* *Robert E. Beal, Executive Director*

Vision: Sustainably Managing Atlantic Coastal Fisheries

MONTH DAY, YEAR

Kelly Denit
Division Chief
Office of Sustainable Fisheries
National Marine Fisheries Service
1315 East-West Highway, SSMC3
Silver Spring, Maryland 20910

Dear Ms. Denit,

The Atlantic States Marine Fisheries Commission's (Commission) Atlantic Striped Bass Management Board (Board) recommends that NOAA Fisheries maintain the current prohibition on fishing, harvest and possession of Atlantic striped bass in the Federal Block Island Sound Transit Zone (Transit Zone) and not move forward with rulemaking at this time.

Based on the results of the 2018 Atlantic Striped Bass Benchmark Stock Assessment, the stock is overfished and is experiencing overfishing and the proposed measures could compromise the Board's efforts to end overfishing and rebuild spawning stock biomass to the target level. The benchmark assessment also indicated that roughly 90% of total striped bass removals in 2017 are attributed to the recreational sector and opening the Transit Zone to striped bass fishing may result in increased effort and subsequent fishing mortality.

The long-term sustainability of this resource is vital to the Commission stakeholders and we look forward to continuing to work with you on this issue.

Please contact me or Toni Kerns, ISFMP Director, at tkerns@asmfc.org, if you have questions.

Sincerely,

Robert E. Beal

L19-XXX

Max Appelman

From: John Papciak <jpapciak@optonline.net>
Sent: Monday, March 4, 2019 4:07 PM
To: Max Appelman; Michael Armstrong
Cc: Sen. TODD KAMINSKY; Maureen Davidson; James Gilmore; Emerson Hasbrouck
Subject: Atlantic Striped Bass Overfished Again?

Subject: Atlantic Striped Bass Overfished Again?

Dear Dr. Armstrong and Mr. Appleman,

I am a citizen from New York. I have been fishing for striped bass since the late 1970s, just when the striped bass fishery began its historic decline. The 1980s were essentially the "lost years" for striped bass. Dwindling stock assessments were ignored. It took congressional action to implement effective conservation measures.

Now it seems we are trending in this direction again. I can cite my own anecdotal observations, but they track closely with the stock declines as documented by the ASMFC Striped Bass Technical Committee.

After that historic stock crash, there was renewed optimism in the early 1990s. It was still rare to expect a 'keeper' fish, but that didn't stop large numbers of fishermen from planning trips. Regulations for striped bass were relaxed after the fishery was declared restored. I remember a long and fierce debate, which gave way to more fish and smaller fish being kept.

The proponents of relaxed regulation assured conservation-minded stakeholders not to worry. There was a biomass target, and plenty of opportunity to change course if management plans proved to be too liberal.

That never happened. The spawning stock target was ignored.

ASMFC minutes, covering many years, illustrate in detail how the scientific assessments by the Technical Committee projected the fishery would decline. Reading many of the past ASMFC Striped Bass Board meeting minutes is disheartening - here we clearly see an oversight body that resisted proactive measures, despite repeated warning signs.

For example, the November 8, 2011 Management Board meeting minutes document the trend observed by the Technical Committee - overfishing would likely occur by 2017.[1]

Here we are in 2019. The striped bass is overfished by the agreed measures, just as predicted.

This is both puzzling and highly disturbing, since ASMFC Guiding Documents suggest that the singular most import objective of the Commission "... shall be to make inquiry and ascertain from time to time such methods, practices, circumstances and conditions as may be disclosed for bringing about the conservation of, the prevention of the depletion and physical waste of the fisheries..."

Decisions made by the ASMFC Board have consequences. ASMFC appointees at the helm during this now second major decline in the striped bass must accept this as their legacy. Elected officials who served as sponsors must also share the blame.

The only remaining question is whether ASMFC and the Striped Bass Board have the capacity to embrace the drastic change required to reverse the downward trend in the population, and do so in a timely manner.

Here are my own observations and suggestions. I hope you will all give this serious consideration.

(1) The next ASMFC Striped Bass Board meeting should begin with a rigorous self-assessment of what went wrong, followed by the release of a public statement of those findings. This is one way to reassure the public that the Board takes the job of managing the stock very seriously, and has the tools and the mindset to now change course accordingly.

(2) The "Procedures" section of the Fishery Management Plan Charter outlines the process for Emergency Action. Such a "Declaration of Emergency Measures" must be thoroughly discussed, even if it is an implicit admission of past mistakes. Given the glaring disconnect between the Commissioner views and the actual Stock Assessments, as evidenced by little or no action over the last five years in particular, there is an excellent case to be made that the Striped Bass situation cannot be effectively managed without breaking from the old process and mindset.

Standard timelines for implementing corrective action suggests the situation will only get much worse, as Striped Bass would be overfished for at least one to two more years before new regulations are vetted and finalized.

This is unacceptable.

Delaying action, or entertaining any discussion of relaxing reference points, would just be another data point supporting the idea that ASMFC cannot effectively manage a stock.

(3) In looking for a root cause to the problems we now have with Striped Bass, there is compelling evidence of the need to better clarify Board roles, in order to strengthen the overall decision-making capabilities at the Management Board level. ASMFC Guiding Documents clearly spell out the educational/technical qualifications for those conducting stock assessments, and assessing management options. There does not appear to any list of similar qualifications for Commissioners. The end result can be (has been) Commissioners who have the power to caucus to dismiss or veto the science, even in the absurd case when they admit they do not fully understand it.[2]

To be more direct, science-based decisions on biological reference points, or levels of fishing mortality needed to adhere to those reference points, should not be made or influenced by political appointees who have no relevant background or training.

I hope you can give my suggestions serious consideration. I hope that the latest stock assessment can be seen as a wake - up call, and that it is treated accordingly.

As always, please feel free to call or write if you have any further comments or suggestions to what I have outlined above.

Sincerely,

John W. Papciak
54 Birch Lane
Massapequa Park, NY 11762
jpapciak@optonline.net
516-647-0032

Note 1
2010 Stock assessment indicates the likelihood of overfishing by 2017. Several questions are asked by Board members, and the conclusions are confirmed several times.

PROCEEDINGS OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION ATLANTIC STRIPED BASS MANAGEMENT BOARD
The Langham Hotel Boston, Massachusetts November 8, 2011
Approved February 7, 2012

CONSIDERATION OF ACCEPTANCE OF STOCK ASSESSMENT FOR MANAGEMENT USE

MR. G. RITCHIE WHITE: Gary, great report as always. In looking at your projections for the spawning stock biomass out to 2017, two questions. One, if you can to expand that another two years, which we know the recruitment already is low for those two years coming into the spawning stock biomass, so 2019 is our first chance for a new big year class; so if we projected mortality out to 2019, we would be overfishing at that point given –
MR. NELSON: Yes, we'd be overfished.
MR. R. WHITE: Okay, the second part of the question; is there any thought that mortality could go up from present rates due to the amount of the spawning stock biomass in that there is a large percentage of fish there of legal size, so anglers are going to have better access to fish they can keep, which then in turn may increase mortality from existing rates?
MR. NELSON: That's possible but it all depends on human behavior and how they respond to the situation, so it's kind of hard to predict that.
MR. R. WHITE: Followup, Mr. Chairman, and that will be last; so if mortality did increase to some degree during this period, then we could be overfishing prior to 2019, and we could be back to 2017, '16 or something; that could be a possibility?
MR. NELSON: Yes, that's possible, yes.
MR. DOUGLAS GROUT: Well, my question on that is I see under the female spawning stock biomass, under the current fishing mortality rate that we'd be overfished by 2017; right, if we're going below the line, it looks like?
MR. NELSON: On the low recruitment scenario it would go below the line. Under the average – and the reason it doesn't go below, it just touches it, is because the female spawning stock biomass – let me just back up and say age four starts to contribute to the female spawning stock biomass. So that's why at least with the SSB the average recruitment does have an impact on that, so it's just going to touch it by 2017.

Note 2
A Commissioner suggests on record he does not understand the single species assessment, though it is the long-standing basis for management, but wants to divert discussion to a multi-species model.

PROCEEDINGS OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION ATLANTIC STRIPED BASS MANAGEMENT BOARD

Hyatt Regency Hotel Newport, Rhode Island November 2, 2009
Board Approved February 2, 2010

2009 STOCK ASSESSMENT UPDATE

MR. PATRICK AUGUSTINE: Very great report, Gary, a lot of information that always overwhelms us old guys, so I will try to ask a couple of simple, dumb questions. One would be with single-species management, if there is an overall decline in the biomass of that particular stock, in the case of striped bass, either biomass or spawning stock biomass, what effect would that have on other species of fish that are prey for the striped bass? Should we see an increase in some of those other than the fact we have other natural predators on some of those species? Would there be a balance there you could measure or recognize from doing your striped bass stock assessment and could you carry that over to give some idea about the other stocks?
MR. SHEPHERD: Not directly. You need to do an analysis of like an ecosystem, a multispecies analysis to really to see what the effect is. Even though the striped bass numbers are declining and the striped bass are a primary predator on some species, removing that competition may increase predation from a different species, so you may not see any net gain. It may be shifted, say, to bluefish instead of striped bass preying on something. It is an interesting idea to see what the implication of that is. I don't know if you want to do the ultimate experiment to find out, though.
MR. AUGUSTINE: Why not! A follow-on question, Mr. Chairman; is a possible decline in a geographic area – well, I think I know what the answer is, but I'll ask a dumb question – lack of prey could have an absolute and direct relationship to the number and size of striped bass. They're predators and they will be where the bait is and so on. I'm trying to tie that into minimum size in fish.

From:	David Dow
To:	Comments
Cc:	David Dow
Subject:	Comments on Summer Flounder and Atlantic Striped Bass Stock Assessments and Resulting Changes to Fishery Management Plans
Date:	Friday, March 22, 2019 6:45:47 AM

I have some concerns regarding the conversion of the Summer flounder and Atlantic striped bass stock assessments by the ASMFC/NOAA Fisheries into management advice for these stocks at the Spring ASMFC meeting. The Statistical Catch at Age equilibrium model ignores the effects of eutrophication and climate change on SSB in inshore breeding areas for Atlantic striped bass (Chesapeake Bay; Delaware Bay and Hudson River Estuary); changes in natural mortality associated with shifts in predator and prey species in space & time, alterations in the marine food chain (microbial food web and grazing food chain which were explored in the NOAA Fisheries EMaX model); and changes in the inshore "productive capacity" of Essential Fish Habitat and the shifting baseline in the ocean which has created a complex dynamic system which is not at equilibrium.

I would urge the ASMFC Technical Committee to consider the recent paper by Kristin N. Marshall et al. 2019. Inclusion of ecosystem information in the US stock assessments suggests progress toward ecosystem-based fisheries management. ICES Jour. Marine Sci. 76 (1): 1-9. The authors urge usage of ecosystem information for stocks which are both overfished (changes in Spawning Stock Biomass) and subject to overfishing (exceed fishing morality target). I feel that a backup adaptive. ecosystem-based fishery model for Atlantic striped bass recovery be developed in case the equiliibrium model predictions turn out not to useful. Certainly Nantucket Sound and Cape Cod Bay suggest that these systems are not at equilibrium which has effected stocks such as Sea herring and Gulf of Maine cod. and lead to great white sharks appearing off of our beaches to feed on seals which consume inshore forage fish migrating up from the Mid-Atlantic region.

Based on the EMAX (Energy Modeling and Analysis Exercise) carbon budget
model for the Northeast Continental Shelf Ecosystem, I feel that the marine food chain should be included in the Essential Fish Habitat for pelagic fish species. The EMaX model had more primary production at the base of the food chain than yield of living marine resources at the top. so that we had to add the microbial food web to the grazing food chain to balance the carbon flow (i.e. the longer food chain lead to greater community respiration loses). Since the ocean has been warming rapidly in the waters surrounding Cape Cod where I live, this will include increased respiration at the base of the food chain and alter the role of forage fish in serving as prey for predators like Summer flounder and Atlantic striped bass. Summer flounder, black sea bass and scup are migrating into southern New England which could provide alternative targets to commercial and recreational fishing sectors.

Since Summer flounder are targeted by both the commercial and recreational sectors in state (0-3 miles) and federal (3-200 miles) waters, my major concern is in allocation of the quotas between the ASMFC; Mid-Atlantic and New England Fishery Management Councils using the best available science. The November 27-30, 2018 Northeast Fisheries Science Center's SAW/SARC summary suggested that Summer flounder stocks were declining, so that I don't want to see them get into the situation that Atlantic striped bass are facing. Five years is a long time between baseline stock assessments and changes in competition between predators feeding on forage fish and top down predation by Apex predators could change the marine food chain dynamics.

The Cape Cod Times published an Op-ed piece on March 5 entitled: "A Moratorium on the Horizon" which has generated some responses from saltwater anglers and Phil Coates (former Director of the Ma. Division of Marine Fisheries). It will take co-operation between commercial fishermen/women and saltwater anglers to develop a recovery plan for Atlantic striped bass and make sure that Summer flounder don't end up in a similar situation as the catch quotas are increased and shifts occur in the ocean ecosystem both inshore and offshore.
I have attached a Letter to the Editor that I had published in CapeCodToday.

Thanks for your consideration of these comments.

Dr. David Dow

East Falmouth, Ma.

Letter: Summer Flounder and Atlantic Striped Bass: Tale of Two Fisheries

from Dr. David Dow of East Falmouth

ARTICLE | **LETTERS TO THE EDITOR** | MARCH 17, 2019 04:45 AM | BY **CAPECODTODAY STAFF**

<letter-to-the-editor_17_260.jpg>

Letter to the Editor:

In November 27-30, 2018 the Northeast Fisheries Science Center conducted baseline stock assessments for these two species which are managed by the Atlantic States Marine Fisheries Commission inshore (0-3 miles) and Mid-Atlantic Fishery Management Council offshore (3-200 miles). Both Summer flounder and Atlantic striped bass are targeted inshore by commercial fishermen/women and saltwater anglers. Summer flounder are also harvested by both fishing groups in federal waters. Even though the final report from the November 2018 stock assessment has been delayed because of the furlough of federal employees/contractors in NOAA Fisheries, Atlantic striped bass were assessed to be both overfished (relates to targets for spawning stock biomass) and subject to overfishing (relates to fishing mortality targets), while Summer flounder stocks were viewed as healthy and proposed catch quotas could be increased for both commercial and recreational sectors.

The worsening situation for Atlantic striped bass will require some type of recovery plan by the management agencies working with constituents (environmentalists/animal rights activists; fishermen/women and concerned public). The ASMFC's Technical Committee is examining various recovery scenarios and will likely seek input from the Atlantic striped bass Management Board; NOAA Fisheries staff and academic scientists and key constituent groups. The Management Board includes some Cape Cod residents (like Rep. Sarah Peake).

There should be an opportunity for concerned citizens on Cape Cod to comment on how the proposed changes in the Atlantic striped bass recovery plan will effect them personally through some type of outreach program by the NOAA Fisheries Recreational Fisheries Coordinators/ASMFC or Massa. Division of Marine Fisheries Staff on the Management Board.

It is not my intention to get into the details of how all of this will be accomplished, but to make some comments based being the former Recreational Fisheries Coordinator in the Northeast and a member of the New England Fishery Management Council's Habitat Plan Development Team which helped develop Omnibus Habitat Amendment 2 which was approved in January 2018.

* Commercial and recreational fishing are important components of the "Blue Economy" on Cape Cod and important parts of our history which requires maintenance of our working waterfronts.

* There is a shifting baseline in the ocean surrounding Cape Cod from environmental stressors like nutrient enrichment; increased acidity in the water column and sediments and increased water temperature. One example is the interaction between forage fish/seals and Great White sharks which has caused concerns for swimming and skate boarding at beaches on the outer Cape. These large Apex predators have shifted in space and time and exert top down effects on the find chain supporting predators like Summer flounder and Atlantic striped bass. There has also been bottom up changes in the plankton/forage fish linkage that influences these first level predators.

* The production and recruitment of Summer flounder and Atlantic striped bass are supported by inshore Essential Fish Habitat

(eelgrass beds; salt marshes; shellfish beds; etc.) which is included as a component of the federal Magnuson-Stevens Sustainable Fisheries Act. EFH is included as a component of an adaptive, ecosystems-based fisheries management approach. In New England, EFH "productive capacity" doesn't include the marine food chain and the influence of environmental stressors like nutrient enrichment/climate change,

* Towns on Cape Cod are developing Comprehensive Wastewater Management Plans to reduce "N" loading from septic systems under section 208 of the Clean Water Act. This $4-6 billion investment over the next 20-30 years is intended to improve both water quality and restore habitat (i.e. link between bay scallop harvests and eelgrass beds).

* The ASMFC; MAFMC, and Massachusetts Division of Marine Fisheries have to work jointly on a recovery plan for Atlantic striped bass in state waters with the key constituent groups and to make sure that Summer flounder with declining stock sizes in recent years doesn't slip into a similar situation. The MAFMC manages the Summer flounder fishery in federal waters (3-200 miles) where Atlantic striped bass fishing is banned, while the ASMFC and Ma. DMF manage both species in state waters (0-3) miles.

* The New England Fishery Management Council will need to coordinate its activities in the management of forage fish; primary and Apex predators as they migrate into southern New England waters from the Mid-Atlantic region. This will include redistribution in the quotas between commercial and recreational fishing which were recently addressed at the ASMFC/MAFMC Management Board meeting in Virginia. This complex bureaucracy may be slow to change in how it links science and monitoring —> fisheries management plans and public policy development —> public outreach and education.

* Since the science and monitoring that supports the baseline stock assessments is data rich, but information poor for non-experts, perhaps the MIT/WHOI Sea Grant Program could explain this to policy makers and

elected officials in a more understandable fashion. The Waquoit Bay National Estuarine Research Reserve has been successful in such science translation efforts.

Dr. David Dow

East Falmouth, Ma.

Atlantic States Marine Fisheries Commission

Coastal Sharks Management Board

April 30, 2019
2:45 – 3:15 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order (*R. Miller)*	2:45 p.m.
2.	Board Consent • Approval of Agenda • Approval of Proceedings from October 2018	2:45 p.m.
3.	Public Comment	2:50 p.m.
4.	Final Rule for Highly Migratory Species Amendment 11 (Shortfin Mako) • Review Final Rule and NOAA Fisheries Request for Complementary Measures (*K. Brewster-Geisz*) • Technical Committee Report (*K. Rootes-Murdy*) • Consider Complementary Management Measures (*R. Miller*) **Final Action**	3:00 p.m.
5.	Consider Approval of 2018 FMP Review and State Compliance Reports (*K. Rootes-Murdy*) **Action**	3:10 p.m.
6.	Other Business/Adjourn	3:15 p.m.

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street, Arlington, Virginia; 703.486.1111

MEETING OVERVIEW

Coastal Sharks Management Board Meeting
April 30, 2019
2:45 – 3:15 p.m.
Arlington, Virginia

Chair: Roy Miller (DE) Assumed Chairmanship: 5/2017	Vice Chair: Pat Geer	Law Enforcement Committee Representative: Greg Garner
Coastal Shark Technical Committee Chair: Bryan Frazier (SC)	Coastal Shark Advisory Panel Chair: Vacant	Previous Board Meeting: October 2018
Voting Members: MA, RI, CT, NY, NJ, DE, MD, VA, NC, SC, GA, FL, NMFS, USFWS (14 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 2018

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the Agenda. Individuals that wish to speak at this time must sign in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Final Rule for NOAA Fisheries Highly Migratory Species Amendment 11 (3:00-3:10 p.m.) Final Action
Background • The 2017 ICCAT stock assessment on North Atlantic shortfin mako indicates that the resource is overfished and overfishing is occurring. In response to the results, NOAA Fisheries implemented emergency rule measures in March 2018 to reduce landings by approximately 72-79 percent and initiated Draft Amendment 11. • In February, NOAA Fisheries finalized Amendment 11 and implemented new measures to protect shortfin mako sharks (**Briefing Materials**) • The Technical Committee met to review the new measures, and provide recommendations to the Board on potential action. (**Briefing Materials**)

Presentations
• Amendment 11 and Request for Complementary Measures by K. Brewster-Geisz • Technical Committee Report by K. Rootes-Murdy
Board Actions for Consideration at this Meeting
• Implement Complementary Measures on shortfin mako sharks as outlined in Amendment 11 in state waters

5. Consider Approval of 2018 FMP Review and State Compliance (3:10-3:15 p.m.) Action
Background • State compliance reports are due August 1. • The Plan Review Team reviewed each state report and drafted the 2018 FMP Review. (**Briefing Materials**)
Presentations • Overview of the 2018 Fishery Management Plan Review by K. Rootes-Murdy
Board Actions for Consideration at this Meeting • Accept the 2018 Fishery Management Plan Review and approve *de minimis* requests

8. Other Business/Adjourn

Coastal Sharks

Activity level: Low

Committee Overlap Score: low (some overlaps with South Atlantic Board species)

Committee Task List
• TC – August 1st: Annual compliance reports due

TC Members: Bryan Frazier (SC, TC Chair), Carolyn Belcher (GA), Brent Winner (FL), Greg Skomal (MA), Chris Scott (NY), Lee Paramore (NC), Conor McManus (RI), Greg Hinks (NJ), Jack Musick (VIMS), Angel Willey (MD, Vice Chair), Matt Gates (CT), Karyl Brewster-Geisz (NOAA), Michael Frisk (SUNY Stony Brook), Enric Cortes (NOAA), Scott Newlin (DE), Julie Neer (SAFMC), Kirby Rootes-Murdy (ASMFC)

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

COASTAL SHARKS MANAGEMENT BOARD

The Roosevelt Hotel
New York, New York
October 23, 2018

These minutes are draft and subject to approval by the Coastal Sharks Management Board.
The Board will review the minutes during its next meeting.

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of agenda** by consent (Page 1).

2. **Approval of proceedings of August 2018** by consent (Page 1).

3. **Move to approve Addendum V for Coastal Sharks with Management Option 3 as the chosen management option** (Page 4). Motion by John Clark; second by Justin Davis. Motion carried (Page 5).

4. **Move to approve the 2019 coastal sharks specifications via an email vote after NOAA Fisheries publishes the final rule for the 2019 Atlantic Shark Commercial Fishing season** (Page 5). Motion by Chris Batsavage; second by John Clark. Motion carried (Page 5).

5. **Motion to adjourn** by consent (Page 17).

ATTENDANCE

Board Members

Steve Train, ME (AA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)
David Pierce, MA (AA)
Bob Ballou, RI, proxy for J. McNamee (AA)
Bill Hyatt, CT (GA)
Justin Davis, CT, proxy for P. Aarrestad (AA)
Michael Falk, NY, proxy for Sen. Boyle (LA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
Emerson Hasbrouck, NY (GA)
Heather Corbett, NJ, proxy for L. Herrighty (AA)
Tom Fote, NJ (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
John Clark, DE, proxy for D. Saveikis (GA)
Mike Luisi, MD, proxy for D. Blazer (AA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Russell Dize, MD (GA)
Bryan Plumlee, VA (GA)
Lewis Gillingham, VA, proxy for S. Bowman (AA)
Sen. Monty Mason, VA (LA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Michael Blanton, NC, proxy for Rep. Steinburg (LA)
Robert Boyles, Jr., SC (AA)
Marcel Reichert, SC, proxy for M. Rhodes (GA)
Sen. Ronnie Cromer, SC (LA)
Doug Haymans, GA (AA)
Spud Woodward, GA (AA)
Jim Estes, FL, proxy for J. McCawley (AA)
Rep. Thad Altman, FL (LA)
Karyl Brewster-Geisz, NMFS HMS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Greg Garner, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Kirby Rootes-Murdy
Jessica Kuesel

Guests

Bill Anderson, MD DNR
Brittany Bushee, MA
Ali Donargo, Boston, MA
Lynn Fegley, MD DNR
Jon Hare, NOAA
Arnold Leo, E. Hampton, NY
Chris Scott, NYS DEC
Julia Socrates, NYS DEC
John Whiteside, SFA
Charles Witek, W. Babylon, NY
Catherine Ziegler, NYS DEC

The Coastal Sharks Management Board of the Atlantic States Marine Fisheries Commission convened in the Terrace Ballroom of the Roosevelt Hotel, New York, New York; Tuesday, October 23, 2018, and was called to order at l1:40 o'clock a.m. by Chairman Roy W. Miller.

CALL TO ORDER

CHAIRMAN ROY W. MILLER: Welcome to the Coastal Shark Management Board Meeting. I'm Roy Miller from Delaware; I'm the Governor's Appointee. I'm Chairing the Coastal Shark Board. I would like to call the meeting to order.

APPROVAL OF AGENDA

CHAIRMAN MILLER: First item of business on our agenda is Approval of the Agenda. Are there any additions or corrections to the agenda for this meeting?

Seeing none; I'll assume they are approved as prepared.

APPROVAL OF PROCEEDINGS

CHAIRMAN MILLER: Also, approval of the proceedings from the August, 2018 Shark Board meeting. Are there any comments, suggestions, additions or corrections to those proceedings? Seeing none; I'll assume they're approved as they have been prepared for you.

PUBLIC COMMENT

CHAIRMAN MILLER: At this time I'll offer the opportunity for public comment for any items that are not on our agenda. Is there any public comment, Kirby?

MR. KIRBY ROOTES-MURDY: No.

CONSIDER ADDENDUM V FOR FINAL APPROVAL

CHAIRMAN MILLER: Seeing none; we'll proceed on with our agenda. The next item on our agenda is consideration of Addendum V for final approval. This is a final action today, hopefully. I'm going to call on Kirby Rootes-Murdy of the Commission. I've also got before us up here Greg Garman representing Law Enforcement.

Karyl is over at the end of the table, I missed you, Karyl. Welcome! Karyl Brewster-Geisz is with us representing NOAA Fisheries.

REVIEW OPTIONS AND PUBLIC COMMENT SUMMARY

I will call on Kirby Rootes-Murdy to discuss the Options and the Public Comment Summary on Addendum V, Kirby.

MR. ROOTES-MURDY: I will try to go through this as quickly as possible. This is our outline. I'm going to go briefly through the time table and overview, statement of the problem, background of the management options, and then I'll go through at least the Advisory Panel comments. We didn't receive any public comment; and then I'll take any questions you guys have.

As you guys are aware, this Board initiated draft Addendum V back in May of this year. The Board considered the document for public comment in August of this year; and we had a public comment period that started at the end of August and ran through the beginning of October. Today, as Roy mentioned, the Board will be considering final action on this draft Addendum. Back in May the Board was presented the recent North Atlantic Shortfin Mako Stock Assessment, and the Emergency Rule measures that were implemented by NOAA Highly Migratory Species Division in response to it. The Atlantic Shortfin Mako Stock Assessment indicated that the resource was overfished and that overfishing was occurring. To address the stock status, the International Commission on the Conservation of Atlantic Tunas, ICAT, at their November, 2017 meeting determined that all member countries needed to reduce landings by approximately 72 to 79 percent from current levels to prevent further declines in the population.

Reduction to zero landings is needed to rebuild the resource by 2040. To address the needed landings reduction, NOAA Fisheries implemented the following measures for shortfin makos. They increased the minimum size limit; fork length for the recreational fishery from 54 inches to 83 inches, and prohibited landings in the commercial fishery for all gear types, with the exception of the pelagic longline fleet for those pelagic longline vessels that have an HMS permit.

Electronic monitoring devices are required in order to retain sharks that are dead at haul back. The Board considered these measures and the Technical Committee's report; and decided not to adopt emergency rule measures, but instead initiate an addendum to provide flexibility in implementing measures and changes to those measures for all species within the coastal sharks FMP.

Part of the issue here is that the FMP currently only allows commercial quotas, possession limits, and season dates to be adjusted annually through specifications. All other commercial and recreational measures can be adjusted only through an addendum; as outlined in the Adaptive Management Section, or through emergency action.

The emergency action has a rigorous set of criteria; and basically when looking at the stock assessment for shortfin makos, it didn't meet those criteria in state waters. The Board, as I noted, decided to initiate an addendum that would allow them more flexibility in trying to make changes to the FMP for a number of measures in situations that basically fall short of an emergency action.

As you all are aware, the FMP was adopted in 2008. We have eight different complexes that is under this FMP; prohibited species, research, small coastal, non-sandbar, large coastal, pelagic, smooth dogfish, and it's important to understand that the proposed action, the two options in this addendum, would apply to all of those species complexes and management groups.

In terms of the options, we always include a status quo. As you all know Option 1, this would mean no changes to the current set up; so annually we would continue to only make changes to the commercial quota possession limit and season dates. Again, an addendum or emergency action would be needed to adjust any of the other measures outlined in the FMP for both the commercial and recreational fishery.

Option 2 would allow the Board to adjust all needed measures through annual specifications. Basically we would in addition to the commercial quota possession limit and season length, the Board could adjust recreational size limits, possession limits, season lengths, area closures for both the recreational and commercial fishery, gear specifications for both fisheries, as well as effort controls. Under this option, the way it would work is that any of those changes that the Board wished to make would happen once a year through specifications. These changes could be made through a motion; and it would not require a public hearing or public comment. It would be at the Board's discretion how and when to take public comment on any of those changes.

They could be submitted before a Board meeting, they could be taken at the Board meeting that these are being considered at. Again, for this option and for Option 3, it doesn't preclude the Board if they wanted to in the future to initiate an addendum to make other changes. Option 3 would allow this Board to adjust measures on an ad hoc basis.

The same list that was included in Option 2 would be allowed to be altered annually at any point in the year. It wouldn't line up with the annual meeting; it could happen basically as new information became available. If we had a new stock assessment and NOAA Fisheries came out with a finding that required changes to their measures; this Board could adjust those measures on an ad hoc basis as needed.

Again, these changes could be made for a motion and it would not require public hearing or public comment; it would be at the discretion of the Board how to receive and consider those. In terms of the public comment period, as I mentioned we had no public comment that were submitted. We held a public hearing webinar in September. We had five attendees; of those five, none offered any public comment.

ADVISORY PANEL REPORT

MR. ROOTES-MURDY: We also held an Advisory Panel meeting in October. We had three attendees for that; and two of them indicated their preference for Option 3, to be able to adjust measures on an ad hoc basis. The feedback they offered was basically that this seemed to give the Board the most flexibility, the greatest leeway when needed to adjust measures to respond to changes in the status of the resources. With that I will take any questions from the Board, thanks.

CHAIRMAN MILLER: Questions or comments for Kirby. Lewis Gillingham.

MR. LEWIS GILLINGHAM: I'm just wondering, Kirby. Was the Advisory Board advised regarding the state's ability to implement a change time table? I was talking to Chris Batsavage from North Carolina. They've got proclamation authority. Virginia is able to do it in about a 60 day period; going through a normal cycle.

But I think we know from other events that some states require the meeting of their legislature in order to do this. I believe it was for sharks, there was a survey circulated; well how fast can the states implement this. That is my comment. Were they aware of it, because it seemed like the three people were in favor of Option 3 for that reason? It seems like it would give this Board the most flexibility, but I'm not sure that it really does.

CHAIRMAN MILLER: Kirby.

MR. ROOTES-MURDY: Yes so that is a good point to bring up. We did not on the AP call get into the specifics of each of the states' regulatory process; in terms of how they can change their measures. As you point out, each state is a bit different. That is definitely a consideration for the Board; and if you all were to choose say Option 3, how that may possibly impact certain states versus others, in terms of making those changes to certain measures.

CHAIRMAN MILLER: The next hand I saw was Mike Luisi.

MR. MICHAEL LUISI: I am certainly supportive of the flexibility that is offered in Addendum V; in this case. But my question I guess is to you, Kirby. In planning for an upcoming year, you know we do a lot of specifications with the Council and with ASMFC; and typically they are on an annual cycle, where you know that in a given month during a given meeting you're going to be taking up the question as to specifications for a future year.

Option 3 offers the flexibility even outside of that; where you could at any time throughout the year take up the question of specifications. My question I guess to you as staff, Kirby; what would be better for you, as far as planning? Would it be better to know that every time we have at fall or at annual meeting we're going to be doing specifications for coastal sharks?

That way we know it's all there, it's all before us. We can have a date fixed in our mind when we have those rules in place, or would it be better for staff having that ad hoc ability? It really boils down to what makes more sense as far as a planning process for you and the folks at the Commission.

CHAIRMAN MILLER: Kirby.

MR. ROOTES-MURDY: Thanks for the question, Mike. From staff's standpoint, I don't really see this addendum as posing challenges for planning per se. It's really more of an administrative process change for this Board. It gets to how quickly really does the Board want to be able to change measures; in response to new information, and changes to the status of the resource.

I brought up the shortfin mako assessment as kind of this case example of how we kind of came to the point to this addendum being initiated; and you all considering it today. We had an assessment completed basically late fall last year. NOAA came out with what their Emergency Rule measures were going to be.

In those situations you could have the Board kind of respond very quickly to say we're going to make a decision on accepting those measures; rather than having to each time initiate an addendum. The alternative is if you think if it's better to organize all this around one time annually to really consider changes across a number of commercial and recreational specifications. You know there are obviously benefits to that.

CHAIRMAN MILLER: Robert Boyles.

MR. ROBERT H. BOYLES, JR.: Lewis to your point, and I appreciate you bringing up the question. Many times I have sat at this Board or at another species board asking for patience and forbearance; because we do have to regulate via our General Assembly. However, in the case of sharks it is the law of the state of South Carolina that we adopt by reference federal regulatory measures; and so when the Feds change those measures, we adopt immediately. We in this unusual case with sharks don't have to work through our legislative process, so we're able to implement these measures pretty quickly. As a result I like the ad hoc approach as well.

CHAIRMAN MILLER: Any further comments or questions? John Clark.

MR. JOHN CLARK: No Mr. Chair. I was just going to ask if you're ready for a motion.

CHAIRMAN MILLER: Hold that thought for just a second, John. Any further comments or questions before I give the floor to John Clark go ahead, John.

MR. CLARK: I don't mean to be rushing the issue, Roy, but it is lunch time. **Move to adopt draft Addendum V with Management Option 3 as the chosen management option.**

CHAIRMAN MILLER: It will take us a second to get it up on the board**. The motion reads; move to approve Addendum V for Coastal Sharks with Management Option 3 as the chosen management option.** Motion by John Clark; is there a second to the motion, first hand, Justin Davis? Is there any discussion on the motion? Seeing none; are we ready for a vote? Is there a need for a caucus? Toni.

MS. TONI KERNS: Roy, to simplify things since there is only one management option in this document. It would be the intention of this document to be implemented immediately; since there is not anything that the states would need to follow up on, if I am correct, and if I'm wrong then please let us know. But then we could count this as the final approval of the document; and this would be the only vote that we'll need to approve the document, since I don't believe we'll need an implementation date, because it would just be immediate.

CHAIRMAN MILLER: Does everyone understand that because some states have the authority to implement it immediately and others don't. Since there is no implementation criteria for this one it can be done expeditiously. If everyone understands that and there is no further comments. Is there any objection to this motion?

Seeing none; I'll ask are there any null votes, any abstentions? **Seeing none; then the motion passes unanimously by lack of objection.** It goes into effect immediately I guess.

SET 2019 COASTAL SHARKS SPECIFICATIONS

Thank you for that and I guess we'll move on to Agenda Item 5; which is 2019 Coastal Sharks Specifications, and again I'll call on Kirby Rootes-Murdy, Kirby.

MR. ROOTES-MURDY: Thank you, Mr. Chair; this will be a short presentation. We have the 2019 commercial specifications for your consideration. They were published in a Proposed Rule back on September 11, FR Notice 45866. We included it in the briefing materials. The big takeaway is that the quotas are effectively status quo from 2018; so there are no changes in the quotas.

The proposed open date for all the shark management groups is January 1, 2019, and it's also status quo on the retention limit. What that means is it's going to start out at 25 large coastal sharks other than sandbars per vessel per trip. They can be adjusted as needed; as we've done in the past few years. The way that that works is that at some point in the summer, usually around July, depending on how the landings are tracking with the quota; that possession limit can be adjusted. Sometimes it gets adjusted down and then back up. These just if you are able to see, these are what the quotas again were in 2018; what we're working under right now, and what will be carried forward for 2019.

We have them broken out for the Atlantic by large coastal sharks, hammerheads, non-blacknose small coastal sharks, blacknose sharks. South of 45 degrees north latitude, smooth hound sharks, and then for the next slide we have all the non-regional quotas, so non-sandbar, large coastal shark research, sandbar research, blue sharks, porbeagles, and pelagic sharks other than porbeagles or blue sharks.

In terms of next steps, what this Board often does is we wait until the Final Rule is published later in the fall. Traditionally what happens is the Board will approve specifications by e-mail vote once the Final Rule is published. That being said, many years we have a motion to accept that that is how the Board will move forward in approving these specifications following the Board meeting effectively. With that I'll take any questions and thanks.

CHAIRMAN MILLER: Any questions? Seeing none; I guess we can request any other agenda items. Sorry, we'll need a motion to approve the specifications that Kirby just presented. Would anyone care to make that motion? Chris Batsavage.

MR. CHRIS BATSAVAGE: I move to approve the 2019 coastal shark's specifications via an e-mail vote after NOAA Fisheries publishes the final rule for the 2019 Atlantic Shark Commercial Fishing season.

CHAIRMAN MILLER: Thank you, Chris. The motion is on the board; move to approve the 2019 coastal shark's specifications via an e-mail vote after NOAA Fisheries publishes the final rule for the 2019 Atlantic Shark Commercial Fishing season. Motion by Mr. Batsavage, second by John Clark, is there any discussion on the motion?

Seeing none; is there any objection to the motion? Seeing none; I'll assume the motion is approved as read. Thank you.

ADJOURNMENT

On to other business, is there any other business before the Shark Board? Seeing none; are we ready for adjournment? If there is no objection then we'll declare this Board meeting adjourned. Thank you very much.

(Whereupon the meeting adjourned at 12:05 o'clock p.m. on October 23, 2018) in the **DATES** heading, not postmarked or otherwise transmitted by this date.

Classification

There is good cause to waive prior notice and an opportunity for public comment on this action pursuant to 5 U.S.C. 553(b)(B). Providing an opportunity for prior notice and comment would be contrary to the public interest because the SEZ closure has been triggered by a second observed M&SI, and immediate closure of the SEZ is necessary to prevent additional mortalities or serious injuries, which may have unsustainable impacts on the Hawaii pelagic stock of the false killer whale. Furthermore, prior notice and comment is unnecessary because the take reduction plan final rule (77 FR 71259, November 29, 2012) that implements the procedure for closing the SEZ (codified at 50 CFR 229.37(d)(2) and (e)) has already been subject to an extensive public process, including the opportunity for prior notice and comment. All that remains is to notify the public of the second observed mortality and serious injury of a pelagic false killer whale resulting from commercial longline operations, and the longline closure of the SEZ. Although this action is being implemented without the opportunity for prior notice and comment, NMFS is soliciting and will respond to public comments from those affected by or otherwise interested in this rule.

The NOAA Assistant Administrator for Fisheries also finds good cause to waive the 30-day delay in the effectiveness of this action under 5 U.S.C. 553(d)(3). Failing to waive the 30-day delay in effectiveness would likely result in additional interactions and possible M&SI to the Hawaii pelagic false killer whale stock. Under the MMPA, NMFS must reduce M&SI of marine mammal stocks protected by take reduction plan regulations. This includes taking action to close the SEZ immediately upon a second observed M&SI resulting from commercial longlining in the EEZ. Accordingly, the SEZ closure must be implemented immediately to ensure compliance with the provisions of the MMPA and the take reduction plan regulations. Nevertheless, NMFS recognizes the need for fishermen to have time to haul their gear and relocate to areas outside of the SEZ; thus, NMFS makes this action effective 7 days after filing this document in the **Federal Register**.

This action is required by 50 CFR 229.37(e)(3), and is exempt from review under Executive Order 12866.

Authority: 16 U.S.C. 1361 *et seq.*

Dated: February 15, 2019.

Chris Oliver,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

[FR Doc. 2019–02995 Filed 2–15–19; 4:15 pm]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 635

[Docket No. 180212159–9102–02]

RIN 0648–BH75

Atlantic Highly Migratory Species; Shortfin Mako Shark Management Measures; Final Amendment 11

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: NMFS is amending the 2006 Consolidated Atlantic Highly Migratory Species (HMS) Fishery Management Plan (FMP) based on the results of the 2017 stock assessment and a subsequent binding recommendation by the International Commission for the Conservation of Atlantic Tunas (ICCAT) for North Atlantic shortfin mako sharks. The North Atlantic shortfin mako shark stock is overfished and is experiencing overfishing. Consistent with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and the Atlantic Tunas Convention Act (ATCA), NMFS is implementing management measures that will reduce fishing mortality on shortfin mako sharks and establish the foundation for rebuilding the shortfin mako shark population consistent with legal requirements. The final measures could affect U.S. commercial and recreational fishermen who target and harvest shortfin mako sharks in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea, by increasing live releases and reducing landings. NMFS is also clarifying the definition of fork length (FL) in the definitions section of the HMS regulations.

DATES: This final rule is effective on March 3, 2019.

ADDRESSES: Copies of the Final Amendment 11 to the 2006 Consolidated HMS FMP, including the Final Environmental Impact Statement (FEIS) containing a list of references used in this document, the dusky shark stock assessments, and other documents relevant to this rule are available from the HMS Management Division website at *https://www.fisheries.noaa.gov/topic/atlantic-highly-migratory-species.*

FOR FURTHER INFORMATION CONTACT: Guý DuBeck or Karyl Brewster-Geisz at (301) 427–8503.

SUPPLEMENTARY INFORMATION:

Background

The North Atlantic shortfin mako stock is managed primarily under the authority of the Magnuson-Stevens Act and also under ATCA. The 2006 Consolidated HMS FMP and its amendments are implemented by regulations at 50 CFR part 635. A brief summary of the background of this final rule is provided below. Additional information regarding Atlantic shark management can be found in the FEIS accompanying this final rule for Amendment 11, the 2006 Consolidated HMS FMP and its amendments, the annual HMS Stock Assessment and Fishery Evaluation (SAFE) Reports, and online at *https://www.fisheries.noaa.gov/topic/atlantic-highly-migratory-species.*

The North Atlantic shortfin mako shark (*Isurus oxyrinchus*) is a highly migratory species that ranges across the entire North Atlantic Ocean and is caught by numerous countries. The stock is predominantly caught offshore in association with fisheries that primarily target tunas and tuna-like species. While these sharks are a valued component of U.S. recreational and commercial fisheries, U.S. catch represents only approximately 9 percent of the species' total catch in the North Atlantic by all reporting countries. International measures are, therefore, critical to the species' effective conservation and management.

Based on a 2017 ICCAT assessment, on December 13, 2017, NMFS issued a status determination finding the stock to be overfished and experiencing overfishing, applying domestic criteria. The 2017 assessment estimated that total North Atlantic shortfin mako catches across all ICCAT parties are currently between 3,600 and 4,750 metric tons (mt) per year. The assessment further indicated that such total catches would have to be at or below 1,000 mt (72–79 percent reductions) to prevent further population declines, and total catches of 500 mt or less would be expected to stop overfishing and begin rebuilding the stock.

Based on this information and given that the stock is primarily caught in association with ICCAT fisheries, ICCAT at its November 2017 meeting adopted management measures for Atlantic shortfin mako in Recommendation 17–08. The measures largely focused on maximizing live releases of Atlantic shortfin mako sharks, allowing retention only in certain limited circumstances, increasing minimum size limits for retention, and improving data collection in ICCAT fisheries. ICCAT stated that the measures in the Recommendation were ''expected to prevent the population from decreasing further, stop overfishing and begin to rebuild the stock.''

On March 2, 2018, NMFS implemented an interim final rule using emergency authority under the Magnuson-Stevens Act, 16 U.S.C. 1855(c), to quickly implement measures in the HMS recreational and commercial fisheries consistent with Recommendation 17–08. The emergency measures were initially effective for 180 days, and on August 22, 2018, they were extended to March 3, 2019 (83 FR 42452). This final rule is intended to replace these emergency measures with long-term measures.

A Notice of Intent (NOI) to prepare an EIS for Amendment 11 of the Consolidated HMS FMP was published in the **Federal Register** on March 5, 2018 (83 FR 9255) and provided notice of the availability of an Issues and Options document for scoping. Based on the alternatives presented and commented on during scoping, NMFS published a proposed rule for Draft Amendment 11 on July 27, 2018 (83 FR 35590), and the Environmental Protection Agency (EPA) published the notice of availability of the Draft Environmental Impact Statement (DEIS) on July 27, 2018 (83 FR 35637). The details of this rulemaking can be found in the proposed rule and are not repeated here.

During the comment period on the proposed rule and DEIS, which lasted for 73 days, NMFS conducted six public hearings (Texas, Florida, North Carolina, New Jersey, and Massachusetts) and a public webinar. In addition, NMFS presented Draft Amendment 11 to the Atlantic HMS Advisory Panel, four Atlantic Regional Fishery Management Councils (the New England, Mid-Atlantic, South Atlantic, and the Gulf of Mexico Fishery Management Councils), and the Atlantic States Marine Fisheries Commission. The comment period ended on October 8, 2018. The comments received on Draft Amendment 11 and its proposed rule, and responses to those comments, are summarized below in the section labeled ''Response to Comments.''

This final rule implements the measures preferred and analyzed in the FEIS for Amendment 11 to the 2006 Consolidated HMS FMP in order to address and establish a foundation for rebuilding the North Atlantic shortfin mako shark stock, which ICCAT will adopt in 2019 after obtaining additional scientific information, as set out in Recommendation 17–08. It also includes a clarification to the regulatory definition of ''FL (fork length),'' as proposed and discussed in the DEIS and FEIS. The FEIS analyzed the direct, indirect, and cumulative impacts on the human environment as a result of the preferred management measures. The FEIS, including the preferred management measures, was made available on December 21, 2018 (83 FR 65670). On February 15, 2019, the Assistant Administrator for NOAA signed a Record of Decision (ROD) adopting these measures as Final Amendment 11 to the 2006 Consolidated HMS FMP. A copy of the FEIS, including Final Amendment 11 to the 2006 Consolidated HMS FMP, is available from the HMS Management Division (see **ADDRESSES**). In the FEIS, NMFS divided the alternatives into the following four broad categories for organizational clarity and to facilitate effective review: Commercial fishery, recreational fishery, monitoring, and rebuilding. NMFS fully considered 29 alternatives within these categories and is implementing five measures, one in the commercial fishery, two in the recreational fishery (each regarding a different regulation type), one regarding monitoring, and one regarding rebuilding the stock, to meet the objectives of the rule and achieve at least a 75 percent reduction in U.S. shortfin mako shark landings consistent with the suggested level of reduction recommended in the stock assessment. The stock assessment recommends this level of reduction throughout the stock's range, and all ICCAT parties fishing on the stock are committed to take the specified measures to achieve the needed reductions. NMFS' detailed analyses of the alternatives are provided in the FEIS for Draft Amendment 11 (see **ADDRESSES** for how to get a copy of the FEIS) and a summary is provided in the FRFA below.

In developing the final measures, NMFS considered the commercial retention restrictions and the 83-inch FL recreational minimum size limit temporarily put in place through the emergency interim final rule, public comments received on that rule, other conservation and management measures that have been implemented in the HMS fisheries since 2008 that have affected shark fisheries or shark bycatch in other fisheries, and public comments received on the proposed rule and DEIS, including comments provided at the September 2018 HMS Advisory Panel meeting. In response to public comment on the proposed rule and the DEIS, NMFS made three changes from the proposed rule in the final rule. The first change adopts a new commercial measure that is a modified version of the previously preferred measure. A second change adopts a different recreational size limit measure that was not preferred in the proposed rule. A third change clarifies the application of retention restrictions for the few permit holders who hold a commercial shark permit and a permit that also allows recreational landings of sharks. All other proposed conservation measures, as well as the proposed clarification of the definition of ''fork length,'' did not change between the proposed and final rules. Measures that are different from the proposed rule, or measures that were proposed but not implemented, are described in detail in the section titles, ''Changes from the Proposed Rule.''

Response to Comments

NMFS received a total of 30 individual written comments on the proposed rule from fishermen, dealers, and other interested parties along with State of North Carolina, Commonwealth of Massachusetts, the Mid-Atlantic and New England Fishery Management Councils, several shark conservation or other environmental groups, including Oceana, and several commercial and recreational groups. Oral comments were received from the South Atlantic Fishery Management Council. All written comments can be found at *http://www.regulations.gov/* by searching for RIN 0648–BH75. All of the comments received are summarized below.

Comment 1: NMFS received multiple comments expressing support for Amendment 11 management measures as well as comments opposing implementation of ICCAT shortfin mako shark recommendations. Commenters in support of Amendment 11 wanted management measures to prevent overfishing of shortfin mako sharks by placing limits and restrictions on fishing that results in mortality of shortfin mako sharks. They also stressed the need for international cooperation if shortfin mako shark measures are to be effective and the need for all countries fishing on the stock to implement comparable regulations as required by ICCAT. In addition, some commenters cited the importance of shortfin mako sharks to the health of ocean ecosystems. One commenter opposed any management measures for shortfin mako sharks, citing their understanding of previous ICCAT stock assessment issues, including the underlying uncertainties with other shark stock assessments such as the porbeagle shark assessment. Specifically, this commenter stated that ICCAT had recommended similar regulations for porbeagle sharks after a stock assessment, and later changed the results after the United States supplied additional information.

Response: NMFS agrees that shortfin mako sharks play an important role in maintaining ocean ecosystems, and notes that there are statutory obligations to effectively manage shark fisheries, prevent overfishing, and achieve long-term sustainability of the stock. NMFS has determined that the management measures in this rule will address overfishing and begin the process of rebuilding the North Atlantic shortfin mako shark stock as required by law, understanding that any effective rebuilding plan or measures to end overfishing depend on effective international measures, given that the United States contributes to only a portion of the fishing mortality on the stock.

NMFS believes that the 2017 ICCAT stock assessment for shortfin mako sharks is not appropriately compared to the previous stock assessment for porbeagle sharks and generally does not agree with the commenter's implication that the ICCAT assessments are routinely flawed. The 2017 ICCAT stock assessment for shortfin mako sharks included many improvements in the data and modeling compared to previous shark stock assessments, including past porbeagle and shortfin mako shark assessments. NMFS has determined that the 2017 SCRS shortfin mako shark stock assessment is the best scientific information available for shortfin mako sharks, and NMFS is using the results, as appropriate, as required under National Standard 2 of the Magnuson-Stevens Act.

Comment 2: NMFS received comments about the stock assessment methodology and results. A commenter had concerns that the methodology applied in evaluating the results of different stock assessment models used in the 2017 shortfin mako stock assessment introduced an inappropriate negative bias in the overall assessment results. Other commenters were concerned about the large change in stock status between all the most recent previous ICCAT stock assessment results, the conversion rates used to convert dressed weight to whole weight of sharks, the potential for under-reporting of harvest by other ICCAT members particularly those countries that have larger fishing fleets than the United States, and the potential implications of the Marine Recreational Information Program (MRIP) catch estimates. These commenters requested that NMFS postpone implementing Amendment 11 until the next shortfin mako shark stock assessment is completed.

Response: While there is always uncertainty in stock assessment data inputs, model outputs, and the subsequent interpretation of results, the SCRS methodologies appropriately considered how to best address such uncertainties in this particular context. The SCRS described these sources of uncertainty and concluded that the 2017 stock assessment was an improvement over previous assessments for shortfin mako sharks, and reflects the best scientific information available on the status of the stock. ICCAT reviewed and accepted the results for use in management, and made specific recommendations which the United States is obligated to implement as necessary and appropriate under ATCA. NMFS is also required to take action to end overfishing and rebuild the stock under the Magnuson-Stevens Act given the stock's status as overfished with overfishing occurring. If future stock assessments reach different conclusions regarding shortfin mako shark stock status, and changes to management measures are recommended by ICCAT, or if NMFS determines that different measures are needed to address management of the stock, then such changes may be considered at that time.

Regarding the comment expressing concern that the United States used incorrect conversion rates for dressed weight to whole weight of sharks, this issue has also come up in the context of reporting to ICCAT. As discussed with the ICCAT Advisory Committee at its Fall meeting, the United States surveyed other countries regarding the conversion rates and the manner in which those countries dress their sharks and then reviewed the data it submitted to ICCAT. Based on this review of the data and the survey of other countries' conversion factors, the United States found errors in the shortfin mako shark commercial landings data previously submitted to ICCAT and determined that changing the conversion rate to match that used by Spain and Canada was appropriate. Accordingly, the United States submitted revised estimates to ICCAT of U.S. harvest for all years. NMFS has accordingly updated all the numbers from the DEIS in the FEIS to reflect the updated analyses, since the numbers in the DEIS were based on the ICCAT submissions. As a result of these revised estimates, the U.S. proportion of shortfin mako catches compared to all catches by all countries was reduced from 11 percent to 9 percent. For U.S. harvest, these changes also resulted in a recalculation of the relative contribution of commercial and recreational fisheries to domestic shortfin mako shark mortality. The proportion of recreational to commercial harvest is not equally split with recreational harvest accounting for 58 percent and commercial harvest (including landings and dead discards) accounting for 42 percent.

Comment 3: NMFS received comments regarding the timing and process of this rulemaking. Commenters urged NMFS to implement management measures immediately based on the best available science to rebuild the stock and end overfishing. Other commenters are concerned that this rulemaking is premature since ICCAT could make changes in upcoming meetings. Some commenters felt the United States should not act unilaterally, and implement a rebuilding plan without ICCAT. Another commenter stated that NMFS has two years to implement rebuilding plans and management measures once the stock is determined to be overfished and requested that NMFS wait to implement Amendment 11.

Response: Amendment 11 is responsive to ICCAT Recommendation 17–08, which is a binding recommendation under the ICCAT Convention, and the United States is obligated to implement it through regulations as necessary and appropriate under ATCA. Due to the requirements in Recommendation 17–08 and the status of shortfin mako sharks, NMFS worked to immediately implement the requirements in Recommendation 17–08 via an emergency interim final rule (83 FR 8946; March 2, 2018). Under sections 305(c) and 304(e)(6) of the Magnuson-Stevens Act, NMFS has the authority to implement interim measures to reduce overfishing on an emergency basis for 180 days. Those measures can be extended again for another 186 days if necessary. NMFS later extended the emergency rule for another 186 days; these emergency measures expire on March 3, 2019 (83 FR 42452; August 22, 2018). NMFS aims to have the management measures in Amendment 11 in place by the time the emergency rule expires or soon thereafter. If ICCAT changes the measures in Recommendation 17–08 at future meetings, then the United States will be responsive to those changes, consistent with ATCA and the Magnuson-Stevens Act. NMFS does not have discretion to delay implementation of management measures adopted at ICCAT simply because we anticipate there may be additional or different ICCAT recommendations in the future. This action does not implement a unilateral rebuilding plan in U.S. waters for shortfin mako sharks. This action establishes the foundation for an international, ICCAT-recommended rebuilding plan, understanding that ICCAT intends to adopt such a plan in the future and that the United States will advocate for its development at that forum.

Regarding the comment on the two-year timeframe to implement management measures being a reason to delay implementation, we note that we have an obligation to implement the measures under ATCA and the ICCAT treaty, and that the Magnuson-Stevens Act requires NMFS to take measures to end overfishing and to rebuild the stocks. The regulatory process to amend the 2006 Consolidated HMS FMP is a lengthy process involving significant public input and review; the two-year reference in the Magnuson-Stevens Act is not to be read as a delay in starting that process, which could prevent measures from being timely implemented. Section 304(e)(6) allows for interim measures to reduce overfishing to be put in place until a FMP amendment can be finalized; this section of the Magnuson-Stevens Act only allows for these interim measures to be put in place pursuant to section 305(c), which limits the amount of time emergency measures can be effective to 366 days. Based on these regulations, NMFS published the emergency interim final rule per the authority in sections 305(c) and 304(e)(6) of the Magnuson-Stevens Act, and is implementing long-term management measures to address overfishing and establish a foundation for rebuilding shortfin mako sharks with Amendment 11, consistent with the Magnuson-Stevens Act.

Comment 4: NMFS received comments in support of adding a sunset clause to this rulemaking, which would remove regulations implemented by Amendment 11 if ICCAT makes changes to Recommendation 17–08.

Response: A ''sunset clause'' on regulations to address overfishing of shortfin mako sharks would not be consistent with the ICCAT recommendation, or the need to rebuild the stock, which could take decades based on the 2017 stock assessment. If ICCAT recommends changes to management measures in the future, NMFS would implement necessary and appropriate responsive regulatory changes at that time, consistent with applicable laws.

Comment 5: NMFS received comments regarding the implementation of the ICCAT regulations and fishing operations by other countries. The commenters had concerns that other countries are not implementing the Recommendation and about the pace of the U.S. implementation when compared to other countries. Commenters also wondered if other ICCAT countries have electronic monitoring systems or observers for their fleets. In addition, the commenters believe that U.S. fishermen will be held accountable for an excessive share of the conservation burden in future ICCAT management measures.

Response: NMFS acknowledges that countries other than the United States are responsible for the majority of North Atlantic shortfin mako shark fishing mortality, hence the need for international coordination through ICCAT on measures to end overfishing and rebuild the stock. Regardless of other countries' capability to adequately implement and enforce ICCAT recommendations, the United States remains obligated under ATCA to implement ICCAT recommendations. As a responsible party to ICCAT, NMFS will continue to work collaboratively within the ICCAT process and advocate for an effective international rebuilding plan, emphasizing the need for all parties to address their relative share of contributions to fishing mortality and for equitable management measures.

Comment 6: NMFS should implement an EFH designation for shortfin mako sharks.

Response: NMFS has recently updated EFH designations for shortfin mako sharks under Amendment 10 to the 2006 Consolidated HMS FMP. This process was initiated with the publication of the draft Atlantic HMS 5 Year Review on March 5, 2015 (80 FR 11981). In this review, NMFS identified new literature and data that should be considered in EFH delineation exercises, and recommended updating boundaries for shortfin mako sharks. There was insufficient information available per the guidelines listed at § 600.815(a)(8)) to warrant a Habitat Area of Particular Concern for shortfin mako sharks. NMFS published a draft Environmental Assessment, which included proposed updates for shortfin mako shark EFH, on September 8, 2016 (81 FR 62100). NMFS received a number of written comments and comments at public meetings. Many comments included suggestions for EFH boundaries based on academic research. NMFS completed a review of EFH-related literature in developing the FEIS (see Chapter 3 and Chapter 4 of Amendment 10 for a review of shortfin mako habitat and biology, and EFH impacts, respectively), and did not identify sufficient literature warranting changes to the recently updated EFH boundaries for shortfin mako sharks. However new data from ongoing surveys, research, and tagging programs was used to update EFH boundaries. EFH updates for shortfin mako sharks were finalized September 6, 2017 (82 FR 42329). Maps of final EFH boundaries for shortfin mako are available in Appendix G of the Final Environmental Assessment. EFH boundaries may also be viewed in the EFH Mapper, an online dynamic mapping tool maintained by the NMFS Office of Habitat Conservation (*https://www.habitat.noaa.gov/protection/efh/efhmapper/*). This office also maintains an EFH Data Inventory, which includes shapefiles of EFH boundaries that may be downloaded by the public (*https://www.habitat.noaa.gov/protection/efh/newInv/index.html*). The next 5-year review process for HMS EFH will be initiated in 2022.

Comment 7: NMFS received several comments suggesting that management measures for shortfin mako sharks should be more restrictive than those implemented in this rulemaking, including prohibiting all retention of shortfin mako sharks, or other more restrictive measures, as the science recommends.

Response: NMFS disagrees that more restrictive measures are required or necessary at this time. The management measures in Amendment 11 are consistent with those recommended in ICCAT Recommendation 17–08 and with NMFS' obligations to address overfishing and rebuilding, understanding that the stock is fished internationally and requires international measures to effectively address these issues. The selected measures are expected to reduce U.S. shortfin mako shark catch consistent with the SCRS recommendation (72–79 percent), while still permitting fishermen to retain shortfin mako sharks under limited circumstances. Given the species' North Atlantic-wide range and that United States catches constitute only approximately nine percent of total North Atlantic shortfin mako shark catch, the United States cannot unilaterally end overfishing and rebuild the stock through domestic regulations alone, even if there were to be a total prohibition on possession (which has not been recommended by ICCAT).

Ending overfishing and rebuilding the stock can only be accomplished through international coordination with nations that harvest the majority of shortfin mako sharks. NMFS will work with ICCAT members to evaluate the effectiveness of these measures, update stock assessment projections, establish a rebuilding plan, and develop additional measures if necessary.

Comment 8: NMFS received comments in support of the proposed preferred commercial alternative (A2), as well as other comments that suggested modifications to Alternative A2. Several commenters along with the State of Georgia and the South Atlantic and New England Fishery Management Councils supported Alternative A2 (the preferred Alternative at the proposed rule stage) since this Alternative is consistent with ICCAT Recommendation 17–08, utilized electronic monitoring, and allowed NMFS to collect real time landings and additional data. NMFS also received comments including from the State of North Carolina, Commonwealth of Massachusetts, and HMS Advisory Panel members supporting Alternative A2 with modifications. Specifically, the State of North Carolina along with other individuals suggested a modification that would allow the retention of dead shortfin mako sharks caught as bycatch in gillnet and bottom longline fisheries. The Commonwealth of Massachusetts and some HMS Advisory Panel members suggested a modification that would allow the retention of dead shortfin mako sharks by any vessel as long as there is an electronic monitoring system or an observer on board the vessel, similar to Alternative A5. These commenters also supported Alternative A3, which would allow vessels the option to opt out of the electronic monitoring system review.

Response: ICCAT Recommendation 17–08 included a variety of measures to reduce shortfin mako shark fishing mortality and to increase live releases in response to the 2017 ICCAT North Atlantic shortfin mako shark stock assessment. Among these measures was the option to require the release of shortfin mako sharks brought to the vessel alive in ICCAT fisheries. This option also allows for the retention of shortfin mako sharks in ICCAT fisheries that are dead at haulback, provided an electronic monitoring system is installed, or an observer is on board to verify the disposition of the shark. In Draft Amendment 11, NMFS preferred to implement Alternative A2, which limited the retention of dead shortfin mako sharks to those caught on vessels with an electronic monitoring system. While the draft amendment preferred alternative did not limit the gear types that could be used to catch and retain dead shortfin mako sharks, the requirement to have an electronic monitoring system installed largely limited the measure to pelagic longline vessels since these vessels are already required to have electronic monitoring systems. Alternative A2 would satisfy the requirements of Recommendation 17–08 and also decrease fishing mortality of shortfin mako sharks. A large number of commenters expressed support for this measure. A full analysis of the ecological and socioeconomic impacts for Alternative A2 is provided in Chapter 4 of the FEIS.

However, during the public comment period, commenters that expressed support for the preferred Alternative A2 in Draft Amendment 11 also voiced support for allowing retention of dead shortfin mako sharks in other, non-ICCAT fishery gear types. Although Alternative A2 did not limit the ability to retain dead shortfin mako sharks to pelagic longline vessels, the requirement to install a costly electronic monitoring system to do so may have effectively limited the allowance for retention to the pelagic longline fishery. HMS-permitted pelagic longline vessels are already required to have electronic monitoring systems on board, but vessels using other gear types are unlikely to install the costly system in order to retain shortfin mako sharks, especially considering the relatively low ex-vessel value. Thus, the practical effect of Alternative A2 could be to limit the measure to pelagic longline vessels. To address the public comments on the Proposed Rule for Amendment 11, NMFS is implementing Alternative A7, an alternative added and analyzed in the FEIS and adopted in this final rule. Alternative A7 is a slight modification and outgrowth of Alternative A2. Under preferred Alternative A7, shortfin mako sharks caught using gillnet, bottom longline, or pelagic longline gear on properly-permitted vessels could be retained, provided they are dead at haulback. In the case of pelagic longline vessels, an electronic monitoring system would still be required, as proposed, but an electronic monitoring system would not be required on vessels that use bottom longline or gillnet gear. To be responsive to public comments, NMFS reviewed the available data for shortfin mako shark interactions by vessels that use bottom longline and gillnet gear. After reviewing the information and considering past actions, NMFS decided to add Alternative A7 as the preferred alternative. One of the alternatives in the proposed rule analyzed and considered retention within the bottom longline and gillnet fisheries, and public comment on the alternatives resulted in the development of Alternative A7. Commenters thus could reasonably have anticipated this alternative, which is a logical outgrowth of the alternatives considered, and is consistent with the ICCAT measure's application to sharks ''caught in association with ICCAT fisheries.'' This alternative is largely the same as Alternative A2 except that it allows retention of dead shortfin mako sharks in the bottom longline and the gillnet fisheries without requiring an observer or electronic monitoring system on board. Shortfin mako sharks are rarely caught with bottom longline and gillnet gear. Based on observer data, only 40 shortfin mako sharks were caught with bottom longline and gillnet gear from 2012 to 2017. Due to the low number of observed interactions, it is doubtful any of these landings were the result of targeted fishing so it is unlikely more could be done to avoid them. NMFS will also continue to track landings and consider additional measures if it appeared that an increase in retention results from this action, which is extremely unlikely. Retaining an additional six to seven dead sharks per year will have no additional negative effects on the stock than considered in the proposed rule, and the United States will still achieve the needed reductions in mortality with this alternative. In addition, allowing retention by these gear types will reduce regulatory dead discards in the non-ICCAT fisheries.

No other commercial gear types would be able to land shortfin mako sharks under this alternative. While it is possible for other commercial gears to catch shortfin mako sharks (*e.g.,* rod and reel and bandit gear), these gears are primarily recreational and are rarely used to fish for sharks commercially. Buoy gear in particular can interact with shortfin mako sharks but is not an authorized gear; this rule does not change that. Under this alternative, all shortfin mako sharks would need to be released if caught commercially on these other commercial gears, with the exception described below for those vessels that hold both a commercial shark permit and a permit with a shark endorsement that allows for recreational shark landings. This approach is consistent with previous rulemakings that implemented ICCAT recommendations for sharks (*e.g.,* prohibiting retention of silky, hammerhead, oceanic whitetip, or porbeagle sharks in ICCAT fisheries: 76

FR 53652, August 29, 2011; 77 FR 60632, October 4, 2012; 81 FR 57803, August 24, 2016). In those cases, NMFS applied ICCAT measures for sharks only to the pelagic longline fishery and the handgear fisheries when swordfish or tunas are retained because they are considered ICCAT fisheries for tunas and tuna-like species. NMFS consistently determined that U.S. bottom longline and gillnet vessels are not part of an ICCAT fishery because these gears do not regularly catch or land ICCAT managed species such as swordfish or tunas. In other words, Alternative A7, which would allow landings of dead shortfin mako sharks caught by these non-ICCAT fishery gear types, is consistent with past U.S. actions.

Additionally, ICCAT Recommendation 17–08 allows retention of shortfin mako sharks that are dead at haulback without the verification of electronic monitoring or observers in certain limited circumstances, including for vessels under 12 meters. Most vessels that have a Directed shark LAP and use bottom longline or gillnet gear have vessel lengths that are below 12 meters. In 2017, bottom longline vessels that interacted with sharks (based on coastal fisheries and HMS logbook reports) averaged 11.4 meters in length. In 2017, gillnet vessels that interacted with sharks (based on coastal fisheries and HMS logbook reports) averaged 9.6 meters in length. Thus, given past rulemakings and given the length of most vessels that target sharks, allowing landings of dead shortfin mako sharks by these other gear types is appropriate and consistent with ICCAT Recommendation 17–08.

Comment 9: NMFS received a suggestion for potential management measures if more commercial regulations are needed to protect the shortfin mako stock. The commenter suggested that NMFS implement a seasonal incidental limit of 18 shortfin mako sharks per trip during the summer months.

Response: The preferred alternatives in Final Amendment 11 are consistent with ICCAT Recommendation 17–08 and are designed to address the United States' contribution to the overfishing of shortfin mako sharks. If future ICCAT SCRS analyses determine that additional shortfin mako shark mortality reductions are needed, NMFS would consider other options, consistent with any ICCAT recommendations. At this time, a seasonal commercial limit of shortfin mako sharks is not consistent with ICCAT Recommendation 17–08 and it is unclear if it would achieve mortality reduction targets.

Comment 10: NMFS received a comment that the combination of preferred alternatives at the proposed rule stage, specifically Alternatives A2 and B3, would cause commercial shark permits that are held with HMS Charter/Headboat permits to be ''worthless.'' Such fishermen hold both permits to allow them to sell sharks caught as bycatch when fishing for tuna with handline gear. The proposed combination of alternatives would require such a dual-permitted vessel to use only pelagic longline gear, to have an electronic monitoring system, and to only land shortfin mako sharks that were greater than 83 inches fork length that were dead at haulback. These requirements would apply even when fishing on a for-hire trip.

Response: The commenter was correct that under the proposed alternatives it was unlikely that a dual-permitted vessel (which could include a variety of permits including, for example, those vessels that hold a commercial shark permit and an Atlantic Tunas General category permit that allows for retention of sharks when participating in a registered tournament) could land shortfin mako sharks. Additionally, NMFS realized this concern about permit combinations could apply to many combinations of the commercial and recreational alternatives considered. NMFS did not intend for this effect as a result of the proposed rule. As such, in the FEIS, NMFS is clarifying how the recreational limits would apply to the few individuals who hold a commercial shark vessel permit in addition to one of a variety of other vessel permits, such as HMS Charter/Headboat, that allow for recreational landings of sharks. These vessels generally fish with rod and reel or other handgear as opposed to pelagic longline, bottom longline, or gillnet gear. However, these vessels are part of the ICCAT fishery as they regularly target tunas, billfish, and swordfish. For the sake of clarity, NMFS would restrict these permit holders to the recreational shark requirements when shortfin mako sharks are onboard and prohibit them from selling any sharks when recreationally retaining shortfin mako sharks.

Comment 11: NMFS received comments both in support of and opposed to Alternative B3, which was the preferred alternative at the proposed rule stage. Some commenters, along with the Commonwealth of Massachusetts and the New England Fishery Management Council, supported Alternative B2 and management measures to protect shortfin mako sharks until they reach maturity. These commenters generally felt that the United States strongly supported the adopted size restrictions at ICCAT, and that NMFS should not now go beyond the recommendations. These commenters noted that the same minimum size under the emergency rule reduced U.S. landings beyond the suggested reduction of 72 to 79 percent. Other commenters noted that NMFS underestimated potential reductions in landings in their analysis of the recreational alternatives because they did not account for reductions in the number of trips that would target shortfin mako sharks. The State of North Carolina supported Alternative B3 and specifically noted that if NMFS chooses Alternative B2 instead, NMFS should include shark sex identification facts on the HMS shark endorsement quiz and other outreach material. Commenters from the Gulf of Mexico supported Alternative B3 because they commonly interact with shortfin mako sharks larger than 83 inches fork length (FL). NMFS also received comments from individuals as well as the State of Georgia and the South Atlantic Fishery Management Council in support of the Alternative B3, which would establish a single recreational size limit of 83 inches FL, and is consistent with the measure established in the emergency rule. In general, these commenters felt the one size limit in Alternative B3 would remove any confusion recreational fishermen may have in identifying shortfin mako sharks by sex. Additionally, NMFS received requests for NMFS to consider other minimum sizes that are smaller than the preferred alternative of 83 inches FL. These commenters felt that NMFS should protect the larger, breeding female sharks over 83 inches FL and implement a smaller minimum size, such as 72 or 75 inches FL, for male sharks since those sharks still provide a decent amount of meat.

Response: Based on the public comment and current recreational estimated harvest under the emergency regulations (83 inches FL for all shortfin mako sharks), NMFS has decided to change the preferred alternative in the Final Amendment 11 to Alternative B2, which establishes different minimum sizes for male and female shortfin mako shark retention (71 inches FL size limit for male and 83 inches FL size limit for female shortfin mako sharks). In Draft Amendment 11 and the emergency interim final rule, the minimum size limit was increased to 83 inches FL for both males and females (Alternative B3) to significantly reduce shortfin mako shark recreational mortality and address overfishing. One size was used for both sexes for reasons discussed in the emergency interim final rule and proposed rule. Updated data gathered from operations occurring under the emergency interim rule provisions indicate, however, that this approach would be unnecessarily restrictive for the longer term. While the shortfin mako shark landings under the 83-inch FL size limit met the suggested reduction target by weight, the size limit exceeded the target reduction in numbers of sharks harvested. As described in Chapter 4 of the FEIS, Large Pelagics Survey (LPS) data indicated there was a substantial reduction in recreational trips targeting shortfin mako sharks as a result of implementation of the emergency interim rule. The recreational landings data observed in the LPS suggest that the separate size limits for male and female sharks now preferred under Alternative B2 should still accomplish the suggested mortality reduction targets while having less detrimental economic impacts on the recreational shark fishery.

Furthermore, studies have indicated that protecting sub-adult sharks is key to conserving and rebuilding shark populations (see Chapter 4 of the FEIS). Sub-adults are generally those juvenile sharks that are a year or two away from becoming mature adults. While the now-preferred Alternative B2 will allow greater harvest of male shortfin mako sharks, those sharks will still be mature individuals as 71 inches FL is the size of maturity for male shortfin mako sharks. Given that studies have indicated that protecting sub-adult sharks is key to conserving and rebuilding shark populations, Alternative B2 ensures that sub-adults would still be adequately protected by establishing minimum size limits for male and female sharks based on their size at maturity. NMFS also anticipates that the now-preferred Alternative B2, which allows recreational fishermen the opportunity to harvest smaller male sharks, will help relieve fishing pressure on the larger female sharks, which were estimated to comprise approximately 75 percent of the harvest under the preferred alternative from the emergency interim final rule (Alternative B3), which established only one size for both males and females. Landings data from the LPS shows that female shortfin mako sharks over 83 inches FL historically made up only about 12 percent of the overall harvest. Under a single 83 inches FL size limit it is highly likely most vessels that successfully harvest a shark over 83 inches FL will have already caught and released several smaller male sharks first. Since recreational fishermen are only allowed to harvest one shortfin mako shark per vessel per day, establishing a separate and significantly smaller size limit for male sharks will greatly increase the probability that the first legal sized shark a vessel interacts with will thus be a male shark which should lead to fewer female sharks ultimately being harvested.

Since the final preferred alternative (Alternative B2) establishes a different minimum size limit for each sex of shortfin mako shark species, NMFS intends to include information on properly distinguishing between male and female sharks on all related outreach materials, web page, and the shark endorsement video (which is mandatory for all HMS permit holders that wish to retain sharks recreationally). NMFS also expects to provide such information to registered HMS shark tournaments to make sure participants are aware of the separate size limits and how to distinguish between male and female sharks. NMFS will continue to monitor recreational landings of shortfin mako sharks, and would take action to increase the minimum size limit if recreational landings targets are not meet or if enforcing separate size limits by sex proves to be impractical.

Comment 12: NMFS received a comment stating that the seasonal recreational alternatives would not allow Gulf of Mexico fishermen ample opportunity to land shortfin mako sharks since they primarily target the species outside of the months considered in the alternative.

Response: NMFS did not prefer Alternative B6, or any of its sub-alternatives, in the proposed rule due to the potential for inequitable fishing opportunities this alternative could create in terms of regional access to the shortfin mako shark recreational fishery. NMFS now prefers Alternative B2, which establishes a minimum size limit of 71 inches FL for male and 83 inches FL for female shortfin mako sharks, which would mean all recreational fishermen would have the same regulations regardless of where and when they decide to fish.

Comment 13: NMFS received comments in support of the no action recreational alternative (Alternative B1). Specifically, commenters supported keeping the shortfin mako shark recreational minimum size at status quo (54 inches FL) since they feel the population decline is not due to the recreational fishery and the recreational fishery should not be impacted by other fisheries.

Response: While NMFS recognizes that the U.S. recreational fishery for shortfin mako sharks only makes up a small portion of the overall international harvest, its contribution to the total U.S. catch is larger than the commercial fishery landings. According to data presented in the Final Amendment 11, the U.S. recreational fishery accounts on average for 58 percent of the total U.S. catch, while the commercial fishery accounts on average for 42 percent. Therefore, U.S. recreational fisheries have a significant role to play in reducing fishing mortality on shortfin mako sharks, and must be included in management of this overfished stock. Furthermore, the no action alternative would fail to meet the minimum requirements set forth in ICCAT Recommendation 17–08 and would be inconsistent with U.S. obligations under the ICCAT treaty, ATCA, and other legal requirements.

Comment 14: NMFS received comments in support of Alternative B8, which would establish a tagging program to implement a per season limit for recreational fishermen.

Response: At this time, NMFS does not intend to implement a tagging program for recreationally harvested shortfin mako sharks since the final preferred alternative (Alternative B2) to establish minimum sizes would sufficiently reduce the recreational harvest levels. In addition, tagging programs are complicated to implement for a variety of reasons including the need to assign a limited number of tags via raffle, and the extra time and resources required to track them when reported. As discussed in the FEIS, NMFS would need to assign tags via raffle as the number of HMS permit holders with shark endorsements far exceeds the number of shortfin mako sharks that could be harvested and still meet the recommended reduction target of 72 to 79 percent. For these reasons, NMFS does not prefer a tagging program at this time.

Comment 15: NMFS received a comment suggesting that we change the shortfin mako shark recreational fishery to be similar to the bluefin tuna recreational fishery regulations. The commenter suggested a shortfin mako shark recreational fishery where permit holders would be restricted to one trophy shark over 83 inches FL, one smaller shark between 65 to 83 inches FL, and a 2 shark per season limit per recreational shark permit.

Response: The management regime suggested in this comment would be similar to the implementation of a tagging program in that such a program would require NMFS to monitor a seasonal bag limit. Similar to the tagging program, NMFS has determined that such a management program is unnecessary to accomplish the recommended reduction in landings as the minimum size limits currently under consideration would reduce overall harvest to far fewer than two sharks per permitted vessel per season. Furthermore, a 65 inch FL size limit for shortfin mako sharks would be below the size limits stipulated in ICCAT Recommendation 17–08, and would fail to meet U.S. obligations to implement binding ICCAT recommendations under ATCA.

Comment 16: NMFS received support and opposition for the preferred alternative (Alternative B9) to implement circle hooks in the recreational fishery. Some commenters along with the Commonwealth of Massachusetts and the South Atlantic and New England Fishery Management Councils supported the preferred alternative due to the benefits of live release of sharks that may provide enhanced survivorship in some species. The State of Georgia opposed the implementation of circle hooks in the recreational fishery for sharks in federal waters due to its ''questionable administration by law enforcement officers'' and the unnecessary burden it will place on recreational anglers. In addition, the State of Georgia noted that it does not intend to adopt circle hooks in state waters.

Response: Research shows that the use of circle hooks reduces gut-hooking and increases post-release survival in shortfin mako sharks. French et al. (2015) examined the effects of recreational fishing techniques, including hook type, on shortfin mako sharks and found that circle hooks were more likely to hook shortfin mako sharks in the jaw compared to J-hooks. In the study, circle hooks were most likely to hook in the jaw (83 percent of the time) while J-hooks most commonly hooked in the throat (33 percent of the time) or gut (27 percent of the time). J-hooks only hooked in the jaw of shortfin mako sharks 20 percent of the time. Jaw-hooking is correlated with increased odds of post release survival. For these and other reasons (*e.g.,* endangered species interactions), NMFS prefers this alternative. In addition, circle hooks are already required by HMS permitted commercial and recreational, except for north of 41°43′ N latitude (near Chatham, Massachusetts), fishermen.

While NMFS recognizes the State of Georgia's concern regarding enforceability, circle hooks have been required by HMS recreational permit holders since January 1, 2018, and other states, such as the State of New York, also requires the use of circle hooks when fishing for sharks. In Amendment 5b to the 2006 Consolidated HMS FMP, NMFS required the use of non-offset, non-stainless steel circle hooks by HMS recreational permit holders with a shark endorsement when fishing for sharks recreationally, except when fishing with flies or artificial lures, in federal waters south of 41°43′ N latitude (near Chatham, Massachusetts). The final preferred Alternative (Alternative B9) would remove this line and require circle hooks when fishing recreationally for sharks in all areas, except when fishing with flies or artificial lures.

Comment 17: NMFS received a comment inquiring whether the new MRIP estimates would impact this rulemaking or future stock assessment.

Response: Recently, NMFS released new MRIP effort and catch estimate time series following the implementation of the new Fishing Effort Survey (FES) designed for the collection of private boat and shore-based fishing effort data, and its calibration with the data collected by the historic Coastal Household Telephone Survey (CHTS). The implications of the revised estimates on all managed species will not be fully understood for several years until they make their way through the rigorous scientific stock assessment process. In the coming years, the new and revised data will be incorporated into stock assessments at the domestic and international level as appropriate. However, NOAA Fisheries' primary source of recreational catch data for shortfin mako sharks is the Large Pelagic Survey (LPS) which does not rely on the FES, and as a result the estimates generated by the LPS used in this rulemaking have not changed.

Comment 18: NMFS received a comment stating that banning tournament fishing for sharks would help to end overfishing, and that NMFS would be justified in doing so on the grounds that tournament awards add a commercial component to what is supposed to be a recreational fishery. The commenter also stated that recreationally harvested fish should only be used for personal consumption, and not monetized.

Response: While tournaments do make up a significant portion of the recreational shark fishery, NMFS is not in favor of prohibiting shark tournaments as a means to address overfishing of shortfin mako sharks for a number of reasons. First, tournaments can provide significant economic benefits to the coastal communities in which they are held. Second, banning tournament or sport fishing while still allowing recreational harvest would constitute an inequitable access of the resource to the problem of overfishing between tournament and non-tournament recreational fishermen, and would set a precedent that would conflict with the management of other U.S. fisheries. Retention of HMS, including shortfin mako sharks submitted for weigh-in to tournaments, is authorized under the regulations by the permitted vessel that caught the fish. Even in cases where anglers donate their fish to the tournament, the tournament is not allowed to sell the fish, but may only donate the fish for human consumption to food banks or other charities.

For HMS fisheries, most tournament participants hold recreational permits or commercial permits that only allow for recreational landings of sharks when used during a registered HMS tournament. None of these participants are allowed to sell their catch. Many commercial businesses are associated with recreational fisheries including for-hire vessels, bait and tackle shops, and fishing guides. Like tournaments, all of these operations service recreational anglers. The distinction between recreational and commercial fishing lies solely in whether the fish themselves are sold commercially, not in whether a business associated with an activity is providing a commercial service. Many shark tournaments are already moving to catch-and-release formats, or are shying away from targeting shark species that are not widely considered to be edible.

Comment 19: NMFS received support and opposition for the preferred alternative of no action Alternative C1. Some commenters along with the Commonwealth of Massachusetts, State of Georgia, and South Atlantic Fishery Management Council supported the preferred alternative since it would not add any additional reporting requirements for fishermen. However, commenters also were concerned that some registered HMS tournaments are currently not required to report their catches of all HMS. Some commenters opposed the preferred alternative since it would create inconsistency with the SCRS advice to gather more data and information on shortfin mako sharks and therefore would negatively impact science and stock assessments. Some individuals along with the Mid-Atlantic Fishery Management Council suggested that NMFS should implement mandatory reporting for all recreationally landed and discarded shortfin mako sharks. The Mid-Atlantic

Fishery Management Council stated that it is imperative to collect data from commercial and recreational fishermen on landings and discards. Other commenters would like equivalent monitoring and accountability requirements for all U.S. HMS fisheries, and to fully and accurately account for all sources of fishing mortality.

Response: There are already a number of reporting requirements under current HMS regulations for commercial and recreational fishermen fishing for shortfin mako sharks. HMS commercial fishermen report shortfin mako shark catches through vessel logbooks along with dealer reporting of landings. Under Alternative C1, HMS recreational anglers fishing from Maine to Virginia would continue to be required to report shortfin mako shark landings and releases if intercepted by the LPS, and data would continue to be collected on shortfin mako shark catches by the APIS, which is part of MRIP. As of January 1, 2019, all registered HMS tournaments will be selected for tournament reporting, which should account for a significant component of recreational shortfin mako shark landings (83 FR 63831; December 12, 2018). In addition, most for-hire vessels fishing in the federal waters in the Mid-Atlantic area (New York to New Carolina) are currently required by the Mid-Atlantic Fishery Management Council to submit electronic vessel trip reports for all their trips within 24 hours, thus providing another major data stream for shortfin mako shark landings. These current reporting systems will allow NMFS to effectively monitor the recreational harvest of the stock using a combination of traditional intercept surveys, tournament reporting, and electronic reporting making the implementation of mandatory 24-hour reporting unnecessary at this time.

NMFS understands that some constituents do not think there is equitable reporting across HMS fisheries; however, the current reporting systems mentioned above should account for all sources of fishing mortality for shortfin mako sharks. NMFS will continue to monitor the landings by commercial and recreational fishermen to determine if the current reporting systems are sufficiently accounting for shortfin mako shark mortality.

Comment 20: NMFS received a comment in support of requiring mandatory reporting with vessel monitoring systems (VMS) if it would simplify commercial fishermen's reporting burden, improve the reporting of HMS catches across all gears, and improve scientific data. The commenters were not supportive of the alternative that would create another unnecessary burden on commercial fishermen.

Response: NMFS agrees that requiring mandatory reporting of shortfin mako sharks via VMS could potentially, and unnecessarily, increase burden to HMS commercial vessels that already report in other ways (vessel logbooks, dealer reports of landings, and electronic monitoring system) that are sufficient reporting systems for improving data collection for shortfin mako sharks. In addition, given the current reporting requirements for all HMS commercial vessels that already enable inseason monitoring and management of shortfin mako sharks, NMFS did not prefer this alternative at this time. Furthermore, NMFS is already implementing electronic HMS logbooks on a voluntary basis to improve the timeliness of reporting, and provide data for management.

Comment 21: NMFS received support and opposition for the preferred alternative. Some commenters along with the Commonwealth of Massachusetts, the State of Georgia, and the South Atlantic and Mid-Atlantic Fishery Management Councils supported the preferred alternative to develop an international rebuilding plan with ICCAT to assist with rebuilding the stock and work with other countries to implement international management measures. A commenter who opposed the preferred alternative wants NMFS to implement a domestic rebuilding plan along with the international plan, while other commenters prefer that NMFS wait until ICCAT takes further action before finalizing the rebuilding plan.

Response: North Atlantic shortfin mako shark distribution spans a large portion of the North Atlantic Ocean basin and many countries besides the United States interact with the species. Therefore, NMFS believes that addressing overfishing and preventing an overfished status can only effectively be accomplished through international efforts where other countries that have large landings of shortfin mako sharks actively and equitably participate in mortality reduction and rebuilding plan discussions. Because of the small U.S. contribution to North Atlantic shortfin mako shark mortality, domestic reductions of shortfin mako shark mortality alone would not end overfishing of the entire North Atlantic stock. For these reasons and for the reasons described in response to comment 3 above, NMFS prefers Alternative D3, which would establish the foundation for developing an international rebuilding plan for shortfin mako sharks.

Comment 22: NMFS received a comment in support of the alternative to remove shortfin mako sharks from the pelagic shark management group and establish a separate management group with quota for the species.

Response: At this time, NMFS does not prefer a shortfin mako shark-specific quota. ICCAT Recommendation 17–08 did not include individual country allocations for shortfin mako sharks upon which to base a domestic quota. It is also not clear that a quota would adequately protect the stock by reducing mortality because quotas allow for sharks that are live at haulback to be landed. Also, it is difficult at this time to determine if setting a species-specific quota for shortfin mako sharks would have positive ecological benefits for the stock, as this scenario was not explored in the stock assessment. A species-specific quota for shortfin mako sharks would require authorized fishermen to discard all shortfin mako sharks once the quota is reached, potentially leading to an increase in regulatory discards, which would not result in decreased mortality of shortfin mako sharks and thus, contribute to the health of the stock. Additionally, commercially, shortfin mako sharks are most often caught with pelagic longline gear incidental to other target catch. Since shortfin mako sharks are rarely targeted, establishing a shortfin mako shark quota is unlikely to stop incidental fishing mortality.

NMFS believes that ending overfishing and preventing an overfished status would be better accomplished through the measures preferred in final Amendment 11 and through further critical international efforts where other countries that have large landings of shortfin mako sharks could participate in mortality reduction discussions instead of a species-specific quota within the U.S. fisheries. NMFS will continue to monitor progress in the international forum and the needs of the stock, as well as whether this action has its intended effect, and will consider whether additional measures are appropriate in the future.

Comment 23: NMFS received a comment in support of the alternative to establish bycatch caps for all fisheries that interact with shortfin mako sharks. Specifically, the commenter noted that NMFS should count the number of shortfin mako sharks caught in all fisheries, cap the number of shortfin mako sharks that can be caught, and implement accountability measures to control, track, and limit the number of shortfin mako sharks that are killed in each fishery.

Response: At this time, NMFS does not prefer bycatch caps for all fisheries that interact with shortfin mako sharks. NMFS has reviewed all data available and found that shortfin mako sharks are primarily caught in HMS fisheries with pelagic longline gear when commercial fishermen are harvesting swordfish and tuna species, and with rod and reel gear when recreational fishermen are targeting sharks or other HMS. The species is rarely caught in other fisheries or with other gear types. To the extent they are, the final preferred commercial alternative, Alternative A7, limits any landing to shortfin mako sharks that are dead at haulback. Because shortfin mako sharks are rarely seen in fisheries other than the ones listed, establishing bycatch caps in non-pelagic longline or non-recreational handgear fisheries is unlikely to provide additional protection. As ICCAT has not established an overall TAC for shortfin mako sharks, it is difficult to determine at what level NMFS would establish a bycatch cap. Given that shortfin mako sharks are rarely caught on these other gear types, a bycatch cap would be unlikely to change fishing behavior or result in sufficient ecological benefits that compensate for administrative and regulatory burden. However, if shortfin mako shark interactions increase in those fisheries, which would then indicate fishing behavior has changed in some form, then NMFS may consider additional measures such as establishing a bycatch cap in these fisheries in the future.

Comment 24: NMFS received a comment suggesting that we increase the minimum recreational size limit for porbeagle sharks.

Response: This comment is beyond the scope of this rulemaking. The purpose of Amendment 11 is to develop and implement management measures that would address overfishing and take steps towards rebuilding the North Atlantic shortfin mako shark stock. The most recent stock assessment for porbeagle sharks indicated that the stock was overfished, but overfishing was no longer occurring, and showing signs of early rebuilding. At this time, NMFS does not have any new scientific information to justify increasing the minimum recreational size limit for porbeagle sharks.

Changes From the Proposed Rule (83 FR 35590; July 27, 2018)

This section explains the changes in the regulatory text from the proposed rule to the final rule. Some changes were made in response to public comment, and others clarify text for the final rule. The changes from the proposed rule text in the final rule are described below.

1. § 635.20(e)(2) and (e)(6). Modification to the Recreational Minimum Size Limit for Shortfin Mako Sharks

This final rule implements separate size limits for male (71 inches FL) and female (83 inches FL) shortfin mako sharks under Alternative B2 as opposed to the single size limit of 83 inches FL (Alternative B3) that was preferred in the proposed rule and implemented in the emergency interim final rule. NMFS decided to change the preferred alternative due to public comment and updated data on the effects of the emergency interim final rule measure on estimated landings and directed effort for shortfin mako sharks in the recreational fishery. The minimum sizes in the final rule also directly match the measures in the ICCAT recommendation, which provided different minimum sizes for males and females.

For the emergency interim rule and the proposed rule, NMFS assumed in the recreational analyses that directed effort for shortfin mako sharks would not change as a result of a change in the minimum retention size, but the 2018 LPS data found that effort actually went down substantially. Thus, NMFS now understands the estimates of expected landings reductions in the earlier actions to be overly conservative. Furthermore, public comment reflected that fewer recreational trips were taken due to the larger minimum size limit and reduced likelihood of catching and landing a shortfin mako shark above the size limit. Thus, in the final rule, it is appropriate to reduce the minimum size limit for males to 71 inches FL, consistent with the ICCAT recommendation. The minimum size for female mako sharks will remain at 83 inches FL.

The differing minimum size limits in the preferred alternative are expected to achieve the needed reduction in landings and fishing mortality while protecting reproductive-age female shortfin mako sharks, but with fewer socio-economic impacts to recreational fishermen. By reducing the minimum size for retaining male shortfin mako sharks, fishermen may more frequently harvest smaller, mature male sharks instead of the larger female sharks, which will leave more female sharks that are critical to reproduction of the stock in the population. This approach, which reduces fishing pressure on the female spawning stock, is consistent with general scientific advice about sharks. (Cortes 2002, Chapple and Botsford 2013).

According to length composition information from the LPS from 2012 through 2017, this final action would reduce the number of recreational landings of male shortfin mako sharks by up to 47 percent and female shortfin mako sharks by up to 78 percent for an average reduction in total morality of 65 percent, if fishing effort for shortfin mako sharks were to remain the same. However, the reduction in landings under this alternative is likely to be somewhat greater than that because recreational fishermen likely will continue taking fewer trips targeting shortfin mako sharks as a result of the changes in size limits. Effort data collected via the LPS suggests that in 2018 there was a large reduction in directed fishing trips targeting shortfin mako sharks under the 83-inch FL size limit implemented by the emergency interim final rule compared to the previous six-year average. Directed trips in the LPS region (Maine to Virginia) for shortfin mako sharks from June through August 2018 declined an estimated 34 percent compared to the six-year average from 2012 through 2017. This reduction in directed trips resulted in greater than projected reductions in shortfin mako shark landings. The June through August time period traditionally accounts for over 90 percent of directed trips for shortfin mako sharks. Based on the LPS data from 2012 through 2017, shortfin mako sharks were the primary target species in approximately 67 percent of trips that caught and 75 percent of trips that landed the species. As such, a reduction in directed fishing effort could substantially reduce the landings expected under this alternative, while achieving the needed fishing mortality reductions in conjunction with other measures in the final rule.

As explained above in the comment and response section, such reductions in fishing effort should result in landings reductions that more closely result in the ICCAT reduction target of 72 to 79 percent than those that would have resulted from the single 83-inch FL size limit (Alternative B3), which resulted in greater reductions. Thus, NMFS is implementing two separate size limits for shortfin mako sharks.

Public comment reflects that some people are concerned about the ability of recreational shark anglers to differentiate between male and female sharks. NMFS is adding information on how to distinguish the sex of sharks in shark outreach materials, including the Shark Endorsement educational video that all HMS permit holders must watch if they wish to receive a shark endorsement needed to retain sharks recreational.

2. §§ 635.21(a)(4), (c)(1), (d)(5), and (g)(6); 635.24(a)(4); and 635.71(d)(27) and (d)(28). Modification to Authorized Commercial Gear To Retain Shortfin Mako Sharks

The commercial measure preferred in the proposed rule (Alternative A2) only allowed the retention of shortfin mako sharks that were dead at haulback by vessels with a functioning electronic monitoring system on board the vessel. While the proposed measure did not limit the gear types that could be used to catch and retain dead shortfin mako sharks, the requirement to have an electronic monitoring system installed effectively limited the measure to pelagic longline vessels since those vessels are already required to have electronic monitoring systems. In response to public comments, NMFS reviewed the available data for shortfin mako shark interactions by vessels that use bottom longline and gillnet gear. Available data indicates that allowing fishermen to retain dead shortfin mako sharks caught in bottom longline or gillnet gear is unlikely to impact the overall mortality or harvest totals, since these gear types rarely interact with the species. Specifically, commercial shark fishermen using bottom longline or gillnet gear rarely, if ever, catch shortfin mako sharks. Since 2012, only six shortfin mako shark were observed in the bottom longline shark fishery and 34 were observed in the gillnet shark fishery. ICCAT Recommendation 17–08 allows retention of shortfin mako sharks that are dead at haulback without the verification of electronic monitoring or observers in certain limited circumstances, including for vessels under 12 meters. Most vessels that have a shark LAP and use bottom longline or gillnet gear have vessel lengths that are below 12 meters. In 2017, bottom longline vessels that interacted with sharks (based on coastal fisheries and HMS logbook reports) averaged 11.4 meters in length. In 2017, gillnet vessels that interacted with sharks (based on coastal fisheries and HMS logbook reports) averaged 9.6 meters in length. Thus, given past rulemakings and given the length of most vessels that target sharks, allowing landings of dead shortfin mako sharks by these other gear types is appropriate and consistent with ICCAT Recommendation 17–08. As a result, in the final rule, NMFS will allow for the retention of shortfin mako sharks that are dead at haulback by properly-permitted vessels that are fishing with bottom longline or gillnet gear even if they do not have a functioning electronic monitoring system on board. The changes in the regulatory text specifies that vessels with bottom longline or gillnet gear onboard must release all live shortfin mako sharks.

3. § 635.22(c)(1) and (c)(7). Modifications Regarding Atlantic HMS Charter/Headboat, Atlantic Tunas General Category, and Swordfish General Commercial Permit Holders

Based on public comment, NMFS is clarifying how the recreational limits would apply to the few individuals who hold a commercial shark vessel permit in addition to one of a variety of other vessel permits, such as HMS Charter/Headboat, that allow for recreational landings of sharks under certain circumstances. These individuals generally fish with rod and reel or other handgear as opposed to pelagic longline, bottom longline, or gillnet gear. While they hold a commercial shark permit, for the most part, these individuals are fishing for sharks recreationally. However, under the combination of measures in the proposed rule, these individuals would not be allowed to land any shortfin mako sharks as they would not have the electronic monitoring equipment required under the proposed commercial measures. For the sake of clarity and in response to public comment, this rule specifies that the recreational shark requirements, including the no sale requirement, apply for these individuals when shortfin mako sharks are onboard.

Classification

Pursuant to the Magnuson-Stevens Act, the NMFS Assistant Administrator has determined that the final rule is consistent with the 2006 Consolidated HMS FMP and its amendments, other provisions of the Magnuson-Stevens Act, ATCA, and other applicable law.

The Assistant Administrator for Fisheries, NOAA, finds good cause to waive the 30-day delay in effective date under 5 U.S.C. 553(d)(3) of the Administrative Procedure Act. Delaying the effectiveness of these regulations could undermine the purpose of this action to put in place measures to address overfishing of shortfin mako sharks. Similar measures were originally implemented by emergency interim final rule under Section 305(c) of the Magnuson-Stevens Act, and have been in place for since March 2018. The emergency measures will expire on March 3, 2019, and a lapse in these measures would be confusing to the regulated community, complicate enforcement efforts, and potentially harm the long-term sustainability of the stock. While NMFS originally timed the rulemaking to allow for a delay in effectiveness, a lapse in government appropriations resulted in a government shutdown for 35 days in December 2018–January 2019. If these measures are not implemented before the emergency rule expires, technically the management measures for the stock would revert to those that existed prior to the emergency rule. This means the recreational minimum size limit for shortfin mako sharks would revert to 54 inches FL, the use of circle hooks by recreational fishermen would not be required across the range of the species stock, and commercial fishermen would no longer be required to release shortfin mako sharks that are alive at haulback. This would be confusing for the regulated community, which would then be required to switch to the new regulations only 30 days later. In the event of a short lapse between the emergency rule and implementation of this final rule, NMFS would notify the regulated community of the situation and encourage voluntary compliance with the emergency rule measures for consistency but compliance would not be assured. Thus, the need to implement these measures in a timely manner to reduce the risk of overfishing shortfin mako sharks constitute good cause to make the rule effective immediately upon publication in the **Federal Register**. Furthermore, prior to the release of this final rule, on December 14, 2018, NMFS published a notice of availability of the Final EIS supporting this action, thereby providing the public and affected entities prior notice of the final measures contained in this rule.

This final rule has been determined to be not significant for purposes of Executive Order 12866. The Agency has consulted, to the extent practicable, with appropriate state and local officials to address the principles, criteria, and requirements of Executive Order 13132.

In compliance with section 604 of the Regulatory Flexibility Act (RFA), NMFS prepared a Final Regulatory Flexibility Analysis (FRFA) for this final rule. The FRFA analyzes the anticipated economic impacts of the final actions and any significant economic impacts on small entities. The FRFA is below.

Section 604(a)(1) of the RFA requires a succinct statement of the need for and objectives of the rule. Consistent with the provisions of the Magnuson-Stevens Act and ATCA, NMFS plans to modify the 2006 Atlantic HMS FMP in response to ICCAT Recommendation 17–08 and the stock status determination for shortfin mako sharks. NMFS has identified the following objectives with regard to this action: Address overfishing of shortfin mako sharks; take steps towards rebuilding; establish the foundation for rebuilding the North Atlantic shortfin mako stock; and modify the 2006 Consolidated HMS FMP in response to ICCAT Recommendation 17–08 and the stock status determination for shortfin mako sharks.

Section 604(a)(2) requires a summary of significant issues raised by public comment in response to the IRFA and a summary of the assessment of the Agency of such issues, and a statement of any changes made in the rule as a result of such comments. NMFS did not receive any comments specifically on the IRFA, however the Agency did receive some comments regarding the anticipated or perceived economic impact of the rule. Summarized public comments and the Agency's responses to them are included above. We did not receive any comments from the Chief Counsel for Advocacy of the Small Business Administration in response to the proposed rule or the IRFA.

Section 604(a)(4) of the Regulatory Flexibility Act requires Agencies to provide an estimate of the number of small entities to which the rule would apply. The Small Business Administration (SBA) has established size criteria for all major industry sectors in the United States, including fish harvesters. Provision is made under SBA's regulations for an agency to develop its own industry-specific size standards after consultation with SBA Office of Advocacy and an opportunity for public comment (see 13 CFR 121.903(c)). Under this provision, NMFS may establish size standards that differ from those established by the SBA Office of Size Standards, but only for use by NMFS and only for the purpose of conducting an analysis of economic effects in fulfillment of the agency's obligations under the RFA. To utilize this provision, NMFS must publish such size standards in the **Federal Register** (FR), which NMFS did on December 29, 2015 (80 FR 81194, December 29, 2015). In this final rule, effective on July 1, 2016, NMFS established a small business size standard of $11 million in annual gross receipts for all businesses in the commercial fishing industry (NAICS 11411) for RFA compliance purposes. NMFS considers all HMS permit holders to be small entities because they had average annual receipts of less than $11 million for commercial fishing. The Small Business Administration (SBA) has established size standards for all other major industry sectors in the U.S., including the scenic and sightseeing transportation (water) sector (NAICS code 487210, for-hire), which includes charter/party boat entities. The Small Business Administration (SBA) has defined a small charter/party boat entity as one with average annual receipts (revenue) of less than $7.5 million.

Regarding those entities that would be directly affected by the recreational management measures, HMS Angling (Recreational) category permits are typically obtained by individuals who are not considered businesses or small entities for purposes of the RFA because they are not engaged in commercial business activity. Vessels with the HMS Charter/Headboat category permit can operate as for-hire vessels. These permit holders can be regarded as small entities for RFA purposes (*i.e.,* they are engaged in the business of fish harvesting, are independently owned or operated, are not dominant in their field of operation, and have average annual revenues of less than $7.5 million). Overall, the recreational alternatives would have impacts on the portion of the 3,635 HMS Charter/Headboat permit holders who hold a shark endorsement. There were also 287 registered HMS tournaments in 2017, which could be impacted by this rule. Of those registered HMS tournaments, 75 had awards or prizes for pelagic sharks.

Regarding those entities that would be directly affected by the preferred commercial management measures, the average annual revenue per active pelagic longline vessel is estimated to be $187,000 based on the 170 active vessels between 2006 and 2012 that produced an estimated $31.8 million in revenue annually. The maximum annual revenue for any pelagic longline vessel between 2006 and 2016 was less than $1.9 million, well below the NMFS small business size standard for commercial fishing businesses of $11 million. Other non-longline HMS commercial fishing vessels generally earn less revenue than pelagic longline vessels. Therefore, NMFS considers all Atlantic HMS commercial permit holders to be small entities (*i.e.,* they are engaged in the business of fish harvesting, are independently owned or operated, are not dominant in their field of operation, and have combined annual receipts not in excess of $11 million for all its affiliated operations worldwide). The preferred commercial alternatives would apply to the 280 Atlantic tunas Longline category permit holders, 220 directed shark permit holders, and 268 incidental shark permit holders. Of these 280 permit holders, 88 pelagic longline vessels were actively fishing in 2017 based on logbook records. Based on HMS and Coastal Fisheries Logbook data, an average of 20 vessels per year that used gear other than pelagic longline gear interacted with shortfin mako sharks between 2015 and 2017.

NMFS has determined that the preferred alternatives would not likely directly affect any small organizations or small government jurisdictions defined under RFA, nor would there be disproportionate economic impacts between large and small entities. Furthermore, there would be no disproportionate economic impacts among the universe of vessels based on gear, home port, or vessel length.

Section 604(a)(5) of the RFA requires agencies to describe any new reporting, record-keeping and other compliance requirements. The action does not contain any new collection of information, reporting, or record-keeping requirements.

Section 604(a)(6) of the RFA requires agencies to describe the steps taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected. Alternative A1, the No Action alternative, would keep the non-emergency rule regulations for shortfin mako sharks. Once the emergency rule for shortfin mako sharks expires, management measures would revert back to those effective before March 2018 (*e.g.,* no requirement to release shortfin mako sharks that are alive at haulback). Directed and incidental shark LAP holders would continue to be allowed to land and sell shortfin mako sharks to an authorized dealer, subject to current limits, including the pelagic shark commercial quota. Short-term direct economic impacts on small entities would likely be neutral since commercial fishermen could continue to catch and retain shortfin mako sharks at a similar level and rate as the status quo.

In recent years, about 181,000 lb dw of shortfin mako sharks have been landed and the commercial revenues from shortfin mako sharks have averaged approximately $373,000 per year, which equates to approximately 1 percent of overall HMS ex-vessel revenues. Approximately 97.5 percent of shortfin mako commercial landings, based on dealer reports, were made by pelagic longline vessels. There were 88 pelagic longline vessels that were active in 2017 based on logbook reports. Therefore, the average revenue from shortfin mako shark landings per pelagic longline vessel is $4,133 per year.

Even though pelagic longline gear is the primary commercial gear used to land shortfin mako sharks, other gear types also interact with this species. Based on HMS and Coastal Fisheries Logbook data, an average of 20 vessels per year that used gear other than pelagic longline gear interacted with shortfin mako sharks between 2015 and 2017. Therefore, these vessels that used gear other than pelagic longline gear landed an average of only $933 worth of shortfin mako sharks per year.

Under Alternative A2, retention of shortfin mako sharks would only be allowed if the following three criteria are met: (1) The vessel has been issued a Directed or Incidental shark LAP, (2) the shark is dead at haulback, and (3) there is a functional electronic monitoring system on board the vessel. This alternative is designed to be consistent with one of the limited provisions allowing retention of shortfin mako sharks under ICCAT Recommendation 17–08. Under the current HMS regulations, all HMS permitted vessels that fish with pelagic longline gear are already required to have a functional electronic monitoring system (79 FR 71510; December 2, 2014) and either a Directed or an Incidental shark LAP. Vessels utilizing other gear types (*i.e.,* gillnet or bottom longline) are not required to have an electronic monitoring system under current regulations but could choose to install one if the operator wishes to retain shortfin mako sharks that are dead at haulback and if the vessel holds a commercial shark LAP. Under this alternative, the electronic monitoring system would be used to verify and ensure that only shortfin mako sharks dead at haulback were retained.

This alternative would be consistent with ICCAT Recommendation 17–08 and would reduce the number of landings by pelagic longline vessels on average by 74 percent based on observer data from 2012–2017. A 74 percent reduction in shortfin mako landings would reduce revenues by an average of $3,058 per vessel for the 88 activate pelagic longline vessels and would eliminate all of the $933 in landing per vessel by the 10 non-pelagic longline vessels that landing shortfin mako sharks since those vessels are unlikely to have electronic monitoring systems currently installed. Those non-pelagic longline vessels would need to pay to install electronic monitoring systems if they wish to retain shortfin mako sharks, introducing an additional expense for those vessels if it there were an economic incentive for those vessels to try to retain shortfin mako sharks under this alternative. Overall, this alternative would have minor economic costs on small entities because these measures would reduce the number of shortfin mako sharks landed and sold by these fishing vessels. However, shortfin mako sharks are rarely a target species and are worth less than other target species. Although this alternative was preferred at the DEIS stage, NOAA Fisheries now prefers Alternative A7 which is a slightly modified version of Alternative A2. Because Alternative A7 is responsive to public comment while still meeting management goals, NOAA Fisheries no longer prefers Alternative A2.

Alternative A3 is similar to Alternative A2 except that the ability to retain dead shortfin mako sharks would be limited to permit holders that opt in to a program that would use the existing electronic monitoring systems, which are currently used in relation to the bluefin tuna IBQ program, also to verify the disposition of shortfin mako sharks at haulback. In other words, this alternative would allow for retention of shortfin mako sharks that are dead at haulback by persons with a Directed or Incidental shark LAP only if permit holders opt in to enhanced electronic monitoring coverage. If the permit holder does not opt in to the enhanced electronic monitoring coverage, they could not retain any shortfin mako sharks.

The economic impacts to small entities under this alternative are expected to be similar to those under Alternative A2. Under this alternative, a portion of the pelagic longline fleet could opt out of any retention of shortfin mako sharks, resulting in a greater reduction in overall shark ex-vessel revenue for those vessels. Overall, the socioeconomic impacts associated with these reductions in revenue are not expected be substantial, as shortfin mako sharks comprise less than one percent of total HMS ex-vessel revenues on average. Non-pelagic longline vessels would need to pay to install electronic monitoring systems if they wish to retain shortfin mako sharks, introducing an additional expense for those vessels. Due to the low commercial value of shortfin mako sharks and the high cost of electronic monitoring it is reasonable to expect that these fisheries will not install cameras and therefore will not retain shortfin mako sharks. Overall, this alternative would have minor economic costs on small entities by reducing the number of shortfin mako sharks landed and sold.

Alternative A4 would establish a commercial minimum size of 83 inches FL (210 cm FL) for retention of shortfin mako sharks caught incidentally during fishing for other species, whether the shark is dead or alive at haulback. Based on observer data, only 8 percent of shortfin mako sharks are caught with pelagic longline gear greater than 83 inches FL. Thus, restricting fishermen to retaining 8 percent of shortfin mako sharks would represent a considerable reduction in number of shortfin mako sharks landed and in the resulting ex-vessel revenue. A 92 percent reduction in shortfin mako landings would reduce annual revenues by an average of $3,802 per vessel for the 88 activate pelagic longline vessels and would reduce annual revenues by an average of $858 per vessel for the 10 non-pelagic longline vessels that land shortfin mako sharks. However, the overall economic impacts associated with these reductions in revenue are not expected be substantial, as shortfin mako sharks comprise less than one percent of total HMS ex-vessel revenues on average. Additionally, the magnitude of shortfin mako landings by other gear types (*e.g.,* bottom longline, gillnet, handgear) is very small. Overall, this alternative would have minor economic impacts on small entities because these measures would reduce the number of shortfin mako sharks landed and sold by these fishing vessels, however, shortfin mako sharks are rarely a target species and are worth less than other more valuable target species.

Alternative A5 would allow fishermen to retain shortfin mako sharks caught on any commercial gear (*e.g.,* pelagic longline, bottom longline, gillnet, handgear) provided that an observer is on board that can verify that the shark was dead at haulback. Under this alternative, electronic monitoring would not be used to verify the disposition of shortfin mako sharks caught on pelagic longline gear, but instead pelagic longline vessels could only retain shortfin mako sharks when the sharks are dead at haulback and an observer is on board.

Since only five percent of pelagic longline gear trips are observed, this alternative would result in a 95 percent reduction in the number of shortfin mako sharks retained on pelagic longline gear. A 95 percent reduction in shortfin mako landings would reduce annual revenues by an average of $3,926 per vessel for the 88 activate pelagic longline vessels and would reduce annual revenues by an average of $886 per vessel for the 10 non-pelagic longline vessels that land shortfin mako sharks. However, the overall economic impacts associated with these reductions in revenue are not expected be substantial, as shortfin mako sharks comprise less than one percent of total HMS ex-vessel revenues on average. Additionally, the magnitude of shortfin mako landings by other gear types (*e.g.,* bottom longline, gillnet, handgear) is very small. Overall, this alternative would have minor economic costs on small entities because these measures would reduce the number of shortfin mako sharks landed and sold by these fishing vessels, however, shortfin mako sharks are rarely a target species and are worth less than other more valuable target species. Compared to the preferred Alternative A7, this alternative would place more restrictive limits on fishermen using pelagic longline, bottom longline, and gillnet gear. Observers are only occasionally on board vessels, so limiting the retention of shortfin mako sharks to trips with an observer would reduce the opportunity to retain dead individuals. The reduced opportunity to retain dead shortfin mako sharks would not reduce fishing mortality on the stock. Therefore, NMFS does not prefer this alternative at this time.

Alternative A6 would place shortfin mako sharks on the prohibited sharks list to prohibit any catch or retention of shortfin mako sharks in commercial HMS fisheries. In recent years, about 181,000 lb dw of shortfin mako sharks have been landed and the commercial revenues from shortfin mako sharks have averaged approximately $373,000 per year, which equates to approximately one percent of overall HMS ex-vessel revenues. That revenue would be eliminated under this alternative. Approximately 97.26 percent of shortfin mako commercial landings, based on dealer reports, were made by pelagic longline vessels. There were 88 pelagic longline vessels that were active in 2017 based on logbook reports. Therefore, the average loss in annual revenue from shortfin mako shark landings per pelagic longline vessel would be $4,133 per year. The average loss in annual revenue from shortfin mako shark landings for vessel using other gear types would be $933 per year. However, the overall economic impacts associated with these reductions in revenue are not expected be substantial, as shortfin mako sharks comprise less than one percent of total HMS ex-vessel revenues on average. Additionally, the magnitude of shortfin mako landings by other gear types (*e.g.,* bottom longline, gillnet, handgear) is very small. Overall, this alternative would have minor economic costs on small entities because these measures would reduce the number of shortfin mako sharks landed and sold by these fishing vessels, however, shortfin mako sharks are rarely a target species and are worth less than other more valuable target species. Therefore, NMFS does not prefer this alternative at this time.

Based on public comment, Alternative A7 is a new alternative in this FEIS that is a logical outgrowth of the previously-preferred Alternative A2. Under preferred Alternative A7, shortfin mako sharks caught using gillnet, bottom longline, or pelagic longline gear on properly-permitted vessels could be retained, provided they are dead at haulback. In the case of pelagic longline vessels, an electronic monitoring system would be required, but not on bottom longline of gillnet vessels.

During the public comment period, some commenters that expressed support for the DEIS preferred alternative also voiced support for expanding the ability to retain dead shortfin mako sharks should not be limited solely to the pelagic longline gear, and they felt that requiring electronic monitoring systems on small vessels essentially would effectively create such a restriction. Although the DEIS preferred alternative did not limit the ability to retain dead shortfin mako sharks to pelagic longline vessels, the requirement to install a costly electronic monitoring system to do so may have limited the measure to the pelagic longline fishery. HMS-permitted pelagic longline vessels are already required to have electronic monitoring systems on board, but vessels using other gear types are unlikely to install the costly system in order to retain shortfin mako sharks, especially considering the relatively low ex-vessel value. Thus, the practical effect of Alternative A2 could be to limit the measure to pelagic longline vessels. To address the public comments, NOAA Fisheries now prefers Alternative A7, a newly added alternative in the FEIS that is a slightly modified extension of Alternative A2. Under preferred Alternative A7, shortfin mako sharks caught using gillnet, bottom longline, or pelagic longline gear on properly-permitted vessels could be retained, provided they are dead at haulback. In the case of pelagic longline vessels, an electronic monitoring system would be required, but not on bottom longline or gillnet vessels.

This alternative would have a similar impact as Alternative A2 for pelagic longline vessels (reducing revenues by an average of $3,058 per vessel), but it would not impact the estimated 10 non-pelagic longline vessels. Therefore, it would prevent the estimated $933 in reduced landings per vessel for those non-pelagic longline vessels that would occur under Alternative A2. Allowing fishermen to retain dead shortfin mako sharks caught in bottom longline or gillnet gear is unlikely to have a large impact since these gear types rarely interact with the species. Overall, this alternative would have minor economic costs on small entities because these measures would reduce the number of shortfin mako sharks landed and sold by these fishing vessels. However, shortfin mako sharks are rarely a target species and are worth less than other more valuable target species. NMFS prefers this alternative because it achieves the objectives of the amendment and largely the same conservation benefit while easing costly requirements on small vessels and thus with less economic impact or restrictions on commercial fishermen.

While HMS Angling permit holders are not considered small entities by NMFS for purposes of the Regulatory Flexibility Act, Charter/Headboat permit holders and tournament operators are considered to be small entities and could be potentially impacted by the various recreational alternatives, as described below.

NMFS received public comment that indicated the proposed suite of measures presented in Alternatives B2 through B8 particularly restricted vessels with multiple HMS permits. These vessels generally fish with rod and reel or other handgear as opposed to pelagic longline, bottom longline, or gillnet gear. However, these vessels are part of the ICCAT fishery as they regularly target tunas, billfish, and swordfish. For the sake of clarity, we are therefore limiting them to the recreational shark requirements when shortfin mako sharks are onboard, and prohibiting them from selling any sharks when recreationally retaining shortfin mako sharks.

For these alternatives, a vessel issued both a Federal Atlantic commercial shark vessel permit under § 635.4(e) and an HMS Charter/Headboat permit with a shark endorsement under § 635.4(b) could land shortfin mako sharks in accordance with the recreational size limits under § 635.20(e), but could not retain them commercially. This will limit the ability of a small number of vessels to generate commercial revenue from sharks while landing shortfin mako sharks under the recreational size limits. In fact, there were only 35 General Category and 14 Charter/Headboat vessels with Directed or Incidental Shark permits in 2017. Between 2012 and 2017, shortfin mako sharks caught on hook and line or handline only composed less than 1 percent of commercial landings. On an individual vessel basis, a prohibition on the landing of shortfin mako sharks is unlikely to affect the profitability of a commercial charter/headboat trip or the value of a shark incidental limited access permit on the open market. Ex-vessel prices for shortfin mako sharks are only around $1.50 per pound while prices for yellowfin, bigeye, and bluefin tuna can range from $3.50 to $8.00 per pound (2017 SAFE Report). Thus, shortfin mako sharks are less valuable than target tuna species. Furthermore, other incidentally-caught sharks could still be legally retained and sold.

Similarly, a vessel issued both a Federal Atlantic commercial shark vessel permit under § 635.4(e) and an Atlantic Tunas General category permit under § 635.4(d) or a Swordfish General Commercial permit under § 635.4(f) with a shark endorsement could land shortfin mako sharks in accordance with the recreational size limits under § 635.20(e) when fishing in a registered HMS tournament § 635.4(c)(2). If a shortfin mako shark is retained by such vessels, any other shark species being retained cannot exceed the recreational retention limits under § 635.22(c) and cannot be sold.

Alternative B1, the no action alternative, would not implement any management measures in the recreational shark fishery to decrease mortality of shortfin mako sharks. This would result in no additional economic impacts on small entities associated with this fishery in the short-term.

Under Alternative B2, the preferred alternative, the minimum size limit for the retention of shortfin mako sharks would be increased from 54 inches FL to 71 inches FL for male and 83 inches FL for female shortfin mako sharks.

Under the proposed rule and Draft Amendment 11, Alternative B2 was not a preferred alternative. Instead, NMFS had preferred Alternative B3 which implemented a single size limit of 83 inches FL for all shortfin mako sharks. NMFS has decided to change that for a number of reasons including public comment, greater than estimated landings reductions under the 83 inch FL size limit implemented under the emergency interim rule, evidence of reduced directed effort for shortfin mako sharks under the emergency interim rule, and because this alternative would not increase harvest of mature female sharks compared to the 83 inch size limit implemented by the emergency interim final rule.

NMFS received a number of public comments urging the agency to adopt this alternative as the preferred alternative, and implement the size limits specified in one of the measures of the ICCAT recommendation. Commenters pointed out that the U.S. delegation had supported the recommendation, and that U.S. recreational landings consisted of less than 5 percent of total international landings of shortfin mako sharks. As such, the added reduction in landings by implementing the 83 inch FL minimum size limit for both sexes would result in a minimal reduction of total international landings while greatly impacting the U.S. recreational fishery. Furthermore, any increases in shortfin mako landings under Alternative B2 would consist solely of male sharks as the minimum size limit for female sharks would remain the same.

This increase in the minimum size limit is projected to reduce recreational landings by at least 65 percent in numbers of sharks landed, and 50 percent in the weight of sharks landed. While this alternative would not establish a shortfin mako fishing season, such a significant increase in the minimum size limit would likely result in some reduction in directed fishing effort for shortfin mako sharks. Effort data collected via the LPS suggests there has been a significant reduction in directed fishing trips targeting shortfin mako sharks compared to the five year average under the 83 inch size limit implemented by the emergency interim final rule. Estimates of directed trips for shortfin mako sharks declined by 34 percent compared to the six year average from 2012 through 2017 resulting in greater than projected reductions in shortfin mako shark landings. This time period (June through August) traditionally accounts for over 90 percent of directed trips for shortfin mako sharks. Based on the LPS data from 2012–2017, shortfin mako sharks were the primary target species in approximately 67 percent of trips that caught and 75 percent of trips that landed them. As such, a reduction in directed fishing effort could substantially reduce the landings expected under this alternative. While this alternative is unlikely to affect directed effort as significantly as the 83 inch size limit, NMFS anticipates directed effort will not fully recover to previous levels.

Under Alternative B3, the minimum size limit for retention of shortfin mako sharks would be increased to 83 inches FL for both males and female sharks consistent with the measure implemented in the emergency rule. Assuming no reduction in directed fishing effort, this increase in the minimum size limit would result in an 83 percent reduction in the number of sharks landed, and a 69 percent reduction in the weight of sharks landed. Such a large increase in the minimum size limit and associated reduction in landings is unlikely to have no effect on directed fishing effort, in fact, an approximately 34 percent reduction in directed effort was observed in the summer of 2018 following the implementation of this size limit under the emergency interim final rule. An 83 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them by about 6 percent. At least three tournaments directed at shortfin mako sharks in the Northeast chose to cancel 2018 events due to the more stringent current 83 inches FL minimum size limit. Tournaments account for over half of directed recreational trips for shortfin mako sharks, and 77 percent of them in the month of June when effort is at its highest. This could result in a substantial reduction in directed fishing trips for shortfin mako sharks, thus leading to moderate adverse economic impacts on some charter/headboats and tournament operators. NMFS no longer prefers Alternative B3 at this time as reduction in directed fishing effort following implementation of the emergency interim final rule suggests this alternative may be more restrictive than needed to achieve the reductions targets recommended by ICCAT, and could place an undue burden on the recreational fishery.

Under Alternative B4, recreational HMS permit holders would only be allowed to retain male shortfin mako sharks that measure at least 71 inches FL and female shortfin mako sharks that measure at least 108 inches FL. Assuming no reduction in directed fishing effort, this increase in the minimum size limit would result in a 77 percent reduction in the number of sharks landed. A 73 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them to approximately 9 percent. This could result in a significant reduction in directed fishing trips for shortfin mako sharks, thus leading to moderate adverse economic impacts on some charter/headboats and tournament operators.

Under Alternative B5, recreational HMS permit holders would only be allowed to retain male shortfin mako sharks that measure at least 71 inches FL and female shortfin mako sharks that measure at least 120 inches FL. Assuming no reduction in directed fishing effort, this increase in the size limit would result in a 78 percent reduction in the number of sharks landed, and a 74 percent reduction in the weight of sharks landed. A 78 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them to 8.6 percent. This could result in a significant reduction in directed fishing trips for shortfin mako sharks, thus leading to moderate adverse economic impacts on some charter/headboats and tournament operators.

Under Alternative B6a, the minimum size limit for the retention of shortfin mako sharks would be increased from 54 inches FL to 71 inches FL for male and 83 inches FL for female shortfin mako sharks, and a shortfin mako fishing season would be established from May through October. The fishing season established under this alternative would have little to no effect on shortfin mako fishing activity in the Northeast, but may reduce fishing effort in the South Atlantic and Gulf of Mexico regions; however, a lack of data on targeted trips for shortfin mako sharks in this region makes any assessment of potential socioeconomic impacts difficult. However, this combination of increase in the size limit and fishing season is projected to reduce recreational landings by at least 65 percent in numbers of sharks landed, and 50 percent in the weight of sharks landed in the Northeast. A 65 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them to 13 percent. This reduction on directed trips could lead to moderate adverse economic impacts on some charter/headboats and tournament operators. NMFS does not prefer this alternative at this time, as it is unlikely to result in significantly greater reductions in landings than the preferred alternative, Alternative B2, and could potentially result in regional inequalities in access to the recreational shortfin mako shark fishery due to difference in seasonal abundance.

Under Alternative B6b, NMFS would establish a three-month fishing season for shortfin mako sharks spanning the summer months of June through August. This season would be combined with a 71-inch FL minimum size limit for males and 100 inch minimum size FL for females. Based on estimates from the LPS, on average 475 directed trips are taken for shortfin mako sharks each September and October, representing approximately 9 percent of all annual directed trips. No registered HMS tournaments held in September and October target sharks exclusively, so it is highly unlikely this alternative would result in the rescheduling of any tournaments due to the fishing season. It is much more likely that directed fishing effort would be affected by the increases in the minimum size limits. Assuming this increase in the size limit has minimal effect on fishing effort directly towards shortfin mako sharks within the season, this combination of season and increase in the size limit should result in a 79 percent reduction in the number of sharks landed, and a 74 percent reduction in the weight of sharks landed. This reduction could result in a significant reduction in directed fishing trips for shortfin mako sharks, thus leading to moderate adverse economic impacts on some charter/headboat operators. NMFS does not prefer this alternative at this time as observed reductions in directed fishing effort following implementation of the emergency interim rule suggest this alternative may be more restrictive than is needed to meet the 72 to 79 percent reduction targets recommended by ICCAT.

Under Alternative B6c, NMFS would establish a two-month fishing season for shortfin mako sharks for the months of June and July. This season would be combined with a 71-inch FL minimum size limit for males and 90-inch minimum sizes FL for females. Based on estimates from the LPS, on average 1,264 directed trips are taken for shortfin mako sharks each August through October, representing approximately 26 percent of all annual directed trips. Only two registered HMS tournaments held in August through October target sharks exclusively, one out of New York that primarily targets thresher sharks and one out of Florida where participants fish exclusively from shore. Thus, it is highly unlikely this alternative would result in the rescheduling of any tournaments due to the fishing season. It is likely that directed fishing effort would also be affected by the increases in the minimum size limits. Assuming this increase in the size limit has minimal effect on fishing effort directly towards shortfin mako sharks within the season, this combination of season and increase in the size limit should result in a 77 percent reduction in the number of sharks landed, and a 69 percent reduction in the weight of sharks landed. Such a large increase in the size limit and associated reduction in landings is unlikely to have no effect on directed fishing effort. A 77 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them to 8 percent. This reduction in directed trips could lead to moderate adverse economic impacts on some charter/headboats and tournament operators. NMFS does not prefer this alternative at this time as observed reductions in directed fishing effort following implementation of the emergency interim rule suggest this alternative may be more restrictive than is needed to meet the 72 to 79 percent reduction targets recommended by ICCAT.

Under Alternative B6d, NMFS would establish a one-month fishing season for shortfin mako sharks for the month of June only. This season would be combined with a 71 inches FL minimum size limit for males and 83 inches FL for females. Based on estimates from the LPS, on average 2,435 directed trips are taken for shortfin mako sharks each July through October, representing approximately 52 percent of all annual directed trips. Additionally, there are seven registered HMS tournaments held in July through October that target sharks exclusively, including three of four tournaments held in the state of Rhode Island, and the only tournament in Massachusetts to target sharks exclusively. It is likely that directed fishing effort would also be affected by the increases in the minimum size limits. Assuming this increase in the size limit has minimal effect on fishing effort directly towards shortfin mako sharks within the season, this combination of season and increase in the size limit should result in an 80 percent reduction in the number of sharks landed, and a 76 percent reduction in the weight of sharks landed. Such a large increase in the size limit and associated reduction in landings is unlikely to have no effect on directed fishing effort. An 80 percent reduction in shortfin mako sharks harvested would thus reduce the percentage of directed trips harvesting them to 8 percent. This reduction in directed trips could lead to moderate adverse economic impacts on some charter/headboats and tournament operators.

Under Alternative B6e, NMFS would establish a process and criteria for determining season dates and minimum size limits for shortfin mako sharks on an annual basis through inseason actions. This process would be similar to how the agency sets season opens and retention limits for the shark commercial fisheries and the Atlantic Tunas General category fishery. NMFS would review data on recreational landings, catch rates, and effort levels for shortfin mako sharks in the previous years, and establish season dates and minimum size limits that would be expected to achieve the reduction targets established by ICCAT, and the objectives of the HMS fisheries management plan. This alternative would also allow NMFS to minimize adverse economic impacts to the HMS recreational fishery by allowing for adjustments to the season and size limits based on observed reductions and redistribution of fishing effort resulting from measures implemented in previous years. NMFS does not prefer this alternative at this time as the establishment of a shortfin mako shark fishing season has the potential to create regional inequalities in access to the fishery given its wide spatial and temporal nature as a highly migratory species. These potential inequalities would appear to be unjustified as there are alternatives available that are capable of meeting the reductions recommended by ICCAT without them.

Under Alternative B7, NMFS would implement a ''slot limit'' for shortfin mako sharks in the recreational fishery. Under a slot limit, recreational fishermen would only be allowed to retain shortfin mako sharks within a narrow size range (*e.g.,* between 71 and 83 inches FL) with no retention above or below that slot. Assuming no reduction in directed fishing effort, this alternative would be expected to result in similar reductions in landings as other alternatives analyzed here. While this alternative would not establish a shortfin mako fishing season, as described above in earlier alternatives, such a significant increase in the size limit would likely result in some reduction in directed fishing effort for shortfin mako sharks and shifting focus to other HMS species. This reduction in effort may be further exacerbated by the complicated nature of slot limits regulations. The amount of effort reduction by recreational fishermen would depend on how much HMS anglers and tournaments are satisfied to practice catch-and-release fishing for sub-legal shortfin mako sharks or shift their fishing effort to other species. NMFS does not prefer this alternative at this time as there are less complicated options available that are capable of meeting the mortality reductions recommended by ICCAT.

Under Alternative B8, NMFS would establish a landings tag requirement and a yearly limit on the number of landings tags assigned to a vessel, for shortfin mako sharks over the minimum size limit. This requirement would be expected to negatively affect fishing effort. An increase in the minimum size limit and a yearly cap on landings for vessels would reduce effort drastically, while maintaining some opportunity for the recreational fleet. This effort reduction would adversely affect the charter fleet the most by limiting the number of trips on which they could land shortfin mako sharks each year. This effort reduction may also affect their ability to book trips. At least one tournament directed at shortfin mako sharks in the Northeast chose to cancel its 2018 event due to the more stringent current 83-inch FL minimum size limit. By excluding tournaments from a landings tag requirement there may be a direct beneficial economic impact for tournaments, as this would be an additional opportunity, beyond their tags, to land shortfin mako sharks for permit holders.

Alternative B9, the preferred alternative, would expand the requirement to use non-offset, non-stainless steel circle hook by all HMS permit holders with a shark endorsement when fishing for sharks recreationally, except when fishing with flies or artificial lures, in federal waters. Currently, this requirement is in place for all federally managed waters south of 41°43′ N latitude (near Chatham, Massachusetts), but this alternative would remove the boundary line, requiring fishermen in all areas to use circle hooks. Recreational shark fishermen north of Chatham, Massachusetts would need to purchase circle hooks to comply with this requirement, although the cost is modest. Additionally, it is possible that once the circle hook requirement is expanded, fishermen in the newly impacted area could find reduced catch rates of sharks including shortfin mako sharks. If reduced catch rates are realized, effort in the recreational shark fishery, including the for-hire fleet, could be impacted by reduced number of trips or reduced demand for chartered trips.

Alternative B10 would place shortfin mako sharks on the prohibited sharks list to prohibit the retention of shortfin mako sharks in recreational HMS fisheries. HMS permit holders would be prohibited from retaining or landing shortfin mako sharks recreationally. In recreational fisheries, recreational fishermen would only be authorized to catch and release shortfin mako sharks. A prohibition on the retention of shortfin mako sharks is likely to disincentivize some portion of the recreational shark fishery, particularly those individuals that plan to target shortfin mako sharks. Businesses that rely of recreational shark fishing such as and tournament operators and charter/headboats may experience a decline in demand resulting in adverse economic impacts. NMFS does not prefer this alternative at this time as it would prohibit all retention of shortfin mako sharks in the recreational fishery. As such, Alternative B10 would create unnecessary inequalities between the commercial and recreational fishing sectors when other alternatives are available that can achieve the ICCAT recommended landings reduction in a more equitable fashion.

Alternative C1, the preferred alternative, would make no changes to the current reporting requirements applicable to shortfin mako sharks in HMS fisheries. Since there would be no changes to the reporting requirements under this alternative, NMFS would expect fishing practices to remain the same and direct economic impacts in small entities to be neutral in the short-term.

Under Alternative C2, NMFS would require vessels with a directed or incidental shark LAP to report daily the number of shortfin mako sharks retained and discarded dead, as well as fishing effort (number of sets and number of hooks) on a VMS. A requirement to report shortfin mako shark catches on VMS for vessels with a shark LAP would be an additional reporting requirement for those vessels on their existing systems. For other commercial vessels that are currently only required to report in the HMS logbook, the requirement would mean installing VMS to report dead discards of shortfin mako and fishing effort.

If a vessel has already installed a type-approved E–MTU VMS unit, the only expense would be monthly communication service fees, which it may already be paying if the vessel is participating in a Council-managed fishery. Existing regulations require all vessel operators with E–MTU VMS units to provide hail out/in declarations and provide location reports on an hourly basis at all times while they are away from port. In order to comply with these regulations, vessel owners must subscribe to a communication service plan that includes an allowance for sending similar declarations (hail out/in) describing target species, fishing gear possessed, and estimated time/location of landing using their E–MTU VMS. Given that most shortfin mako sharks are incidentally caught by pelagic longline vessels that are already required to have an E–MTU VMS system onboard, adverse economic impacts are not expected. If vessels with a shark LAP do not have an E–MTU VMS unit, direct, economic costs are expected as a result of having to pay for the E–MTU VMS unit (approximately $4,000) and a qualified marine electrician to install the unit ($400).

VMS reporting requirements under this alternative could potentially provide undue burden to HMS commercial vessels that already report on catches, landings, and discards through vessel logbooks, dealer reports, and observer reports.

Alternative C3 would implement mandatory reporting of all recreational interactions (landed and discarded) of shortfin mako sharks in HMS fisheries. Recreational HMS permit holders would have a variety of options for reporting shortfin mako shark landings including a phone-in system, internet website, and/or a smartphone app. HMS Angling and Charter/Headboat permit holders currently use this method for required reporting of each individual landing of bluefin tuna, billfish, and swordfish within 24 hours. NMFS has also maintained a shortfin mako shark reporting app as an educational tool to encourage the practice of catch-and-release. Additionally, the potential burden associated with mandatory landings reports for shortfin mako sharks would be significantly reduced under the increased minimum size limits being considered in this rulemaking, although would still represent an increased burden over current reporting requirements. While HMS Angling permit holders are not considered small entities by NMFS for purposes of the Regulatory Flexibility Act, Charter/Headboat permit holders are considered to be small entities and would be potentially impacted by this alternative.

Under Alternative D1, NMFS would not establish a rebuilding plan or the foundation for rebuilding the shortfin mako shark stock. NMFS would still implement management measures in the HMS recreational and commercial fisheries to end overfishing consistent with the Magnuson-Stevens Act and with ICCAT Recommendation 17–08 and our obligations under ATCA. There would likely be no direct short-term impact on small entities from this alternative as there would be no change in fishing effort or landings of shortfin mako sharks that would impact revenues generated from the commercial and recreational fisheries.

Under Alternative D2, NMFS would establish a domestic rebuilding plan independent of a rebuilding plan adopted by ICCAT. While such an alternative could avoid overfishing shortfin mako sharks in the United States by changing the way that the U.S. recreational and commercial fisheries operate, such a plan could not effectively rebuild the stock, since U.S. catches are only 9 percent of the reported catch Atlantic-wide. Such an alternative would be expected to cause short- and long-term direct economic impacts.

Under Alternative D3, the preferred alternative, NMFS would take preliminary action toward rebuilding by adopting measures to end overfishing to establish the foundation for a rebuilding plan. NMFS would then take action at the international level through ICCAT to develop a rebuilding plan for shortfin mako sharks. ICCAT may establish a rebuilding plan for shortfin mako sharks in 2019, and this rebuilding plan would encompass the objectives set forth by ICCAT based on scientific advice from the SCRS. This alternative would not result in any changes to the current recreational and commercial domestic regulations for shortfin mako sharks in the short-term. There would likely be no direct short-term impact on small entities from this alternative as there would be no change in fishing effort or landings of shortfin mako sharks that would impact revenues generated from the commercial and recreational fisheries. Management measures to address overfishing of shortfin mako sharks could be adopted in the future. These measures could change the way that the U.S. recreational and commercial shortfin mako shark fishery operates, which could cause long-term direct economic impacts. Any future action to implement international measures would be analyzed in a separate rulemaking.

Under Alternative D4, NMFS would remove shortfin mako sharks from the commercial pelagic shark management group and would implement a species-specific quota for shortfin mako sharks as established by ICCAT. A shortfin mako-specific quota would likely include both commercial and recreational catches, as do other ICCAT established quotas. In addition, NMFS would establish a new commercial pelagic shark species quota for common thresher and oceanic whitetip sharks based on recent landings. The 2017 ICCAT stock assessment indicated that the North Atlantic population of shortfin mako sharks is overfished and experiencing overfishing. In November 2017, ICCAT adopted management measures (Recommendation 17–08) to address the overfishing determination, but did not recommend a TAC necessary to stop overfishing of shortfin mako sharks. Therefore, it is difficult at this time to determine how setting a species-specific quota for shortfin mako sharks would affect commercial and recreational fishing operations. However, this species-specific quota may provide long-term direct, minor adverse economic impacts if ICCAT established a TAC for the United States that is well below the total average harvest by the United States (*i.e.,* 330 mt ww or 168 mt dw) or below the current annual commercial quota for common thresher, oceanic whitetip, and shortfin mako (488 mt dw) as it could potentially limit the amount of harvest for fishermen. Short-term direct socioeconomic impacts would be neutral for Alternative D4 because initially there would be no reduction in fishing effort and practices.

Under Alternative D5, NMFS would take steps to implement area-based management measures domestically if such measures are established by ICCAT. ICCAT Recommendation 17–08 calls on the SCRS to provide additional scientific advice in 2019 that takes into account a spatial/temporal analysis of North Atlantic shortfin mako shark catches in order to identify areas with high interactions. Without a specific area to analyze at this time, the precise impacts on commercial and recreational fishery operations cannot be determined. Implementing area management for shortfin mako sharks, if recommended by the scientific advice, could lead to a reduction in localized fishing effort, which would likely have adverse economic impacts for small entities that land shortfin mako sharks.

Under Alternative D6, NMFS would annually allocate a specific number of ''allowable'' dead discards of shortfin mako sharks as a bycatch cap or sub-annual catch limit (ACL) that would apply to all fisheries, not just HMS fisheries. This alternative would impact the HMS pelagic longline and shark recreational fisheries similar to Alternative D4. However, this alternative could also impact non-HMS fisheries by closing those fisheries if the bycatch cap were reached. This alternative could lead to short-term adverse impacts since the bycatch caps could close fisheries if they are reached until those fishermen could modify fishing behavior to avoid shortfin mako sharks (even in fisheries where shortfin mako sharks are rarely, if ever, seen) and reduce interactions. In the long-term, this alternative would have neutral impacts as the vessels would avoid shortfin mako sharks. The impacts to small businesses are expected to be neutral in the short and long-term as their businesses would not change.

Section 212 of the Small Business Regulatory Enforcement Fairness Act of 1996 states that, for each rule or group of related rules for which an agency is required to prepare a FRFA, the agency shall publish one or more guides to assist small entities in complying with the rule, and shall designate such publications as ''small entity compliance guides.'' The agency shall explain the actions a small entity is required to take to comply with a rule or group of rules. As part of this rulemaking process, NMFS has prepared a listserv summarizing fishery information and regulations for Atlantic shark fisheries for 2019. This listserv also serves as the small entity compliance guide. Copies of the compliance guide are available from NMFS (see **ADDRESSES**).

NMFS prepared a FEIS for this final rule that discusses the impact on the environment that would result from this rule. A copy of the FEIS is available from NMFS (see **ADDRESSES**).

List of Subjects in 50 CFR Part 635

Fisheries, Fishing, Fishing vessels, Foreign relations, Imports, Penalties, Reporting and recordkeeping requirements, Treaties.

Dated: February 15, 2019.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR part 635 is amended as follows:

PART 635—ATLANTIC HIGHLY MIGRATORY SPECIES

■ 1. The authority citation for part 635 continues to read as follows:

Authority: 16 U.S.C. 971 *et seq.;* 16 U.S.C. 1801 *et seq.*

■ 2. In § 635.2, revise definition of ''FL (fork length)'' to read as follows:

§ 635.2 Definitions.

* * * * *

FL (fork length) means the straight-line measurement of a fish from the midpoint of the anterior edge of the fish to the fork of the caudal fin. The measurement is not made along the curve of the body.

* * * * *

■ 3. In § 635.20, lift the suspension on paragraph (e)(2) and revising it and by adding paragraph (e)(6) to read as follows:

§ 635.20 Size limits.

* * * * *

(e) * * *

(2) All sharks, except as otherwise specified in paragraphs (e)(3) through (6) of this section, landed under the recreational retention limits specified at § 635.22(c)(2) must be at least 54 inches (137 cm) FL.

* * * * *

(6) For North Atlantic shortfin mako sharks landed under the recreational retention limits specified at § 635.22(c)(2), males must be at least 71 inches (180 cm) fork length, and females must be at least 83 inches (210 cm) fork length.

* * * * *

■ 4. Amend § 635.21 by:

■ a. Adding paragraphs (a)(4), (c)(1)(iv), and (d)(5);

■ b. Revising paragraphs (f)(2) and (3);

■ c. Adding paragraph (g)(6); and

■ d. Revising (k)(1) and (2).

The additions and revisions read as follows:

§ 635.21 Gear operation and deployment restrictions.

(a) * * *

(4) Any person on board a vessel that is issued a commercial shark permit must release all shortfin mako sharks, whether alive or dead, caught with any gear other than pelagic longline, bottom longline, or gillnet gear, except that any person on board a vessel that is issued a commercial shark permit in combination with a permit that has a shark endorsement may retain shortfin mako sharks subject to the recreational minimum size limits in § 635.20, the recreational retention limits in § 635.22, and authorized gear requirements in § 635.19.

* * * * *

(c) * * *

(1) * * *

(iv) Has pelagic longline gear on board, persons aboard that vessel are required to promptly release in a manner that causes the least harm any shortfin mako shark that is alive at the time of haulback. Any shortfin mako shark that is dead at the time of haulback may be retained provided the electronic monitoring system is installed and functioning in compliance with the requirements at § 635.9.

* * * * *

(d) * * *

(5) If a vessel issued or required to be issued a permit under this part has bottom longline gear on board persons aboard that vessel are required to promptly release in a manner that causes the least harm, any shortfin mako shark that is alive at the time of haulback.

* * * * *

(f) * * *

(2) A person on board a vessel that has been issued or is required to be issued a permit with a shark endorsement under this part and who is participating in an HMS registered tournament that bestows points, prizes, or awards for Atlantic sharks must deploy only non-offset, corrodible circle hooks when fishing for, retaining, possessing, or landing sharks, except when fishing with flies or artificial lures.

(3) A person on board a vessel that has been issued or is required to be issued an HMS Angling permit with a shark endorsement or an HMS Charter/Headboat permit with a shark endorsement must deploy only non-offset, corrodible circle hooks when fishing for, retaining, possessing, or landing sharks, except when fishing with flies or artificial lures.

* * * * *

(g) * * *

(6) If a vessel issued or required to be issued a permit under this part has gillnet gear onboard, persons aboard that vessel are required to promptly release in a manner that causes the least harm any shortfin mako shark that is alive at the time of haulback.

* * * * *

(k) * * *

(1) A person on board a vessel that has been issued or is required to be issued a permit with a shark endorsement under this part and who is participating in an HMS registered tournament that bestows points, prizes, or awards for Atlantic sharks must deploy only non-offset, corrodible circle hooks when fishing for, retaining, possessing, or landing sharks, except when fishing with flies or artificial lures.

(2) A person on board a vessel that has been issued or is required to be issued an HMS Angling permit with a shark endorsement or a person on board a vessel with an HMS Charter/Headboat permit with a shark endorsement must deploy only non-offset, corrodible circle hooks when fishing for, retaining, possessing, or landing, except when fishing with flies or artificial lures.

* * * * *

■ 5. In § 635.22, revise paragraph (c)(1) and add paragraph (c)(7) as follows:

§ 635.22 Recreational Retention Limits.

(c) * * *

(1) The recreational retention limit for sharks applies to any person who fishes in any manner on a vessel that has been issued or is required to have been issued a permit with a shark endorsement, except as noted in paragraph (c)(7) of this section. The retention limit can change depending on the species being caught and the size limit under which they are being caught as specified under § 635.20(e). A person on board a vessel that has been issued or is required to be issued a permit with a shark endorsement under § 635.4 is required

to use non-offset, corrodible circle hooks as specified in § 635.21(f) and (k) in order to retain sharks per the retention limits specified in this section.

* * * * *

(7) For persons on board vessels issued both a commercial shark permit and a permit with a shark endorsement, the recreational retention limit and sale prohibition applies for shortfin mako sharks at all times, even when the commercial pelagic shark quota is open. If such vessels retain a shortfin mako shark under the recreational retention limit, all other sharks retained by such vessels may only be retained under the applicable recreational retention limits and may not be sold. If a commercial Atlantic shark quota is closed under § 635.28(b), the recreational retention limit for sharks and no sale provision in paragraph (a) of this section will be applied to persons aboard a vessel issued a Federal Atlantic commercial shark vessel permit under § 635.4(e), if that vessel has also been issued a permit with a shark endorsement under § 635.4(b) and is engaged in a for-hire fishing trip or is participating in a registered HMS tournament per § 635.4(c)(2).

* * * * *

■ 6. In § 635.24, lift the suspension on paragraphs (a)(4)(i) and (iii), and revise them to read as follows:

§ 635.24 Commercial retention limits for sharks, swordfish, and BAYS tunas.

* * * * *

(a) * * *

(4) * * *

(i) Except as provided in § 635.22(c)(7), a person who owns or operates a vessel that has been issued a directed shark LAP may retain, possess, land, or sell pelagic sharks if the pelagic shark fishery is open per §§ 635.27 and 635.28. Shortfin mako sharks may be retained by persons aboard vessels using pelagic longline, bottom longline, or gillnet gear only if the shark is dead at the time of haulback and consistent with the provisions of § 635.21(c)(1), (d)(5), and (g)(6) and 635.22(c)(7).

* * * * *

(iii) Consistent with paragraph (a)(4)(ii) of this section, a person who owns or operates a vessel that has been issued an incidental shark LAP may retain, possess, land, or sell no more than 16 SCS and pelagic sharks, combined, per vessel per trip, if the respective fishery is open per §§ 635.27 and 635.28. Of those 16 SCS and pelagic sharks per vessel per trip, no more than 8 shall be blacknose sharks. Shortfin mako sharks may only be retained under the commercial retention limits by persons using pelagic longline, bottom longline, or gillnet gear, only if the shark is dead at the time of haulback and consistent with the provisions at § 635.21(c)(1), (d)(5), and (g)(6). If the vessel has also been issued a permit with a shark endorsement and retains a shortfin mako shark, recreational retention limits apply to all sharks retained and none may be sold, per § 635.22(c)(7).

* * * * *

■ 7. In § 635.30, paragraph (c)(4) is revised to read as follows:

* * * * *

(c) * * *

(4) Persons aboard a vessel that has been issued or is required to be issued a permit with a shark endorsement must maintain a shark intact through landing and offloading with the head, tail, and all fins naturally attached. The shark may be bled and the viscera may be removed.

* * * * *

■ 8. In § 635.71, revise paragraphs (d)(22), (23), (27), (28), and (29) to read as follows:

§ 635.71 Prohibitions.

* * * * *

(d) * * *

(22) Except when fishing only with flies or artificial lures, fish for, retain, possess, or land sharks without deploying non-offset, corrodible circle hooks when fishing at a registered recreational HMS fishing tournament that has awards or prizes for sharks, as specified in § 635.21(f) and (k).

(23) Except when fishing only with flies or artificial lures, fish for, retain, possess, or land sharks without deploying non-offset, corrodible circle hooks when issued an Atlantic HMS Angling permit or HMS Charter/Headboat permit with a shark endorsement, as specified in § 635.21(f) and (k).

* * * * *

(27) Retain, land, or possess a shortfin mako shark that was caught with gear other than pelagic longline, bottom longline, or gillnet gear as specified at § 635.21(a).

(28) Retain, land, or possess a shortfin mako shark that was caught with pelagic longline, bottom longline, or gillnet gear and was alive at haulback as specified at § 635.21(c)(1), (d)(5), and (g)(6).

(29) As specified at § 635.21(c)(1), retain, land, or possess a shortfin mako shark that was caught with pelagic longline gear when the electronic monitoring system was not installed and functioning in compliance with the requirements at § 635.9.

* * * * *

[FR Doc. 2019–02946 Filed 2–20–19; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 648

[Docket No. 170828822–70999–04]

RIN 0648–XG796

Fisheries of the Northeastern United States; Summer Flounder Fishery; Quota Transfer

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Temporary rule; quota transfer.

SUMMARY: NMFS announces that the State of North Carolina is transferring a portion of its 2019 commercial summer flounder quota to the State of New Jersey. This quota adjustment is necessary to comply with the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan quota transfer provisions. This announcement informs the public of the revised commercial quotas for North Carolina and New Jersey.

DATES: Effective February 20, 2019, through December 31, 2019.

FOR FURTHER INFORMATION CONTACT: Cynthia Ferrio, Fishery Management Specialist, (978) 281–9180.

SUPPLEMENTARY INFORMATION: Regulations governing the summer flounder fishery are found in 50 CFR 648.100 through 648.110. These regulations require annual specification of a commercial quota that is apportioned among the coastal states from Maine through North Carolina. The process to set the annual commercial quota and the percent allocated to each state is described in § 648.102, and the initial 2019 allocations were published on December 17, 2018 (83 FR 64482).

The final rule implementing Amendment 5 to the Summer Flounder Fishery Management Plan, as published in the **Federal Register** on December 17, 1993 (58 FR 65936), provided a mechanism for transferring summer flounder commercial quota from one state to another. Two or more states, under mutual agreement and with the concurrence of the NMFS Greater Atlantic Regional Administrator, can transfer or combine summer flounder

Atlantic States Marine Fisheries Commission

Coastal Sharks Technical Committee Call Summary

Monday April 8, 2019

Attendees: Bryan Frazier (TC Chair, SC), Donna McDonnell (GA), Angel Willey (TC Vice Chair, MD), Chris Scott (NY), Brent Winner (FL), Karyl Brewster-Geisz (NOAA HMS), Jack Musick (VA), Lee Paramore (NC), Conor McManus (RI), Julie Neer (SEDAR)
Staff: Kirby Rootes-Murdy, Caitlin Starks, Kristen Anstead

Presentation on Atlantic shortfin mako shark Amendment 11 and new regulations

Karyl Brewster-Geisz presented the new regulations under Amendment 11. The final rule for Amendment 11 was implemented on March 3. Amendment 11 responds to the 2017 benchmark stock assessment which showed shortfin mako stocks are overfished and experiencing overfishing occurring. The US landings accounts for 9% of global catch of mako sharks. Based on the stock assessment results, catch and harvest reductions are needed (72-79%) to prevent further population declines, and a total catch of 0 lbs per year is needed to rebuild the stock by 2040. At the International Commission for the Conservation of Atlantic Tunas (ICCAT) meeting later this year there will be a review of current measures taken by member countries and then determine next steps, as needed.

The shortfin mako regulations as outlined in the Amendment 11 final rule are similar to those implemented in the emergency rule from March 2018, with some modifications. For commercial fisheries, pelagic longline, bottom longline, and gillnet fisheries, may now land shortfin mako as long as the shark is dead at haul-back. For recreational fisheries, the minimum size limits will be different for male and female sharks. The male minimum size is 71 inches (straight-line fork length (FL)), and the female minimum size 83 inches (FL). These size limit requirements were changed from the emergency rule to account for different size at maturity among sexes. Circle hooks are required across the fishery on lines intended to catch sharks. Some administrative actions are not expanding current reporting systems, and establishing the foundation for international rebuilding plan. NOAA HMS has requested that ASMFC modify regulations in state waters to match the commercial and recreational federal waters measures for shortfin mako.

To evaluate the new regulations and provide advice to the Board considering adopting complementary management, the Board Chair tasked the TC with the following:

Review the recent management measures implemented for Atlantic shortfin mako sharks through Amendment 11, and provide the Board a report on the potential conservation benefits of adopting complementary management measures in state waters for state permit holders.

In considering the task put forward by the Board Chair, Bryan Frazier (TC Chair) asked the TC members to provide information and available data (fishery independent or dependent) on shortfin mako shark within their respective states. On the call, the TC members offered the following information (by state):

Florida – Since 2008, shortfin mako sharks harvested by recreational anglers in state waters occurred only in the year 2013, based upon MRIP survey data. Similarly, commercial landings of shortfin mako sharks in Florida state waters are not common (only 4,000 lbs landed since 1991). Commercial fishing is subject to the same gear and catch regulations as recreational fishing (1 per person or 2 per vessel per day, whichever is less). No fishery-independent data is available for mako sharks.

Georgia – Do not observe shortfin mako in state waters.

Virginia – Shortfin mako are not found within 3 miles of shore. One possible reason for this is VA has a long shallow shelf. The TC member expressed concern that if the states do not match the federal regulations, some anglers could claim they captured the sharks within 3 miles to avoid complying with federal regulations.

North Carolina – There is no fishery independent data demonstrating the presence of shortfin mako sharks in state waters. For commercial fisheries, there are 72 fish house samples of shortfin mako, but location data does not allow for distinguishing between federal and state waters. There are some dealer reported inshore landings (.04%) but the TC member indicated they are not fully confident in the location data provided for this small portion of the harvest.

Maryland – No data (fishery independent or dependent) demonstrating the presence of shortfin mako shark in state waters.

Delaware – No TC member present, but it was noted that it is probably a similar situation to MD.

New Jersey – There is some data from NJ from SAFIS commercial landings database, but these landings occurred in both state and federal waters. The data shows there are almost 12,000 lbs landed in 2016 and 2017, but it is not differentiated between state and federal waters. An additional data request for statistical areas of where the landings occurred would be needed. Regarding recreational data, there is no MRIP records for the past 10 years of shortfin makos being caught in NJ state waters.

New York – There are VTRs from party/charter boats from 2010 - 2018 that show 2,676 lbs of shortfin mako were harvested in state waters based on the geographic area codes. The weight range is 75-225 lbs per shark (avg. 149 lbs.). MRIP data show harvest and release of shortfin mako in state waters throughout the time series, albeit with high error values. It is clear that shortfin mako are in NY state waters and are targeted there, but not in significant numbers.

Rhode Island –Shortfin mako are not commonly observed in the fishery independent surveys. Commercial landings for RI are low and likely caught in federal waters, with the annual maximum landings at 3,000 lbs over the last 3-5 years, but they are usually an order of magnitude lower. Most often the fishing activity occurs outside of state waters.

Based on the presented state information, the TC noted there is not enough data for shortfin mako sharks in state waters to demonstrate that implementing the proposed regulations would have a significant change in harvest and catch; as noted only NY appears to have recreational data demonstrating fishing is occurring in state waters.

In considering the conservation benefits of implementing complementary measures in state waters, given the commercial fisheries encountering shortfin makos generally occur in federal waters, the TC did not provide comment on whether allowing retention of dead sharks at haul-back would be beneficial. For considering complementary recreational measures, the TC was largely in agreement that adopting the same recreational size limits by sex would be best for consistency and likely enforcement. As indicated from the available data, it does not seem possible to quantify the conservation benefits of implementing the regulatory change in state waters.

The other component of the recreational measures is the requirement of circle hooks. Currently, the states are at varying stages of considering or implementing circle hook requirements for shark fishing: New York and Florida have both implemented circle hooks for shark fishing; MD is going through a regulatory process for implementing a circle hook requirement for all sharks; NC, SC, and GA do not require circle hooks. One TC member mentioned there is a study wrapping up of post release mortality on blacktip sharks using circle hooks. The results show that fish hooked anywhere besides the jaw had a 50% mortality rate. If they were hooked in the jaw, the mortality rate was less than 4%. The TC member noted it may be likely that J hooks would produce higher mortality rates. While there may be conservation benefits from the implementation of circle hooks, there is some concern that it may present some challenges for law enforcement, even if it's a requirement for only shark fishing; Karyl (NOAA/NMS) noted that when complimentary measures were requested for dusky sharks, several states were against a circle hook requirement because of enforcement issues.

Summary

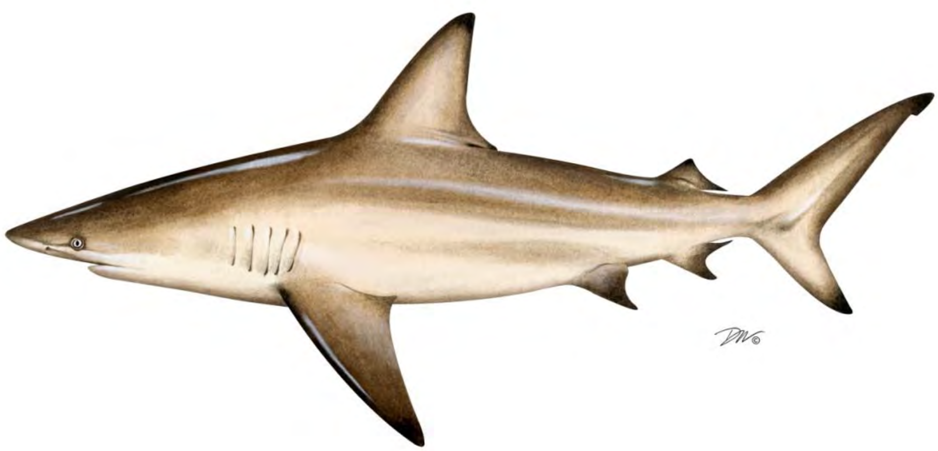
The TC recommends implementing complimentary size limits in state waters. The primary reasons cited was the consistency with federal regulations would be less confusing for the angling community and may ensure that smaller shortfin makos caught in federal waters are not 'claimed' to be caught in state waters. Additionally, by adopting the new regulations it may help raise awareness of the current status of shortfin makos.

Regarding implementing a new circle hook requirement, nearly all TC members were in agreement with recommending this measure for shark fishing in state waters, with the exception of Georgia. The Georgia TC member opposes the circle hook requirement because of the challenges in proving the intent of individuals fishing for sharks, and that based on the data presented, shortfin mako sharks are not in much of state waters along the Atlantic coast.

2018 REVIEW OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
FISHERY MANAGEMENT PLAN FOR

COASTAL SHARKS

2017 FISHING YEAR



Coastal Sharks Plan Review Team

Bryan Frazier, South Carolina Department of Natural Resources
Lee Paramore, North Carolina Department of Environmental Quality
Kirby Rootes-Murdy, Atlantic States Marine Fisheries Commission, Chair

Table of Contents

I. Status of the Fishery Management Plan

Date of FMP Approval:	August 2008
Amendments	None
Addenda	Addendum I (September 2009) Addendum II (May 2013) Addendum III (October 2013) Addendum IV (August 2016)
Management Unit:	Entire coastwide distribution of the resource from the estuaries eastward to the inshore boundary of the EEZ
States With Declared Interest:	Maine, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida
Active Boards/Committees:	Coastal Shark Management Board, Advisory Panel, Technical Committee, and Plan Review Team

a) Goals and Objectives

The Interstate Fishery Management Plan for Coastal Sharks (FMP) established the following goals and objectives.

GOALS

The goal of the Interstate Fishery Management Plan for Coastal Sharks is "to promote stock rebuilding and management of the coastal shark fishery in a manner that is biologically, economically, socially, and ecologically sound."

OBJECTIVES

In support of this goal, the following objectives proposed for the FMP include:

1. Reduce fishing mortality to rebuild stock biomass, prevent stock collapse, and support a sustainable fishery.
2. Protect essential habitat areas such as nurseries and pupping grounds to protect sharks during particularly vulnerable stages in their life cycle.
3. Coordinate management activities between state and federal waters to promote complementary regulations throughout the species' range.
4. Obtain biological and improved fishery related data to increase understanding of state water shark fisheries.
5. Minimize endangered species bycatch in shark fisheries.

b) Fisheries Management Plan Summary

The Atlantic States Marine Fisheries Commission (Commission) adopted its first fishery management plan (FMP) for coastal sharks in 2008. Coastal sharks are managed under this plan as six different complexes: prohibited, research, small coastal, non-sandbar large coastal, pelagic and smooth dogfish. The Board does not actively set quotas for any shark species. The Commission follows National Oceanic and Atmospheric Administration's (NOAA Fisheries) openings and closures for small coastal sharks, non- sandbar large coastal shark, and pelagic sharks. Species in the prohibited category may not be possessed or taken. Sandbar sharks may only be taken with a shark fishery research permit. All species must be landed with their fins attached to the carcass by natural means.

The FMP has been adapted through the following addenda:

Addendum I (2009) modified the FMP to allow limited smooth dogfish processing at sea (removal of fins from the carcass), as long as the total wet weight of the shark fins does not exceed 5 percent of the total dressed weight. In addition, smoothhound recreational possession limits and gill net check requirements for smoothhound fishermen were removed. These restrictions were removed because they were intended for large coastal sharks. The removal allowed smoothhound fishermen to continue operations while upholding the conservation measures of the FMP.

Addendum II (2013) modified the FMP to allow year round smooth dogfish processing at sea. If fins are removed the total wet weight of the shark fins may not exceed 12 percent of the total dressed weight. State-shares of the smoothhound coastwide quota were allocated. The goal of Addendum II was to implement an accurate fin-to-carcass ratio and prevent any one state from harvesting the entire smoothhound quota.

Addendum III (2013) modified the species groups in the FMP to ensure consistency with NOAA Fisheries (Table 1). The recreational size limit for the hammerhead species group was increased to 78" fork length.

Addendum IV (2016) was added to reflect measures outlined in the Shark Conservation Act into state regulations. It amends the Coastal Sharks FMP to allow smooth dogfish carcasses to be landed with corresponding fins removed from the carcass as long as the total retained catch, by weight, is composed of at least 25 percent smooth dogfish. Fishermen can retain smooth dogfish in an amount less than 25 percent of the total catch provided the smooth dogfish fins remain naturally attached to the carcass.

Table 1. List of commercial shark management groups

Species Group	Species within Group
Prohibited	Sand tiger, bigeye sand tiger, whale, basking, white, dusky, bignose, Galapagos, night, reef, narrowtooth, Caribbean sharpnose, smalltail, Atlantic angel, longfin mako, bigeye thresher, sharpnose sevengill, bluntnose sixgill and bigeye sixgill sharks
Research	Sandbar sharks
Non-Blacknose Small Coastal	Atlantic sharpnose, finetooth, and bonnethead sharks
Blacknose	Blacknose sharks
Aggregated Large Coastal	Silky, tiger, blacktip, spinner, bull, lemon, and nurse
Hammerhead	Scalloped hammerhead, great hammerhead and smooth hammerhead
Pelagic	Shortfin mako, porbeagle, common thresher, oceanic whitetip and blue sharks
Smoothhound	Smooth dogfish and Florida smoothhound

II. Status of the Stocks

Stock status is assessed by species or by species complex if there is not enough data for an individual assessment. Fourteen species have been assessed domestically, three species have been assessed internationally, and the rest have not been assessed. Table 2 describes the current stock status of several shark species along with references for the stock assessment.

The 2017 International Commission on the Convention of Atlantic Tunas (ICCAT) assessment of the North Atlantic population of shortfin mako indicates that the stock is overfished and overfishing is occurring. Multiple models were explored and new data sources integrated. Combined probability of overfishing occurring and the stock being in an overfished state was 90% across all models.

The 2017 Southeast Data and Assessment Review (SEDAR 54) stock assessment for sandbar sharks indicates the stock is overfished and not experiencing overfishing. This assessment used a new approach (Stock Synthesis) instead of the State Space Age Structure Production Model that was used in the previous assessment (SEDAR 21). A replication analysis conducted using the prior model (updated with data through 2015) resulted in the same stock status as the new model (overfished, no overfishing occurring).

The 2016 stock assessment update (SEDAR 21) for Atlantic dusky sharks indicates the stock is overfished and experiencing overfishing. This latest review functioned an update to the 2011 assessment, so no new methodology was introduced. However, all model inputs were updated with more recent data (i.e. 2010-2015 effort, observer, and survey data).

In 2015, a benchmark stock assessment (SEDAR 39) was conducted for the smoothhound complex, including smooth dogfish, the only species of smoothhound occurring in the Atlantic. The assessment indicates Atlantic smooth dogfish (*Mustelus canis*) are not overfished and not experiencing overfishing.

The North Atlantic blue shark (*Prionace glauca*) stock was assessed by ICCAT's Standing Committee on Research and Statistics (SCRS) in 2015. Similar to results of the 2008 stock assessment, ICCAT's 2015 analysis, the assessment indicated the stock is not overfished and not experiencing overfishing. However, scientists acknowledge there is a high level of uncertainty in the data inputs and model structural assumptions; therefore, the assessment results should be interpreted with caution.

SEDAR 34 (2013) assessed the status of Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*) and bonnetheads (*Sphyrna tiburo*). The Atlantic sharpnose shark stock is not overfished and not experiencing overfishing. The stock status of bonnethead stocks (Atlantic and Gulf of Mexico) is considered unknown. Assessment results indicated the stock was not overfished with no overfishing occurring, however all available data pointed towards separate stocks. As the assessment framework would not allow stocks to be split, the assessment continued under a single stock scenario. The results of the assessment were rejected by reviewers noting that the stocks need to be assessed independently. A benchmark assessment is recommended for both stocks of bonnetheads.

A 2011 benchmark assessment (SEDAR 21) of dusky (*Carcharhinus obscures*), sandbar (*Carcharhinus plumbeus*), and blacknose (*Carcharhinus acrontus*) sharks indicates that dusky and blacknose sharks are overfished and experiencing overfishing. Sandbar sharks continued to be overfished (SEDAR 54). As described in the Magnuson-Stevens Act, NOAA Fisheries must establish a rebuilding plan for an overfished stock. As such, the rebuilding date for dusky sharks is 2108, sandbar sharks is 2070, and blacknose sharks is 2043.

Porbeagle sharks (*Lamna nasus*) were assessed by the ICCAT's SCRS in 2009. The assessment found the Northwest Atlantic stock is increasing in biomass, however the stock is considered to be overfished with overfishing not occurring. NOAA Fisheries established a 100-year rebuilding plan for porbeagle sharks; the expected rebuilding date is 2108.

A 2009 stock assessment for the Northwest Atlantic and Gulf of Mexico populations of scalloped hammerhead sharks (*Sphyrna lewini*) indicated the stock is overfished and experiencing overfishing. This assessment was reviewed by NOAA Fisheries and deemed appropriate to serve as the basis for U.S. management decision. In response to the assessment findings, NOAA Fisheries established a scalloped hammerhead rebuilding plan that will end in 2023. However, since the assessment, research has determined that in the US Atlantic a portion of animals considered scalloped hammerheads are actually a cryptic species, recently named the Carolina hammerhead (*Sphyrna gilberti*). Little to no species-specific information exists regarding the distribution, abundance and life history of the two species, therefore for now, both species are currently managed under the name scalloped hammerhead.

SEDAR 11 (2006) assessed the Large Coastal Sharks (LCS) complex and blacktip sharks (*Carcharhinus limbatus*). The LCS assessment suggested that it is inappropriate to assess the LCS complex as a whole due to the variation in life history parameters, different intrinsic rates of increase, and different catch and abundance data for all species included in the LCS complex. Based on these results, NMFS changed the status of the LCS complex from overfished to unknown. As part of SEDAR 11, blacktip sharks were assessed for the first time as two separate populations: Gulf of Mexico and Atlantic. The results indicated that the Gulf of Mexico stock is not overfished and overfishing is not occurring, while the current status of blacktip sharks in the Atlantic region is unknown.

Table 2. Stock Status of Atlantic Coastal Shark Species and Species Groups

Species or Complex Name	Stock Status		References/Comments
	Overfished	Overfishing	
Pelagic			
Porbeagle	Yes	No	Porbeagle Stock Assessment, ICCAT Standing Committee on Research and Statistics Report (2009); Rebuilding ends in 2108 (HMS Am. 2)
Blue	No	No	ICCAT Standing Committee on Research and Statistics Report (2015)
Shortfin mako	Yes	Yes	ICCAT Standing Committee on Research and Statistics Report (2017)
All other pelagic sharks	Unknown	Unknown	
Aggregated Large Coastal Sharks (LCS)			
Atlantic Blacktip	Unknown	Unknown	SEDAR 11 (2006)
Aggregated Large Coastal Sharks - Atlantic Region	Unknown	Unknown	SEDAR 11 (2006); difficult to assess as a species complex due to various life history characteristics/ lack of available data
Non-Blacknose Small Coastal Sharks (SCS)			
Atlantic Sharpnose	No	No	SEDAR 34 (2013)
Bonnethead	Unknown	Unknown	SEDAR 34 (2013)
Finetooth	No	No	SEDAR 13 (2007)
Hammerhead			
Scalloped	Yes	Yes	SEFSC Scientific Review by Hayes et al. (2009); Rebuilding ends in 2023 (HMS Am. 5a)
Blacknose			
Blacknose	Yes	Yes	SEDAR 21 (2010); Rebuilding ends in 2043 (HMS Am. 5a)
Smoothhound			
Atlantic Smooth Dogfish	No	No	SEDAR 39 (2015)
Research			
Sandbar	Yes	No	SEDAR 54 (2017)
Prohibited			
Dusky	Yes	Yes	SEDAR 21 (2016); Rebuilding ends in 2108 (HMS Am. 2)
All other prohibited sharks	Unknown	Unknown	

III. Status of the Fishery

Specifications (Opening, closures, quotas)

NOAA Fisheries sets quotas for coastal sharks through the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan. The opening dates, closures dates and quotas are detailed in Table 3. All non-prohibited coastal shark management groups, except aggregated large coastal and hammerheads shark groupings, opened on January 1, 2017. NOAA Fisheries closes commercial shark fisheries when 80% of the available quota is reached. Commercial shark dealer reports indicate the following commercial fisheries exceeded 80% of the available quota and had an early closure: blacknose, non-blacknose small coastals, aggregated large coastal and hammerhead fisheries. When the fishery closes in federal waters, the Interstate FMP dictates that the fishery also closes in state waters.

Table 3. Commercial quotas and opening dates for 2017 shark fishing season

2017 Season

Species Group	Region	2017 Annual Quota (mt dw)	Season Opening Dates	Closing Date
Aggregated Large Coastal Sharks (LCS)	Atlantic	168.9	June 1, 2017	
Hammerhead Sharks	Atlantic	27.1	June 1, 2017	
Non-Blacknose Small Coastal Sharks (SCS)	Atlantic	264.1	January 1, 2017	
Blacknose Sharks	Atlantic	17.2	January 1, 2017	
Blue Sharks	No regional quotas	273.0	January 1, 2017	
Porbeagle Sharks	No regional quotas	1.7	January 1, 2017	
Pelagic Sharks other than Porbeagle or Blue	No regional quotas	488.0	January 1, 2017	
Shark Research Quota (Aggregated LCS)	No regional quotas	50.0	January 1, 2017	
Sandbar Research Quota	No regional quotas	90.7	January 1, 2017	

Commercial Landings

Commercial landings of Atlantic large coastal sharks species in 2017 were 381,067 pounds (lbs) dressed weight (dw), a 18% decrease from 2016 landings (Table 4). Commercial landings of small coastal shark species in 2017 were 294,841 lbs dw, a 40% increase from 2016 landings (Table 5). 2016 Landings were the lowest for the time series over the last 9 years and a result of the early closure of both blacknose and non-blacknose sharks south of 34°00' N. latitude on May 29, 2016. Commercial landings of Atlantic pelagic sharks was 251,375 lbs dw, which represents an approximate 5% increase from 2016 landings (Table 6).).

Table 4. Commercial landings of authorized Atlantic large coastal sharks by species (pounds dw), 2009-2017. Source: HMS SAFE Report, 2018.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Great hammerhead	0	0	0	371	7,406	13,538	36,892	20,454	17,646
Scalloped hammerhead	0	0	0	15,800	27,229	24,652	13,197	12,329	4,919
Smooth hammerhead	4,025	7,802	110	3,967	1,521	601	304	125	1,193
Unclassified	62,825	43,345	35,618	9,617	0	0	0	0	0
Hammerhead Total	**66,850**	**51,147**	**35,728**	**29,755**	**36,156**	**38,791**	**50,393**	**32,908**	**23,758**
Blacktip	229,267	246,617	176,136	215,403	256,277	282,009	229,823	248,470	205,138
Bull	61,396	56,901	49,927	24,504	33,980	32,372	33,737	31,417	23,802
Lemon	30,909	25,316	45,448	21,563	16,791	13,047	18,158	19,205	12,005
Nurse	0	71	0	81	0	0	24	0	0
Silky	1,386	1,049	992	29	186	289	1,246	446	702
Spinner	20,022	13,544	4,113	10,643	26,892	25,716	33,002	55,610	62,314
Tiger	15,172	43,145	36,425	23,245	16,561	29,062	28,460	14,896	6,324
Unclassified	70,894	2,229	50,711	53,705	0	0	0	0	
Aggregated LCS Total	**429,046**	**388,872**	**363,752**	**349,173**	**350,687**	**382,495**	**344,450**	**370,044**	**310,286**
Sandbar	54,141	84,339	94,295	46,446	46,868	82,308	112,610	62,984	47,023
Hammerhead, Aggregated LCS, Sandbar Total	**550,037**	**524,358**	**493,775**	**425,374**	**433,711**	**503,594**	**507,453**	**465,936**	**381,067**

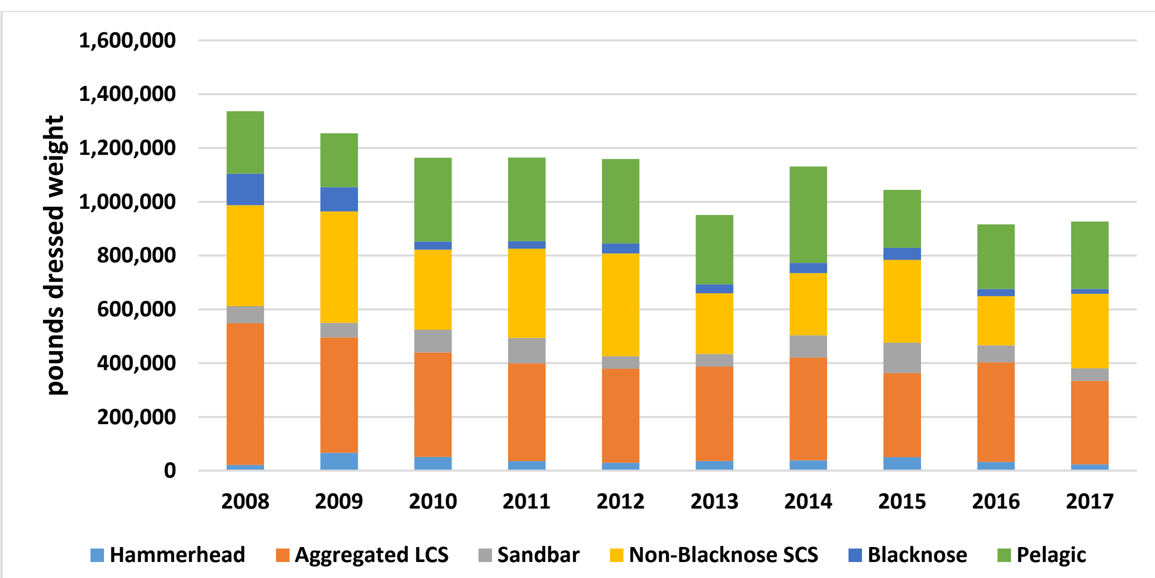
Table 5. Commercial landings of authorized Atlantic small coastal sharks by species (lbs dw), 2009-2017. Source: HMS SAFE Report, 2018.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blacknose	90,023	30,287	28,373	37,873	33,382	38,437	45,405	26,842	17,241
Bonnethead	53,912	9,069	28,284	19,907	22,845	13,221	5,885	1,688	6,077
Finetooth	63,359	76,438	52,318	15,922	19,452	19,026	8,712	5,647	19,874
Atl. Sharpnose	262,508	211,190	214,382	345,625	183,524	198,568	293,128	175,890	251,289
Unclassified	34,429	851	36,639	492	0	0	0	0	0
SCS Total	**504,231**	**327,835**	**359,996**	**419,819**	**259,203**	**269,252**	**353,130**	**210,067**	**294,481**

Table 6. Commercial landings of authorized pelagic sharks by species off the Atlantic coast of the United States (lbs dw), 2009-2017. Source: HMS SAFE Report, 2018.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Blue	4,793	9,135	13,370	17,200	9,767	17,806	1,114	607	4,272
Porbeagle	3,609	4,097	5,933	4,250	54	6,414	0	0	C
Shortfin Mako	141,456	220,400	207,630	198,841	199,177	218,295	141,720	160,829	184,993
Unclassified	9,383	0	0	0	0	0	0	0	0
Oceanic	933	796	2,435	258	62	22	0	0	0
Thresher	33,333	61,290	47,462	63,965	48,768	116,012	72,463	78,219	61,990
Unclassified	6,650	16,160	33,884	28,932	0	0	0	0	0
Pelagic Total	**200,157**	**311,878**	**310,714**	**313,446**	**257,828**	**358,549**	**215,297**	**239,655**	**251,375**

Figure 1: Commercial landings of coastal sharks off the east coast of the United States by species complex, 2008-2017. Source: HMS SAFE Report, 2018.



Recreational Landings

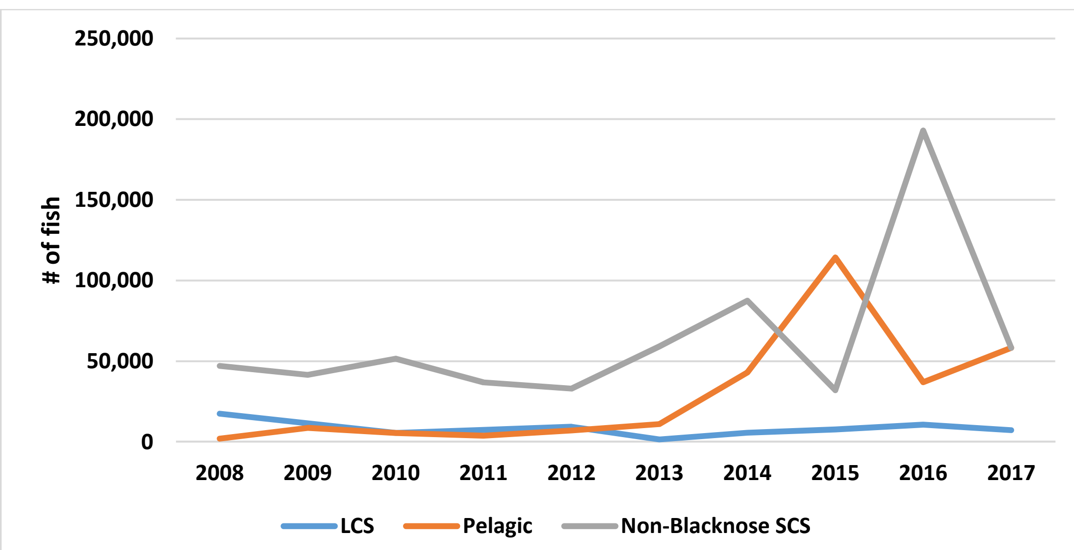
Approximately 126,419 sharks were harvested during the 2017 recreational fishing season, a decrease from 2016 landings by approximately 50% (Table 7). The non-blacknose small coastal shark group and pelagic shark group both comprised 46% of the overall recreational harvest.

Table 7. Estimated recreational harvest of all Atlantic shark species by species group in numbers of fish, 2009-2017. Source: Updated based HMS SAFE Report, 2018.

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Aggregated LCS	11,536	5,540	7,397	9,386	1,547	5,704	7,622	10,596	7,291
Hammerhead	574	13	178	41	600	900	1	799	0
Pelagic*	8,694	5,529	3,806	7,034	11,057	43,047	114,282	37,009	58,259
Blacknose	947	0	573	0	70	4,146	1,211	225	13
Non-Blacknose SCS	41,577	51,529	36,851	33,005	59,208	87,480	32,065	192,855	58,242
Sandbar	6,461	2,193	1,125	857	399	1,873	1,252	5	2,608
Prohibited	506	4	23	15	16	2	0	0	6
Total	70,295	64,808	49,952	50,338	72,895	143,152	156,433	241,489	126,419

*Pelagic sharks include Gulf of Mexico landings.

Figure 2: Estimated recreational harvest for LCS, SCS and pelagic species by species group, in numbers of fish, 2009-2017. Source: HMS SAFE Report, 2018.



IV. Status of Research and Monitoring

Under the Interstate Fishery Management for Coastal Sharks, the states are not required to conduct any fishery dependent or independent studies; however, states are encouraged to submit any information collected while surveying for other species. This section describes the research and monitoring efforts through the 2017 fishing year, where available.

The Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) appears in multiple state monitoring efforts. The survey monitors the presence of young-of-year and juvenile sharks along the east coast. It is managed and coordinated by NOAA's Northeast Fisheries Science Center (NEFSC) through the Apex Predators Program based at the NEFSC's Narragansett Laboratory in Rhode Island. Longline and gillnet sampling, along with mark-recapture techniques are used to determine relative abundance, distribution and migration of sharks utilizing nursing grounds from Massachusetts to Florida. In 2017, COASTSPAN program participants were the University of North Florida (samples Georgia and North Florida state waters) and the South Carolina Department of Natural Resources. In addition, the survey is conducted in summer months in Narragansett and Delaware Bays, and in Massachusetts waters. Standardized indices of abundance from COASTPAN surveys are used in the stock assessments for large and small coastal sharks.

Massachusetts

Movement and Habitat Studies:

White Shark: Massachusetts Division of Marine Fisheries' efforts to study the movement ecology of white sharks continued with an additional 27 sharks being tagged in 2017, bringing the total to 132 individuals since 2009. These sharks were tagged with one or more of the following technologies: pop-up satellite tag, real-time satellite tags, coded acoustic transmitters, active acoustic transmitters, and NMFS conventional tags. Work also continued on a five-year study (initiated in 2014) to quantify the regional population size and relative abundance of white sharks in Massachusetts waters; aerial and vessel surveys were conducted from mid-June through October off the eastern coast of Cape Cod.

Rhode Island

Fishery independent monitoring is limited to coastal shark species taken in the RI Division of Fish & Wildlife, Marine Fisheries Section monthly and seasonal trawl survey. During the 2017 calendar year the only coastal shark species captured in the trawl survey was smooth dogfish (*Mustelus canis*). A summary of fishery independent monitoring for coastal sharks is summarized in Table 8 below.

Table 8 Total number of smooth dogfish captured by the RI DEM Division of Marine Fisheries (RI DMF) monthly and seasonal trawl survey during the 2017 Fishing Year (FY). Smooth dogfish are the only coastal shark captured by the RI DMF trawl survey during the 2017 FY.

Year	Time Period	Species	Number of Tows	Total Weight (kg)	Total Number Caught
Monthy Coastal Trawl Survey					
2017	JAN	Smooth Dogfish	13	0.0	0.0
2017	FEB	Smooth Dogfish	13	0.0	0.0
2017	MAR	Smooth Dogfish	13	0.0	0.0
2017	APR	Smooth Dogfish	13	0.0	0.0
2017	MAY	Smooth Dogfish	13	0.0	0.0
2017	JUN	Smooth Dogfish	13	2.0	1.0
2017	JUL	Smooth Dogfish	13	6.2	4.0
2017	AUG	Smooth Dogfish	13	33.1	24.0
2017	SEP	Smooth Dogfish	13	17.8	19.0
2017	OCT	Smooth Dogfish	13	7.2	9.0
2017	NOV	Smooth Dogfish	13	0.0	0.0
2017	DEC	Smooth Dogfish	13	0.0	0.0
Seasonal Coastal Trawl Survey					
2017	Spring	Smooth Dogfish	44	0.0	0.0
2017	Fall	Smooth Dogfish	44	68.2	55.0

Connecticut

The Connecticut Department of Energy and Environmental Protection monitors the abundance of marine resources in nearby coastal waters with the Long Island Sound Trawl Survey. Spring (April, May and June) and fall (September and October) surveys are conducted each year. Other than smooth dogfish, coastal sharks are not encountered by the Long Island Sound Trawl Survey. Smooth dogfish are caught most often in the fall and the fall indices are presented below. See the link below for the latest Long Island Sound Trawl Survey report.

Table 10. Long Island Trawl Survey Fall Smooth Dogfish indices (geometic mean catch/tow)

Year	Kg/tow	Count/tow
1996	1.16	0.80
1997	1.09	0.59
1998	1.32	0.72
1999	1.27	0.93
2000	2.85	1.88
2001	3.02	1.69
2002	6.09	3.58

2003	6.18	3.10
2004	2.95	1.44
2005	2.70	1.41
2006	2.46	0.94
2007	6.23	2.27
2008	1.25	0.63
2009	2.8	1.13
2010	-	-
2011	3.66	1.43
2012	4.69	2.41
2013	7.93	4.13
2014	11.05	5.78
2015	11.70	7.30
2016	8.30	5.24
2017	14.82	8.29

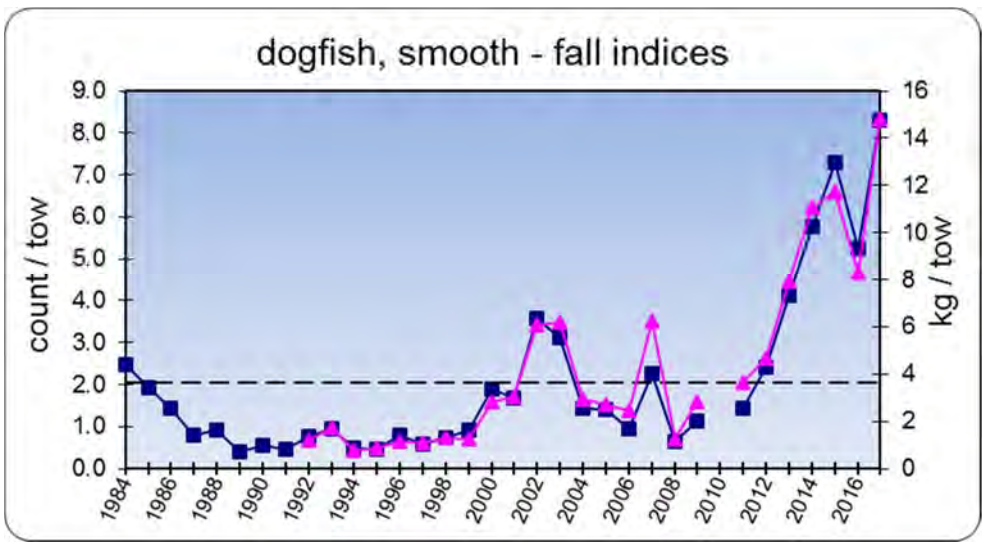


Figure 3. CT DEEP Smooth Dogfish Long Island Sound Trawl Survey

New York

While NY DEC does not currently conduct fishery-independent monitoring programs for Atlantic Coastal Sharks, a research permit was issued in 2017 for the collection of information on sand tiger sharks (*Carcharias taurus*), blue sharks (*Prionace glauca*), sandbar sharks (*Carcharhinus plumbeus*), dusky sharks (*Carcharhinus obscurus*), and tiger sharks (*Galeocerdo cuvier*). In 2017, 13 sand tiger sharks, one blue sharks, 11 sandbar sharks, 5 dusky sharks, and 1 tiger shark were caught and released. Information on each (morphometrics and sex) as well location, date, biological samples collected, telemetry gear deployed, and final disposition of the animals were recorded.

New Jersey

New Jersey does not currently conduct any fishery-independent monitoring programs specifically for Atlantic Coastal Sharks, but does encounter sharks from the State's Ocean Stock Assessment Survey. In 2017, the Survey caught approximately 135 lbs of Atlantic Angel Sharks, 41 lbs of Atlantic Sharpnose Sharks, 11 lbs of Dusky Sharks, 469 lbs of Sand Tiger Sharks, 71 lbs of Sandbar Sharks, 9,328 lbs of Smooth Dogfish, and 59 lbs of Thresher Sharks (see figure below). Sharks from the New Jersey Ocean Stock Assessment Survey were collected by a 30-meter otter trawl every January, April, June, August, and October since 1989. Tows are approximately 1 nautical mile and are performed via a stratified random sampling design. Latitudinal strata are identical to those used by the National Marine Fisheries Service groundfish survey. Longitudinal boundaries are defined by the 18-30, 30-60, and 60-90 foot isobaths. Smooth Dogfish are cumulatively weighed and measured by total length in centimeters. All other shark species are sorted by gender, weighed individually, and measured by total length in centimeters.

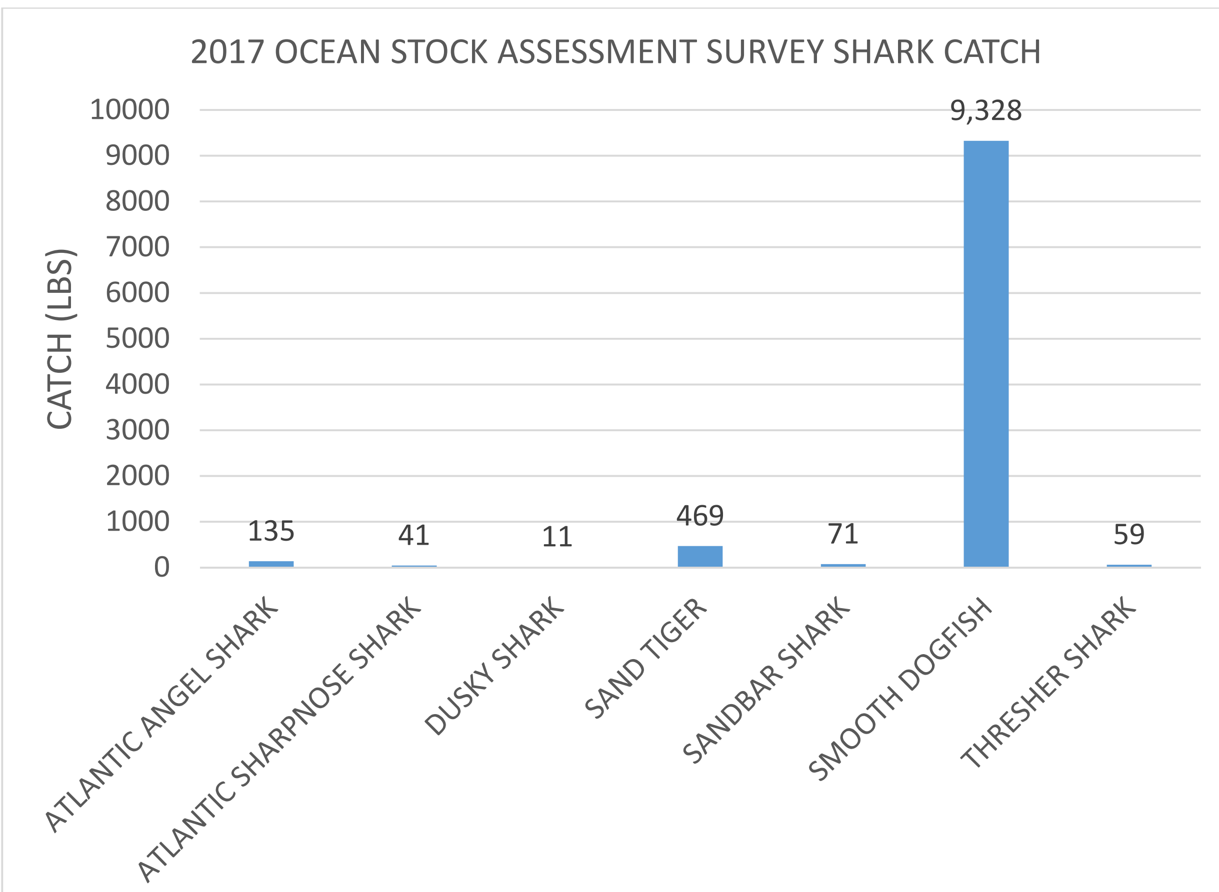


Figure 4. NJ 2017 Ocean Stock Assessment Survey- Atlantic Coastal Sharks

Delaware

Delaware conducts a 30’ adult trawl survey and a 16’ juvenile trawl survey in the Delaware Bay. In the adult trawl survey, Smoothhound are the most common shark species caught (Figure 5), with Sand Tiger Shark (Figure 6) and Sandbar Sharks (Figure 7) taken in low numbers. Thresher, Atlantic Angel, Atlantic Sharpnose (Figure 8) and Dusky shark were caught in the past, but rarely. Sand Tiger Shark catch per nautical mile decreased in 2017 and but was still near the time series average. Sandbar Shark catch per nautical mile increased in 2017 to its highest point since 1967. Smoothhound catch per nautical mile decreased slightly in 2017. In the juvenile trawl, the species caught were sand tiger shark (Figure 9), Sandbar Sharks (Figure 10) and Smoothhound (Figure 11). With the exception of Smoothhound, the capture of coastal sharks in the juvenile trawl is a rare occurrence.

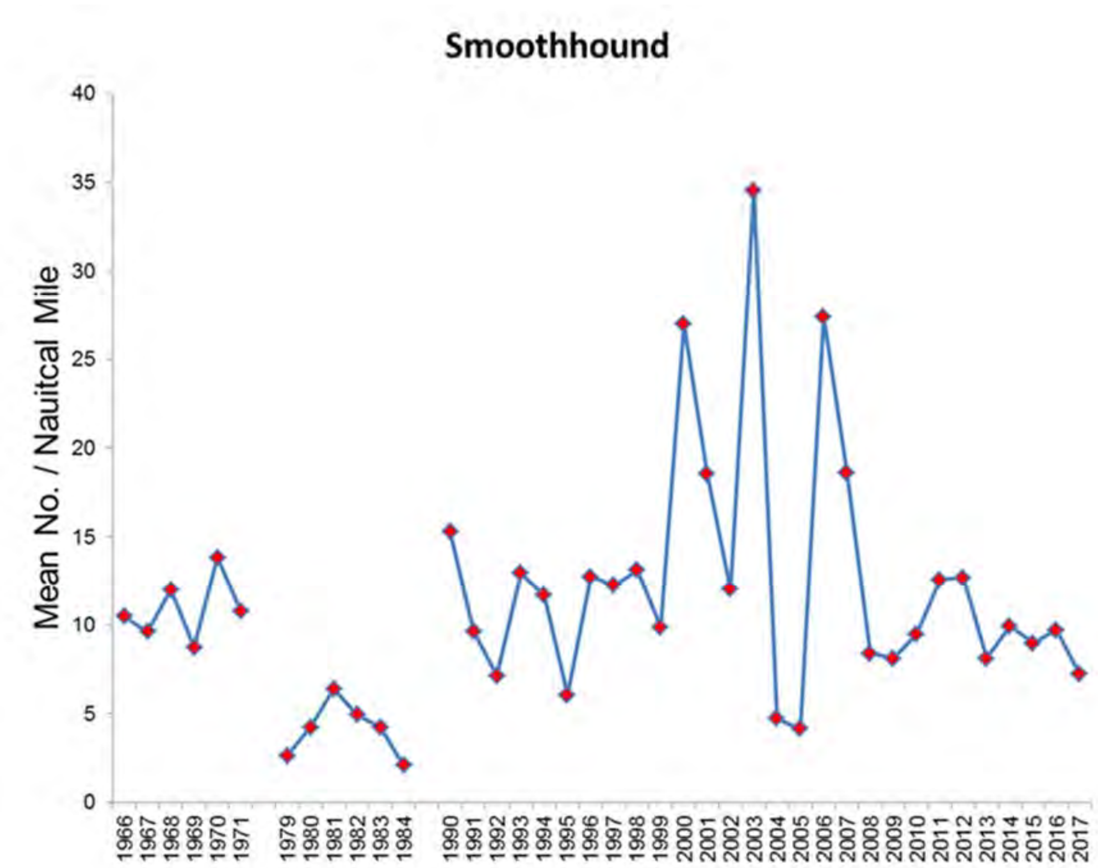


Figure 5. Smoothhound relative abundance (mean number per nautical mile), time series (1966 – 2017) as measured in 30-foot trawl sampling in the Delaware Bay.

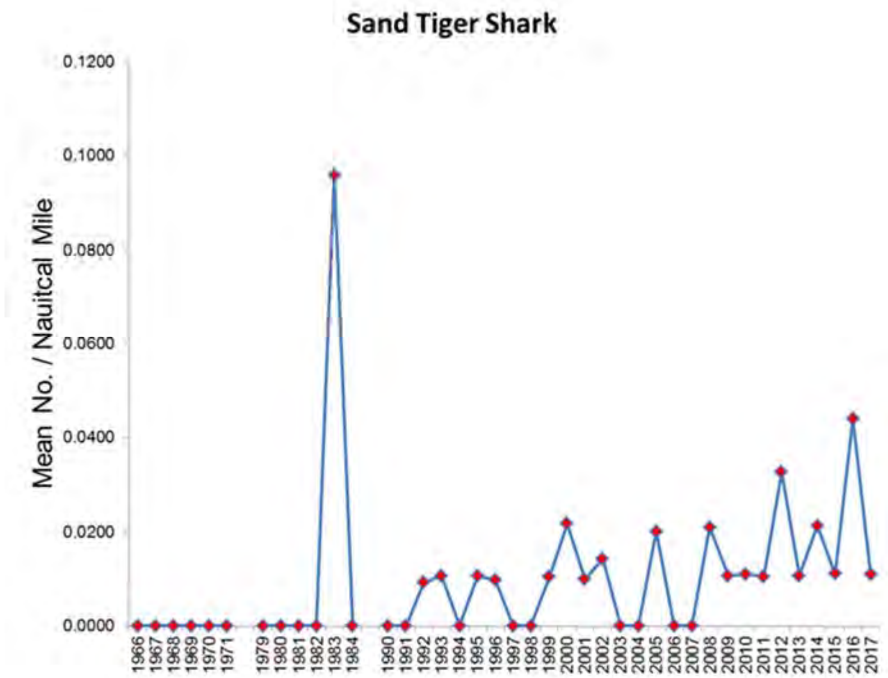


Figure 6. Sand Tiger Shark relative abundance (mean number per nautical mile), time series (1966 – 2017) as measured in 30-foot trawl sampling in the Delaware Bay.

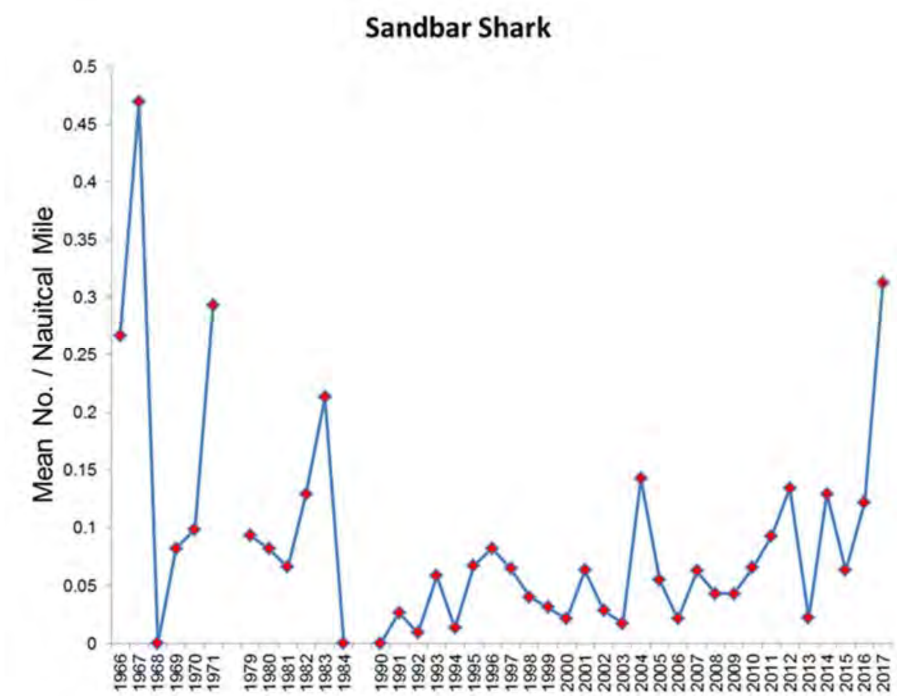


Figure 7. Sandbar Shark relative abundance (mean number per nautical mile), time series (1966 – 2017) as measured in 30-foot trawl sampling in the Delaware Bay.

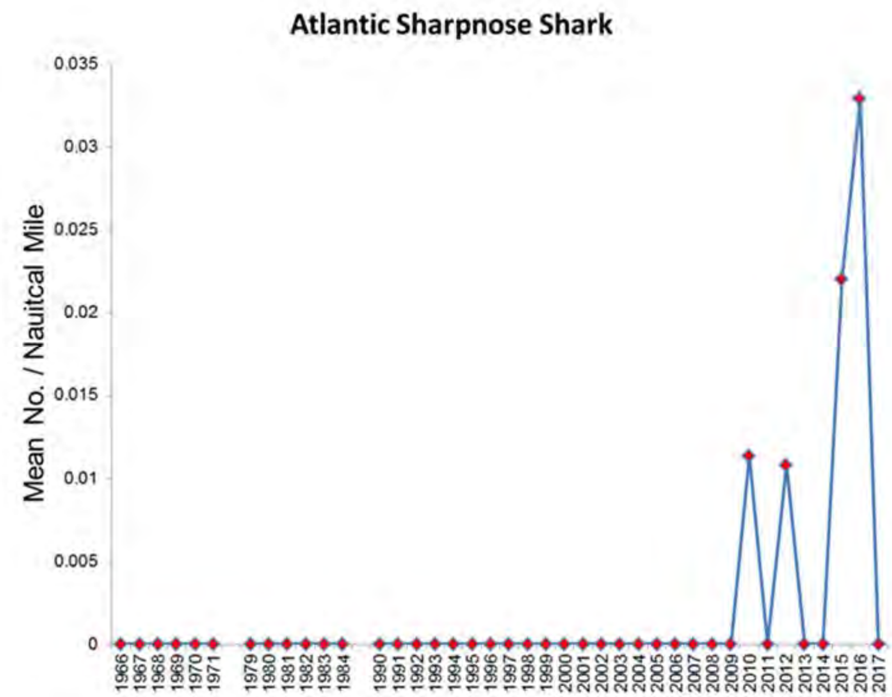


Figure 8. Atlantic Sharpnose Shark relative abundance (mean number per nautical mile), time series (1966 – 2017) as measured in 30-foot trawl sampling in the Delaware Bay.

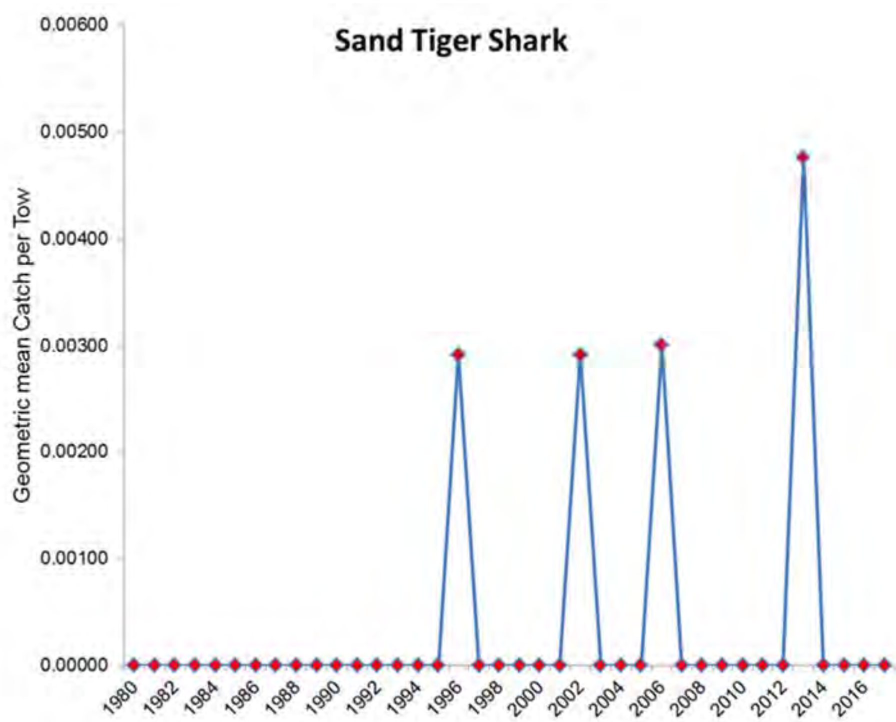


Figure 9. Index of Sand Tiger Shark, time series (1980 – 2017) as measured by 16-foot trawl sampling in the Delaware estuary.

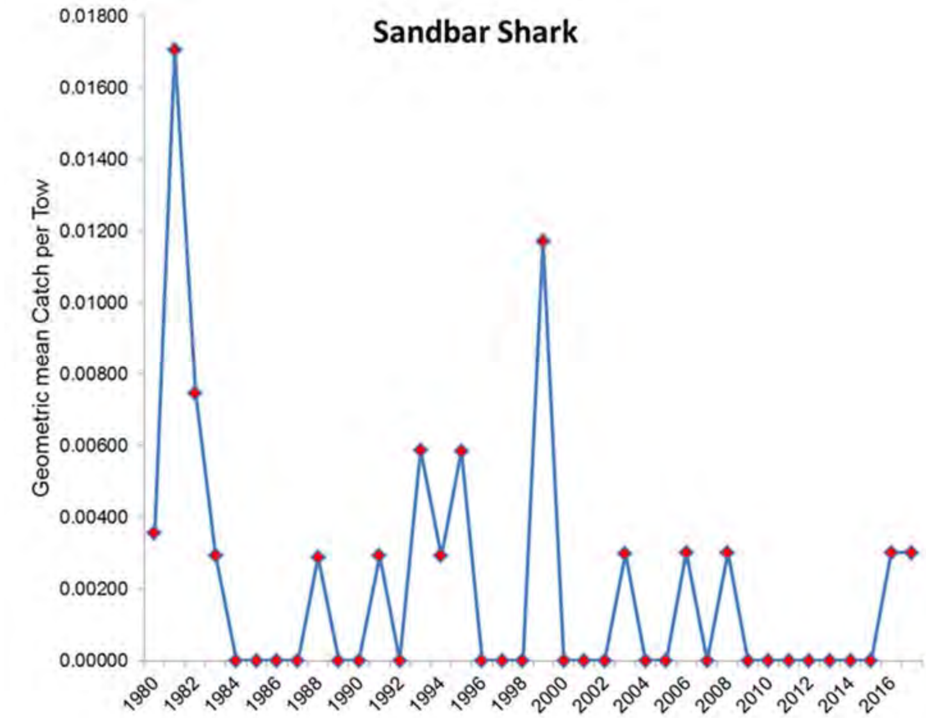


Figure 10. Index of Sandbar Shark, time series (1980 – 2017) as measured by 16-foot trawl sampling in the Delaware estuary.

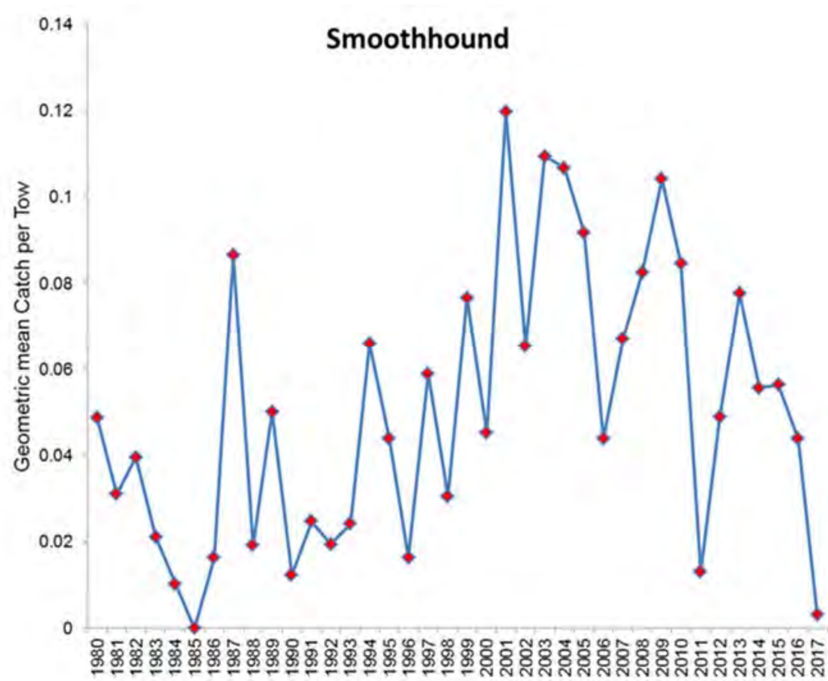


Figure 11. Index of young-of-the-year Smoothhound abundance, time series (1980 – 2017) as measured by 16-foot trawl sampling in the Delaware estuary.

Maryland

There was no specific at sea sampling program for coastal sharks in Maryland. Limited biological sampling of catch onboard a commercial offshore trawler targeting horseshoe crabs occurred at night in June, July, August, and October. While sharks were encountered through a scientific permit, information regarding species and number encountered are confidential.

Virginia

The Virginia Institute of Marine Science Shark Research Program began in 1973 and is one of the longest running longline surveys in the world. The program has provided data on habitat utilization, age, growth, reproduction, trophic interactions, basic demographics, and relative abundance for dominant shark species.

Beginning in 2012 a separate longline survey, conducted by the Virginia Institute of Marine Science designed specifically to target YOY sandbar sharks in the lower Chesapeake Bay and Eastern Shore, was initiated. The new survey follows a stratified random sampling design, rather than a fixed survey design, and falls under the broader COASTSPAN umbrella survey.

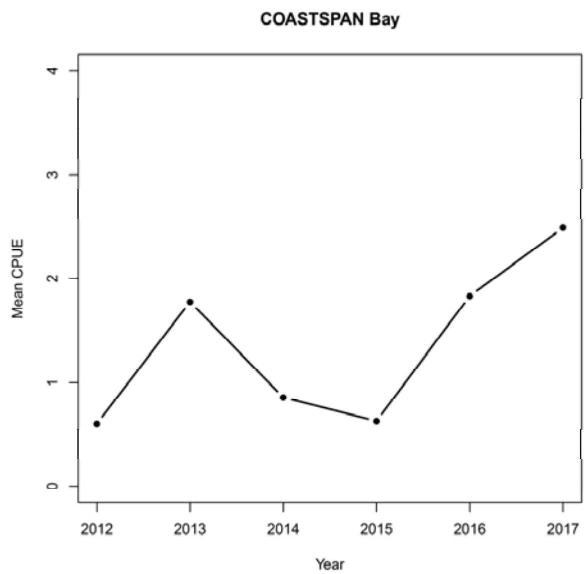
In 2017, Atlantic sharpnose shark (Rhizoprionodon terraenovae) was the most commonly encountered species by the offshore survey, followed by sandbar, spinner (Carcharhinus brevipinna), and blacktip (Carcharhinus limbatus) shark (Table 11). Seasonal patterns in survey catches were also evident with the September and June showing higher overall catches of sharks, respectively, followed by August and July.

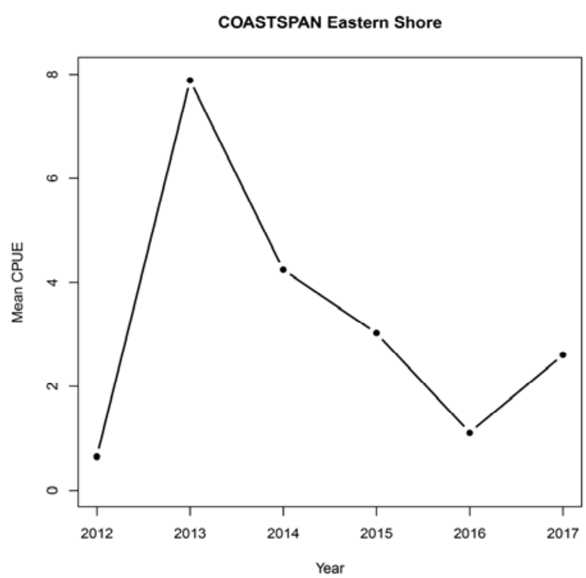
COASTSPAN catches of neonate sandbar shark were highest in July for both the lower Chesapeake Bay and coastal lagoons of the Eastern Shore, followed by August and June (Table 2). In magnitude, survey catches during 2017 in the lower Chesapeake Bay were higher than those in the Eastern Shore lagoons presumably due to greater available nursery habitat in the bay. Indices of relative abundance of neonate sandbar shark in the lower Chesapeake Bay showed a variable but generally increasing pattern over the time series with 2017 showing the highest index on record (Figure 12).

Table 11. Monthly catch summaries for key shark species encountered during offshore longline cruise conducted by VASMAP, 2017 pooled across the standard six sampling sites. Effort is expressed as total longline soak time.

Month	Effort (hrs)	Sand Tiger	Sandbar	Tiger	Atlantic sharpnose	Spinner	Dusky	Blacktip
Jun	29.9	5	9	1	54	1	1	10
Jul	28.8	2	5	3	27	1	1	1
Aug	28.8	2	6	3	58	1	0	0
Sep	29.5	5	44	0	32	15	10	5

Figure 1. Annual indices of relative abundance for neonate sandbar sharks estimated from generalized linear models (GLMs) fitted to COASTSPAN longline catch-per-unit-effort (CPUE) data from the lower Chesapeake Bay and coastal lagoons of the Eastern Shore, 2012-2017.





North Carolina

The North Carolina Division of Marine Fisheries (NCDMF) conducts both fishery-dependent and independent sampling within state waters. Fishery-dependent sampling of North Carolina commercial fisheries has been ongoing since 1982 (conducted under Title III of the Interjurisdictional Fisheries Act and funded in part by the U.S. Department of Commerce, National Marine Fisheries Service). Predominate fisheries sampled included the ocean gill net, estuarine gill net, ocean trawl, long haul seine/swipe net, beach seine and pound net fisheries.

A total of 50 fishery-dependent samples containing sharks were collected from the ocean gill net, ocean trawl and estuarine gill net fisheries in 2017 (Table 11). This sample number is up compared to the 9 samples obtained in 2016. Whole weights and lengths for sharks other than spiny dogfish are rarely obtained during sampling. Sharks are typically dressed or processed when sampling occurs therefore the number of processed individuals and aggregate weights are obtained during sampling. Atlantic sharpnose and smoothhound sharks were the most abundant species in dependent sampling by numbers and weight (Table 12).

Table 12. North Carolina fishery-dependent shark sampling summary by month for the 2017 fishing year.

Month	# of Samples
January	5
February	6
March	1
April	9
May	4
June	3
July	3
August	10
September	1
October	6
November	1
December	1
Total	50

Table 13. North Carolina fishery-dependent shark sampling summary by species, number of individuals, and sum of sample weight (lb) for the 2017 fishing year.

Species	# Indv.	Sum of Sample Wgt. (lb)
Atlantic Sharpnose Shark (*R. terraenovae*)	124	206
Blacktip (*C. limbatus*)	20	166
Bonnethead (*S. tiburo*)	1	0.9
Bull (*C. leucas*)	3	8
Common thresher (*A. vulpinus*)	1	5
Lemon (*N. brevirostris*)	1	23
Sandbar (*C. plumbeus*)	25	128
Smoothhound Shark (*M. canis*)	51	121
Spinner (*C. brevipinna*)	10	55
Total	236	712.9

Fishery-Independent

The NCDMF initiated a fishery-independent red drum longline survey in 2007 for developing an index of abundance for adult red drum (*S. ocellatus*); this project also allows for capture and tagging of Atlantic coastal sharks in cooperation with the North East Fisheries Science Center's (NEFSC) Cooperative Shark Tagging Program. The red drum longline survey in the Pamlico Sound resulted in a catch of 21 sharks in 2017 (Table 14). Three species of shark were captured; one Atlantic Sharpnose (*R. terraenovae*), 18 Blacktip (*C. limbatus*), and two Bull shark (*C. leucas*). Both bull sharks and six of the blacktips were tagged for NOAA's tagging program.

Table 14. Species, number of individuals, minimum, maximum and average total length [TL (mm)] of sharks caught in the 2017 North Carolina Red Drum Longline Survey.

Species	Number Measured	Min of TL (mm)	Max of TL (mm)	Avg TL (mm)
Atlantic Sharpnose Shark	1	495	495	495
Blacktip Shark	18	472	1,760	1,051
Bull Shark	2	890	1,520	1,205

The NCDMF initiated a fishery-independent gill net survey in 2001 and expanded its coverage in 2008 to include the Cape Fear and New Rivers and the near shore (0-3 miles) Atlantic Ocean from New River Inlet south to the South Carolina state line. The Atlantic Ocean portion of the survey was discontinued in June of 2015 due to low catches of target species, none of which were sharks. The objective of this project is to provide annual, independent, relative abundance indices for key estuarine species in the near shore Atlantic Ocean, Pamlico Sound, Pamlico, Pungo, Neuse, New, and Cape Fear Rivers. The survey employs a stratified random sampling design and utilizes multiple mesh gill nets (3.0 inch to 6.5 inch stretched mesh, by ½ inch increments. In 2017, eight species of shark were encountered in the gill net survey, with bull sharks (n=23) representing the highest abundance (Table 15).

Table 15. Species, number of individuals, minimum, maximum, and average total length [TL (mm)] of sharks caught in the 2017 North Carolina Cape Fear, Neuse and New River gill net survey.

Shark Species	Number Measured	Min of TL (mm)	Max of TL (mm)	Average of TL (mm)
Atlantic Sharpnose	10	436	901	534
Blacknose	1	1,227	1,227	1,227
Blacktip	1	1,680	1,680	1,680
Bull Shark	23	611	1,100	797
Bonnethead	20	575	958	704
Sandbar	17	697	974	807
Scalloped hammerhead	1	536	536	536
Smoothhound	10	617	964	710

South Carolina

Data related to the presence and movement of sharks in South Carolina's coastal waters will continue to be collected as encountered within the context of existing fishery dependent or fishery independent programs conducted by the SCDNR. Currently, data are collected from estuarine waters by the SCDNR Cooperative Atlantic States Shark Pupping and Nursery Habitat survey (COASTSPAN) and the SCDNR trammel net survey. The COASTSPAN survey monitors the presence and abundance of young-of-year and juvenile sharks in the estuaries and bays of South Carolina. The survey operates from April-September using gillnets, longlines, and drumlines to sample index stations. Species captured are measured, sexed, tagged, released, and physical and water quality parameters are recorded (Table 16).

The SCDNR trammel net survey is designed to sample recreationally important species in shallow estuarine waters. Sharks are not a target species, but their abundance as well as length and sex data are recorded (Table 16). Stations selected based on suitable habitats are randomly sampled using a multi-panel gillnet to encircle a section of marsh. Species captured are measured, sexed if possible, select species (no sharks) are tagged and released and physical and water quality data are recorded.

The presence and abundance of juvenile and adult coastal sharks in the bays, sounds and coastal waters of South Carolina are documented by the Adult Red Drum and Coastal Shark Longline survey. This survey uses a stratified-random approach to sample for adult red drum and coastal sharks. The survey operates annually from August to December using longlines to sample suitable habitat for targeted species. Species captured are measured, sexed, tagged and released, and physical and water quality parameters are recorded. Species encountered and tagged for all surveys are reported in Table 16. The data gathered from these programs are shared with the NMFS apex predators program and are utilized in stock assessments and management decisions in South Carolina.

Table 16. Number of sharks captured by South Carolina Department of Natural Resources' Cooperative Atlantic States Shark Pupping and Nursery Habitat Survey (COASTSPAN), the Trammel Net Survey, and Adult Red Drum and Coastal Sharks Longline survey in 2017

	COASTSPAN		Trammel Net		Adult Red Drum and Coastal Sharks	
Shark Species	Captured	Tagged	Capture	Tagged	Captured	Tagged
Atlantic Sharpnose	318	0	44	0	1051	0
Blacknose	1	1	0	0	89	87
Blacktip	272	158	2	0	55	39
Bonnethead	306	197	142	0	8	8
Bull	19	17	4	0	7	5
Finetooth	541	193	68	0	52	40
Great Hammerhead	0	0	0	0	1	0
Lemon	13	12	8	0	4	2
Nurse	0	0	0	0	8	2
Sandbar	241	211	0	0	123	110
Sand Tiger	0	0	0	0	0	0
Scalloped/Carolina	124	3	0	0	4	1
Smooth Dogfish	0	0	0	0	0	0
Spinner	0	0	0	0	21	13
Tiger	6	4	0	0	2	1
Total	1841	796	268	0	1425	308

Georgia

Although a directed fishery for sharks does not exist in Georgia waters, there are a several fishery dependent sampling surveys conducted by the Coastal Resources Division that could result in the incidental capture of coastal sharks. In 2016, coastal sharks were found in the following fishery independent surveys.

Sampling for the *Adult Red Drum Survey (via SEAMAP)*: Sampling occurs in inshore and nearshore waters of southeast Georgia and in offshore waters of northeast Florida. Sampling occurs from mid-May through the end of December. Sampling gear consists of a bottom set 926m, 600lb test monofilament mainline configured with 60, 0.5 m gangions made of 200lb test monofilament. Each gangion consists of a longline snap and a 15/0 circle hook. Thirty hooks of each size are deployed during each set. All hooks are baited with squid or mullet. Soak time for each set is 30 minutes. During 2017, CRD staff deployed 179 sets consisting of 10,662 hooks and 89.5 hours of soak time. A total of 500 sharks, representing nine species were captured (Table 16).

Sampling for the *Shark Nursery Survey (via COASTSPAN)*: The University of North Florida assumed field operations for this survey in 2016. Data for the complete time series are maintained by the National Marine Fisheries Service's Apex Predator Program in Narragansett, RI (contact: Cami McCandless).

Each month the *Ecological Monitoring Trawl Survey (EMTS)*, a 40-foot flat otter trawl with neither a turtle excluder device nor bycatch reduction device is deployed at up to 42 stations across six estuaries. At each station, a standard 15 minute tow is made. During this report period, 482 tows/observations were conducted, totaling 120.41 hours of tow time. A total of 120 sharks, representing five species, were captured during 2017 (Table 16).

Monitoring of estuarine finfish and crustaceans in the lower salinity, upriver sectors of selected estuaries is done monthly as part of the *Juvenile Trawl Survey* conducted onboard the research vessel *Navigator*. A 20-foot, semi-balloon otter trawl is towed for 5 minutes at up to 18 stations within three Georgia estuaries. In 2017, 99 tows (observations) were conducted, totaling 8.25 hours of tow time. No sharks were observed during the 2017 season.

The Marine Sportfish Population Health Survey (MSPHS) is a multi-faceted ongoing survey used to collect information on the biology and population dynamics of recreationally important finfish. Currently two Georgia estuaries are sampled on a seasonal basis using entanglement gear. During the June to August period, young-of-the-year red drum in the Altamaha/Hampton River and Wassaw estuaries are collected using gillnets to gather data on relative abundance and location of occurrence. During the September to November period, fish populations in the Altamaha/Hampton River and Wassaw estuaries are monitored using monofilament trammel nets to gather data on relative abundance and size composition. In 2017, a total of 216 gillnet and 150 trammel net sets were made, resulting in the capture of 134 individuals representing five species of coastal sharks (Table 17).

Table 17. Numbers of coastal sharks captured in Georgia fishery independent surveys in 2016 by species and by survey.

	SEAMAP	EMTS	MSPHS
SHARK, ATLANTIC SHARPNOSE	319	56	19
SHARK, BLACKNOSE	105	---	---
SHARK, BLACKTIP	19	3	6
SHARK, BONNETHEAD	19	57	106
SHARK, BULL	1	---	---
SHARK, FINETOOTH	21	---	2
SHARK, LEMON	---	---	1
SHARK, SANDBAR	11	1	---
SHARK, SCALLOPED HAMMERHEAD	---	3	---
SHARK, SPINNER	1	---	---
SHARK, TIGER	4	---	---
ALL SPECIES COMBINED	500	120	134

V. Status of Management Measures and Issues

Fishery Management Plan

Coastal Sharks are managed under the Interstate FMP for Coastal Sharks, which was implemented in August 2008, Addendum I (2009), Addendum II (2013), and Addendum III (2013). The FMP addresses the management of 40 species and establishes a suite of management measures for recreational and commercial shark fisheries in state waters (0 – 3 miles from shore). In 2016, Smooth dogfish was added to NOAA Fisheries' Atlantic Highly Migratory Species FMP through Amendment 9; as part of the Amendment, a new requirement that smooth dogfish harvest need to make up at least 25% of the retained catch in order for fishermen to be able to remove their fins at sea. The Commission later in the year approved Addendum IV (2016) to maintain consistency between state and federal FMP.

ASMFC will continue to respond to changes in the Atlantic Highly Migratory Species FMP and make changes as necessary to the interstate FMP.

VI. Implementation of FMP Compliance Requirements for 2017

Addendum III to the Coastal Sharks FMP was implemented in March 2014. All states must demonstrate through the inclusion of regulatory language that the following management measures were implemented.

i. Recreational Minimum Size Limits

This modifies Section 4.2.4 Recreational Minimum Size Limits in the FMP.

Sharks caught in the recreational fishery must have a minimum fork length of 4.5 feet (54 inches) with the exception of smooth hammerhead, scalloped hammerhead, great hammerhead, smoothhound, Atlantic sharpnose, blacknose, finetooth, and bonnethead.

Smooth hammerhead, scalloped hammerhead and great hammerhead must have a minimum fork length of 6.5 feet (78 inches).

Smoothhound, Atlantic sharpnose, blacknose, finetooth and bonnethead do not have recreational minimum size limits.

Table 4.4. Recreational minimum size limits, 2017.

No Minimum Size	Minimum Fork Length of 4.5 Feet		Minimum Fork Length of 6.5 Feet
Smoothhound Atlantic sharpnose Finetooth Blacknose Bonnethead	Tiger Blacktip Spinner Bull Lemon Nurse	Shortfin mako* Porbeagle Thresher Oceanic whitetip Blue	Scalloped hammerhead Smooth hammerhead Great hammerhead

***Per emergency rule measures implemented in March 2018 in response to the 2017 Assessment, minimum size limit (fork length) for Shortfin makos is now 83 inches or 6.9 feet**

ii. Commercial Species Groupings

This modifies Section 4.3.3 Commercial Species Groupings (and the appropriate sub-sections, outlined below). Two new species groups ('Blacknose' and 'Hammerhead') are created.

This FMP establishes eight commercial 'species groups' for management (Table 1): Prohibited, Research, Smoothhound, Non-Blacknose Small Coastal, Blacknose, Aggregated Large Coastal, Hammerhead and Pelagic. These groupings apply to all commercial shark fisheries in state waters.

VII. PRT Recommendations

State Compliance

All states with a declared interest in the management of sharks have submit compliance reports and have regulations in place that meet or exceed the requirements of the Interstate Fisheries Management Plan for Coastal Sharks and associated addenda.

De Minimis Status

This FMP does not establish specific *de minimis* guidelines that would exempt a state from regulatory requirements contained in this plan. *De minimis* shall be determined on a case-by case basis. *De minimis* often exempts states from monitoring requirements in other fisheries but this plan does not contain any monitoring requirements.

De minimis guidelines are established in other fisheries when implementation and enforcement of a regulation is deemed unnecessary for attainment of the fishery management plan's objectives and conservation of the resource. Due to the unique characteristics of the coastal shark fishery, namely the large size of sharks compared to relatively small quotas, the taking of a single shark could contribute to overfishing of a shark species or group. Therefore, exempting a state from any of the regulatory requirements contained in this plan could threaten attainment of this plans' goals and objectives.

Massachusetts is the only state that have been granted *de minimis* status. Maine and New Hampshire have renounced management interest and is therefore no longer members of the coastal shark management board. These states do not land sharks in any significant quantity and very few of the species managed by this plan are ever encountered in their state waters. Massachusetts can continue to have *de minimis* status until their landings patterns change or they request a discontinuation.

In some cases, it is unnecessary for states with *de minimus* status to implement all regulatory requirements in the FMP.

A. Massachusetts has implemented all regulations with two exceptions, it is exempt from the possession limit and closures of the aggregated large coastal and hammerhead shark fisheries.

Research Priorities

Species-Specific Priorities

- Investigate the appropriateness of using vertebrae for ageing adult sandbar sharks. If appropriate, implement a systematic sampling program that gathers vertebral samples from entire size range for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys.[1]
- Determine what is missing in terms of experimental design or/and data analysis to arrive at incontrovertible conclusions on the reproductive periodicity of sandbar sharks
- Continue work on reconstruction of historical catches of sandbar sharks, especially catches outside of the US EEZ

[1] Recent bomb radiocarbon research has indicated that past age estimates based on tagging data for sandbar sharks may be correct and that vertebral ageing may not be the most reliable method for mature individuals. See Andrews *et al.* 2011.

- Investigate the length composition of the F3 Recreational and Mexican fisheries for sandbar sharks more in depth as this fishery is estimated to have a large impact on the stock mainly due to selecting age-0 fish.
- Research to estimate the degree of connectivity between the portions of the sandbar stock within the US and outside of the US EEZ.
- Study the distribution and movements of the sandbar stock relative to sampling coverage. It is possible that none of the indices alone track stock-wide abundance trends.
- Develop and conduct tagging studies on dusky and blacknose stock structure with increased international collaboration (e.g., Mexico) to ensure wider distribution and returns of tags. Expand research efforts directed towards tagging of individuals in south Florida and Texas/Mexico border to get better data discerning potential stock mixing.

General Priorities

- Generally update age and growth and reproductive studies for all species currently assessed, especially for studies with low sample sizes or over 20 years old.
- Determine gear-specific post-release mortality estimates for all species currently assessed
- Determine life history information for data-poor species that are currently not assessed
- Examine female sharks during the pupping periods to determine the proportion of reproductive females. Efforts should be made to develop non-lethal methods of determining pregnancy status
- Expand or develop monitoring programs to collect appropriate length and age samples from the catches in the commercial sector by gear type, from catches in the recreational sector, and from catches taken in research surveys to provide reliable length and age compositions for stock assessment
- Continue investigations into stock structure of coastal sharks using genetic, conventional and electronic tags to determine appropriate management units
- Evaluate to what extent the different CPUE indices track population abundance (e.g., through power analysis)
- Explore modeling approaches that do not require an assumption that the population is at virgin level at some point in time.
- Increase funding to allow hiring of additional HMS stock assessment scientists. There are currently inadequate staff to conduct stock assessments on more than one or two stocks/species per year.

References

Andrews et al. 2011. Bomb radiocarbon and tag-recapture dating of sandbar shark (*Carcharhinus plumbeus*). Fisheries Bulletin. 109: 454-465.

Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species. 2014. NOAA Fisheries, December 18, 2015.
< http://www.nmfs.noaa.gov/sfa/hms/hmsdocument_files/SAFEreports.htm>

APPENDIX 1. OVERVIEW OF COASTAL SHARK REGULATIONS

Coastal Sharks FMP Regulatory Requirements

1. Recreational seasonal closure (Section 4.2.1)
   a. Recreational anglers are prohibited from possessing silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead in the state waters of Virginia, Maryland, Delaware and New Jersey from May 15 through July 15—regardless of where the shark was caught.
   b. Recreational fishermen who catch any of these species in federal waters may not transport them through the state waters of VA, MD, DE, and NJ during the seasonal closure.
2. Recreationally permitted species (Section 4.2.2)
   a. Recreational anglers are allowed to possess aggregated large coastal sharks, hammerheads, tiger sharks, SCS, and pelagic sharks. Authorized shark species include: aggregated LCS (blacktip, bull, spinner, lemon, and nurse); hammerhead (great hammerhead, smooth hammerhead, scalloped hammerhead); tiger sharks; SCS (blacknose, finetooth, Atlantic sharpnose, and bonnethead sharks); and, pelagic sharks (blue, shortfin mako, common thresher, oceanic whitetip, and porbeagle). Sandbar sharks and silky sharks (and all prohibited species of sharks) are not authorized for harvest by recreational anglers.
3. Landings Requirements (Section 4.2.3)
   a. All sharks (with exception) caught by recreational fishermen must have heads, tails, and fins attached naturally to the carcass. Anglers may still gut and bleed the carcass by making an incision at the base of the caudal peduncle as long as the tail is not removed. Filleting sharks at sea is prohibited.
   b. All sharks (with exception) harvested by commercial fishermen within state boundaries must have the tails and fins attached naturally to the carcass through landing. Fins may be cut as long as they remain attached to the carcass (by natural means) with at least a small portion of uncut skin. Sharks may be eviscerated and have the heads removed. Sharks may not be filleted or cut into pieces at sea.
   c. Exception: Fishermen holding a valid state commercial permit may process smooth dogfish sharks at sea out to 50 miles from shore, as long as the total weight of smooth dogfish shark fins landed or found on board a vessel does not exceed 12 percent of the total weight of smooth dogfish shark carcasses landed or found on board.
4. Recreational Minimum Size Limits (Section 4.2.4)
   a. Sharks caught in the recreational fishery must have a fork length of at least 4.5 feet with the exception of Atlantic sharpnose, blacknose, finetooth, bonnethead

and smoothhound which have no minimum size. Hammerhead species must have a fork length of 6.5 feet.

5. Authorized Recreational Gear (Section 4.2.5)
    a. Recreational anglers may catch sharks only using a handline or rod & reel. Handlines are defined as a mainline to which no more than two gangions or hooks are attached. A handline must be retrieved by hand, not by mechanical means.

6. Possession limits in one twenty-four hour period (Section 4.2.7 and 4.3.6)
    a. Recreational and commercial possession limits as specified in Table 9.
    b. Smooth dogfish harvest is not limited in state waters and recreational shore-anglers may harvest an unlimited amount of smooth dogfish.

7. Commercial Seasonal Closure (Section 4.3.2)
    a. All commercial fishermen are prohibited from possessing silky, tiger, blacktip, spinner, bull, lemon, nurse, scalloped hammerhead, great hammerhead, and smooth hammerhead in the state waters of Virginia, Maryland, Delaware and New Jersey from May 15 through July 15. Fishermen who catch any of the above species in a legal manner in federal waters may transit through the state waters listed above is allowed if all gear is stowed.

8. Quota Specification (Section 4.3.4)
    a. When NOAA Fisheries closes the fishery for any species, the commercial landing, harvest, and possession of that species will be prohibited in state waters until NOAA Fisheries reopens the fishery.

9. Permit requirements (Section 4.3.8)
    a. State: Commercial shark fishermen must hold a state commercial license or permit in order to commercially catch and sell sharks in state waters.
    b. Federal: A federal Commercial Shark Dealer Permit is required to buy and sell any shark caught in state waters.
    c. Display and research permit is required to be exempt from seasonal closure, quota, possession limit, size limit, gear restrictions, and prohibited species restrictions. States are required to include annual information for all sharks taken for display throughout the life of the shark.

10. Authorized commercial gear (Section 4.3.8.3)
    a. Commercial fishermen can only use one of the following gear types (and are prohibited from using any gear type not listed below) to catch sharks in state waters.
        i. **Rod & reel**

ii. **Handlines.** Handlines are defined as a mainline to which no more than two gangions or hooks are attached. A handline is retrieved by hand, not by mechanical means, and must be attached to, or in contact with, a vessel.
iii. **Small Mesh Gillnets.** Defined as having a stretch mesh size smaller than 5 inches.
iv. **Large Mesh Gillnets.** Defined as having a stretch mesh size equal to or greater than 5 inches.
v. **Trawl nets.**
vi. **Shortlines.** Shortlines are defined as fishing lines containing 50 or fewer hooks and measuring less than 500 yards in length. A maximum of 2 shortlines are allowed per vessel.
vii. **Pounds nets/fish traps.**
viii. **Weirs.**

11. Bycatch Reduction Measures (Section 4.3.10)
    a. Any vessel using a shortline must use corrodible circle hooks. All shortline vessels must practice the protocols and possess the recently updated federally required release equipment for pelagic and bottom longlines for the safe handling, release, and disentanglement of sea turtles and other non-target species; all captains and vessel owners must be certified in using handling and release equipment.
12. Smooth Dogfish
    a. Each state must identify their percentage of the overall quota (Addendum II, 3.1)
    b. Smooth dogfish must make up at least 25%, by weight, of total catch on board at time of landing. Trips that do not meet the 25% catch composition requirement can land smooth dogfish, but fins must remain naturally attached to the carcass. (Addendum IV, 3.0; modifies Addendum II Section 3.5)

Table 10. Possession/retention limits for shark species in state waters

Recreational	*Shore-angler*	1 shark (of any species except prohibited) per person per day; plus one Atlantic sharpnose, bonnethead and smoothhound
	Vessel-fishing	1 shark (of any species except prohibited) per vessel per trip; plus one Atlantic sharpnose, bonnethead and smoothhound per person, per vessel
Commercial	*Directed permit*	Variable possession limit for aggregated large coastal sharks and hammerhead shark management groups, the Commission will follow NMFS for in-season changes to the possession limit. The possession limit range is 0-55, the default is 45 sharks per trip. No limit for SCS or pelagic sharks.
	Incidental permit	3 aggregated LCS per vessel per trip, 16 pelagic or SCS (combined) per vessel per trip

Atlantic States Marine Fisheries Commission

Atlantic Coastal Cooperative Statistics Program Coordinating Council

April 30, 2019
3:30 – 5:00 PM
Arlington, VA

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(L. Fegley)*
2. Council Consent
3. Approval of Agenda
4. Approval of Previous Meeting Minutes
5. Public Comment
6. Review Progress on Accountability/Validation (*J. Simpson*)
7. Program Updates
    a. Administrative *(M. Cahall*)
    b. SAFIS *(M. Cahall*)
    c. Recreational *(APAIS Staff*)
8. Committee Updates *(Staff*)
    a. Commercial Technical
    b. Information Systems
    c. Joint Operations/Advisors
9. Review and Consider 2020 Request for Proposals *(L. Fegley*)
10. Other Business/Adjourn

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street Arlington, VA 22202; 703.486.1111

ATLANTIC STATES MARINE FISHERIES COMMISSION
ATLANTIC COASTAL COOPEATIVE STATISTICS PROGRAM
COORDINATING COUNCIL

The Westin Crystal City Arlington, Virginia

FEBRUARY 6, 2018

- - -

The Atlantic Coastal Cooperative Statistics Program Coordinating Council of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Wednesday, February 6, 2018, and was called to order at 10:00 o'clock a.m. by Chairman Lynn Fegley.

CHAIRMAN LYNN FEGLEY: Good morning; I'm Lynn Fegley, your Chair from Maryland, and to my left is John Carmichael from the South Atlantic Fisheries Management Council as Vice Chair, and of course our team from ACCSP. With that my first order of business is to get approval of the agenda. Is there anybody who has any modifications to the agenda?

Seeing none; and you have in your meeting materials minutes from our October meeting in New York City, does anybody have any modifications or changes to the minutes? Okay seeing none. Then finally, is there anybody out there in the public who would like to provide comment; seeing none, so with that we'll roll straight into our agenda.

The first thing on the list is to discuss this funding status. If you remember, we found ourselves a little bit short on our proposals. We had a couple of things change; I believe with New Jersey, and we are still waiting for information from the federal government. With that I'll turn it over to you, Mike.

MR. MIKE CAHALL: Lynn is exactly right. We don't have a lot of new information. The main thing that we do know is New Jersey decided to go ahead and direct hire one of its ACCSP folks. Just running the numbers roughly through their grant request that will free approximately $70,000.00; which is not quite half of what the shortfall ended up being on the worst case scenario. We will keep you guys informed again; and we'll notify the committee no longer called the Executive Committee, it's a team, and I can never remember the name.

CHAIRMAN FEGLEY: It is the Management and Policy Committee.

MR. CAHALL: Thank you. We'll notify them as soon as we have numbers again. The big variables, just as a reminder, are the overhead rates; whether or not we'll be charged an overhead by the Northeast or Southeast grants offices, and also what the final overhead for the Commission is going to look like.

Those numbers are at variance enough to cover the entire request. If we don't get charged at all, we would be able to cover everybody. Then depending on who charges us how much; we'll have more information on that I'm sure once the Feds have a budget.

CHAIRMAN FEGLEY: Just to remind everybody where we left that in October. There was a motion made that we would wait until we got this information; and depending on what the result is that that Management and Policy Committee will convene to make any decisions that need to be made. I guess everybody needs to be aware that the money could be coming later with the shut downs going on; and we're just going to have to be patient, so any questions? Pat.

MR. PATRICK C. KELIHER: The issue of funding as it relates more long term; and I'm thinking about the maintenance that is currently slated to start going down. I raised this at the Executive Committee this morning. I think we're going to need to have further conversations regarding maintenance and loss of maintenance funds long term. I just bring it to the Chairs attention as a place holder for future conversation. I know there are several jurisdictions that were going to be in very difficult financial situations; if that goes forward as it is currently planned.

CHAIRMAN FEGLEY: Okay note made; and that is something perhaps we'll take up in the spring, anybody else? With that we'll move on to the next agenda item; and I'll turn it over to Mike to go over the results of the Data Accountability Survey. I want to thank everybody's staff and everybody who participated in that.

I think it's a really interesting outcome. We do not have a lot of time today. There was a lot of information. I think what we're going to do is do a real high level overview; and plan on coming back with a more detailed discussion on this in May. With that Mike, take it away.

MR. CAHALL: I think the first thing that we found when we did the survey is that we aren't all speaking the same language; which was a lot like how things began in the program. For those of us that are long term survivors of this program. I can remember arguing about what a dock was or what a landing net. I think in the survey some of that came through.

Having said that going through this really quickly, what we're looking at is a mechanism to verify our harvest data. There is a lot of different ways that we can do that. What we would eventually like to do is come up with a consistent standard on how we would like to see that accomplished.

To do that we went ahead and put together a survey and my thanks to Julie and Ali for doing that; they pulled it together and sent it out. Basically asking our member agencies what kind of accountability measure did they use; and again, if they used some kind of accountability measure to describe it for us.

Again why we're looking at it, we would like to develop an accountability standard; so that we have some universal measurement that we could use that we could provide help, and also eventually integrate into the tools that we provide, and also data that meet these standards could be flagged in our database.

I don't want to say we would put the gold flag on it; but what we would say is that we know these data have been validated by a methodology that everyone has agreed is sound. There is some potential benefits of course to having a standard in our new electronic tools; especially as we move forward with development, or we certify other contractors that they would be able to provide this level of validation. We would also potentially be able to do a tool that could assist the states; and also of course improve the data itself for stock assessments and for allocation decisions.

Here is what we found. The most common method, no surprise to be honest, is the comparing commercial fishermen trips to dealer reports. Then after that they saw them going down. Some require negative trip reporting; also almost everybody does do some kind of a data on it. Less used, and not surprisingly, because it's also really expensive, are the onboard observers and VMS.

Then kind of in the middle we have dockside monitoring and sampling, free trip notifications, and hale-ins or hale-ins and hale-outs, different comparison with data that you might get from another agency, and then finally actually having law enforcement. What we think we need to do is some further analysis on the results of the survey.

We do have a meeting of our Commercial Technical Committee upcoming; and where we could start chewing through this a little bit. We're not at the point where we could even begin to make recommendations. We've had the results of the survey less than two weeks. I think the main news that we're sending back to you all is that we did do the survey.

There are a lot of different methods that are in use. One of the benefits I think also is recognition that there are a lot of different things going on in a lot of different places. No surprise, NOAA Fisheries has generically the most robust program; and that there may be some lessons that we could learn from them. I think that's what we got right now for the survey. Does anybody have any questions?

CHAIRMAN FEGLEY: Thanks, Mike, and thank you TR Team for getting that done. For me, I found this to be fascinating; and I certainly learned a lot. It was very helpful for me to get out of my parochial view of Maryland systems; and see what everybody else is doing. We'll have a more detailed discussion about this in May.

Like I said, go home, digest it, and read the results. But I have a couple sort of high level questions to throw out to the group to think about for the spring. One is if we were to go down this road of accountability standards, you know the question is; would accountability standards be helpful to you? I think that they would be helpful; obviously in the context of stock assessment, understanding the quality and accuracy of the data that go into our assessments.

But would they be helpful to your state in the context of seeking funding; and also support from your leadership to implement some of the accountability measures that could be helpful. That's one question. Would these standards actually be helpful to you? The second one is; when I read through the results there are some states that have some pretty interesting stuff going on.

They are doing some things accountability-wise that we in Maryland, it would be very difficult for us to get there just through stakeholder buy-in. I wondered if it would be helpful to the group to hear from some of these states who have some of these interesting programs going on; and understand how they go there. You know how did they get the stakeholder buy-in to get where they are? What was the genesis of their construction of these programs? Those are just two questions I have to throw at the group; and if anybody else has questions lay them on us, otherwise we'll move on. With that we'll just move along.

MR. CAHALL: I've condensed five or six months worth of work down into one slide here; because our primary focus today is our recreational data collection. The shutdown may or may not influence the effective date of the regulations for the Southeast and the Gulf. We had a regroup conference call with the folks at the SEFHIER Program yesterday; and they are not sure at all yet either.

They are having a meeting on Thursday with their General Counsel to talk it over; and see what they think the right solutions need to be. The likelihood is that the regulations will be delayed; but we don't' know by how long, and there is also a likelihood that the Gulf requirements may be split off from the Southeast requirements.

The Gulf requirements are much more stringent in many ways than the South Atlantic's requirements are. Having said that we maintained our development schedule through the shutdown, because we weren't impacted by the federal government folks not being available, in terms of the software development, and we're moving forward and we're on time to have a testing version of the new version of eTrips mobile, which we're calling Version 2, which you could also call SAFIS redesign beta.

But it is intended to run on multiple platforms; all three of the common tablets, as well as phones. It will allow partner-specific configurations much more flexibly. The goal also is to allow; an example I'll sight is the gear configurations. The system will allow you different kinds of configurations of gear by partner; depending on where your fisheries are, and what kind of gears you allow your folks to use.

Our concept for the redesign system would be to allow each individual participating partner to have a switchboard; where they could literally turn fields off and on, or validation lists off and on, depending on whether or not they need them. A good example might be multiple landing locations, and the requirement for a sell-to dealer.

National Marine Fisheries GARFO requires sell-to dealers; and each sell-to dealer has to have a landing location associated with it. That may not be something that is required for folks with the state trip reports. We are on target to have a production version in, in mid-March on the assumption that we would need it to be available by April 15.

We don't know that that is actually going to be the case; but nonetheless, we're going to maintain that schedule at this point, until we hear otherwise. I'll tell you that there are two pieces that are holding us back right now; one of them is that we still do not have South Atlantic permits. We are working with them to get them.

There are some issues with privacy concerns over personal identification information; the birth dates that we need to create the IDENTs that uniquely identify our participants. Those of you who have been around for a while know what an IDENT is, and we use them. We have made a deal with SERO to have them generate the IDENTs and send us the relevant information, and that's the work around. But of course they didn't have staff around to do it during the shutdown. Then the other piece is that we need to make sure that we have all of the ports that are in use in the South Atlantic and Gulf into the system; so that we have places for them to leave and go to that are relevant to their areas.

We're working with that. That got impacted by the shutdown too; and Joan Palmer's retirement. Joan was doing the work with Geoff; and then she retired and shut down, so she was in this weird limbo for the better of a month, where she was sort of retired but not, because they couldn't process here paperwork.

But those of you who know Joan, you can imagine what she did, which was she kept working. We expect to have that resolved in the not-too-distant future as well. I'm very hopeful that we'll get this out on time. I'm very hopeful that it won't be the be-all and end-all; but it's definitely a step forward, and it's definitely a step in the directions that we've been talking about creating a universal flexible tool that will allow for variations within our individual partners. Are there any questions? Yes, sir.

MR. JOHN CLARK: This is kind of off topic. I was just wondering. I noticed in the Modern Fish Act, one of the big points of that is; recreational fishermen reporting. Would this serve as like a basis that could be put out to all recreational anglers; or do you see ACCSP having to get involved in getting all this data from individual anglers?

MR. CAHALL: Thanks for the question. In fact thanks to the South Atlantic Council, we already are. The way that our tools communicate back to our data bases is through an application programming interface, an API. Because of that the tools themselves are independent from our systems.

Any tool that can speak the language that our API speaks can provide us with data. We're currently working with a couple of different systems. The system formally known as SCAMP, whose name was changed, RELEASE, it's now called RELEASE, and a couple of others that are set up that way; eTrips itself can be modified to manage individual anglers, but it's not specifically designed to do citizen science.

But the API that supports it; the data transfer protocol that's used, can support citizen science. We are actively working, as I said before, on two separate projects. Probably what we'll do is we'll publish a standard API for citizen science; so that we have an easy way for vendors or developers to flood data in. We'll keep those data off to the side while we collectively decide how we're going to use these data.

CHAIRMAN FEGLEY: Any other questions? Okay seeing none; we will move on to Agenda Item 7, which is the Recreational Updates. Geoff.

MR. GEOFF WHITE: We're going to start off with just a little bit of the metrics of how the Access Point Intercept Survey has gone for the last three years; and then Alex is going to lead us through kind of the really exciting development for moving to tablets in 2019. With that quick recap, the number of angler intercepts obtained by all of your staff has been increasing; so about a 27 percent overall increase over the last three years, 43 percent increase in charter-mode intercepts. That has been done with essentially the same sampling size of site assignments. Last year there was a 10 percent increase funded by NOAA, of additional site assignments, on average across the states.

But that is really good news; and it shows a lot of attention and work that your staff has all put into that. The productivity, the interviews per assignment has gone up from 5.5 to 6.5. I've got a few graphs, but one of the big ones is really the percent of eligible anglers that are being interviewed.

During that six hour assignment, a bunch of people go by you that have been fishing. What percentage of them were you able to complete an interview for versus maybe you were busy talking to somebody else and they weren't counted, or maybe there was a language barrier, or some other issue.

That is increased from 54 up to 62 percent. That is an efficiency of capturing activity at the site that you're at at the time. That has been fantastic. Also over the last three years dealing with paper, we'll pass these out as a historical comparison. The edit rate, the amount of times that there was something that had to be changed either from logic or handwriting, or maybe just the scanner reading it wrong, has changed from an average of about 6.5 percent down to 3.5 percent.

That is less time of everybody calling back and forth, figuring out exactly what the data were supposed to be, before we end up delivering that to NOAA Fisheries. A lot of good news there, it relies on all of the partners contributing; that's your state staff, what we've been able to do inside of ACCSP, and MRIP working with us on a bunch of things as well, so thanks to everybody.

Then two quick graphs, I won't spend too much time here. This is the number of intercepts overall; and each state is represented, so Maine on the left is northern, and going down to Georgia on the right. A reminder Florida is covered through the Gulf States Marine Fisheries Commission; and that's why they're not on the slide. The lines across there show an increase each year of the average.

You can see that within each state there has been an increase over time of the number of intercepts contained. That's generally just a representation of how you guys are doing within each state. Then the next graphic is that percentage of eligible anglers that were interviewed. Again, you see some pretty large jumps within each state; and of course the biggest jump between 2016 was learning 2017.

There was the Social Economic Survey, so we didn't go down, but maintained the same average number of intercepts. Then 2018 kind of were free to get more intercepts; and that shows with the large increase that is there. This is Alex DiJohnson; he's the South Atlantic and APAIS Coordinator, Coleby Wilt couldn't be with us today. But Alex is going to walk you through all the information about the new tablets. I'll pass out the forms while he talks.

MR. ALEX DiJOHNSON: We started collecting APAIS data electronically in January, Wave 1; and North Carolina is the only state from Maine down to Georgia, like Geoff mentioned that we actually work with the ACCSP. The way that this is working now is that as opposed to distributing all these forms and having people fill in everything manually, it is sort of automatically uploaded through this application that we have.

We distributed both tablets sort of differently for headboats, and also for site assignments that have these applications on them. They can collect everything straight from the NOAA Fisheries site assignment draw that we house in our assignment tracking application or ATA. All of these sites come in automatically once you're in Wi-Fi.

The intercepts out in the field are conducted out of Wi-Fi obviously, with no issues with that. Then you get back into Wi-Fi to submit everything; and it's submitted automatically to the ACCSP. In 2019 we will not be distributing any forms. We did release PDFs just as backups; in case of any catastrophic failure with the tablet, or anything like that.

But still we would require that those paper forms are then transcribed back into the tablet, and then submitted to the ACCSP that way. This has seen a real reduction in the amount of manual corrections; both to things like your state and county, but also some logic that Geoff was mentioning in helping to reduce the number of edits that we're looking at.

In general we're seeing less time spent in fixing data. This is sort of the overarching theme that we're going to talk about here is that this is kind of reducing the time. From paper it was about 15 to 21 days from the time that it would take for an assignment to be completed; until both the state leads and state field interviewers and the ACCSP were kind of working with the data before submitting to NOAA, down to about 1 to 4 days with the tablet.

This is what you would see when you log in; and I'll actually show you a brief demo to go through this. But this is effectively the list of assignments; so you can see some identifying information for the interviewer, for the assignment, some really important parts like the date, the time that you're required to be out there, the full six hours.

We sort of differentiate here between site and headboat assignments; just because they kind of have different procedures, so we color them a little bit differently. It's just important to note that his is sort of going along with the MRIP Strategic Plan; to sort of have more electronic data collection in general.

The point of this graphic is to show you that sort of the process has changed a little bit. It's essentially the same process; but you can see on the left we have the old version in 2018 and before, using paper forms, which is just more cumbersome. People were out in the field collecting information.

They would send that within one to seven days to their state leads. The state leads would then have to take a couple of hours to manually input all of that into our tracking application; and then also to send that all in a couple of days to a week to the ACCSP. The ACCSP would then have to work through everything to make sure that we had all of the correct assignments and the intercepts that we thought we had; then to actually scan that in manually, which was another week on top of that. By the time that we got to the point where we are working with everything, this is that 15 to 21 days that I was talking about earlier. The states and ACCSP kind of confer to make sure all the information looks correct; that is a pretty big chunk of time, and then the states have some time to look at post validation.

They would call 10 percent of the total intercepts; just to make sure that the people were actually out there and that they were doing the procedures correctly. We had a pretty big time lag with that; before the data were eventually sent to NOAA Fisheries. Whereas if you look at on the right now, the interviewing is still taking place obviously in the field, but now with the tablet, and this is now a 1 to 4 day lag as opposed to 15 to 21.

We're essentially halving this. What we saw in Wave 1 so far in January, which I'll get to next, is that pretty much one day after we had everyone's information, so the day after they completed their assignment we had it. Then states can begin conducting these post foul calls, pretty much right afterwards. They are also kind of reducing that recall bias with anglers; and trying to contact them.

Then it's the same process. ACCSP then submits everything to NOAA Fisheries. How has everything gone so far? North Carolina in January, well there were 131 site assignments, and they are all successfully uploaded into the ATA. We have all of the data there already. I think the longest it took was four days; just because people were editing it.

People are still getting used to everything in general; but so far we've seen a really smooth transition from North Carolina. They obtained 112 interviews on 42 assignments; which is almost identical to what we saw in January of 2018 with the paper forms, so no real difference in that so far.

We've heard from North Carolina staff that this has reduced the amount of time that they're spending for their state staff by about 20 hours; with working with the forms and submitting everything in the mailing process to the ACCSP each week. In general North Carolina staff has been really awesome to work with.

They put a lot of time into working on the flow of everything; to make sure everything works as well as possible, both hardware and software. You know all states are also working on this in sort of a test environment as well. But as they continue to provide us feedback, we're able to make changes into the application and into the hardware as well, in order to make this as efficient and timely as possible.

MR. WHITE: Alex has a live demo; but we also have a request to go back to one of the graphics. While he's getting that going, Julie can you go back to the percent efficiency by state graphic? Yes, the graph. Then we'll go to the demo.

MR. DiJOHNSON: I'm just going to walk through the application in general. I'll show you what it's like. Right now I'm just projecting from this tablet that I actually have this up. This is potentially what it would look like. This is the list of assignments that I was talking about; all the details in here. Essentially I'm just going to click on one of these to go through. We'll pick the top one here. Definitely a bit of a lag, so we have the detailed houses everything inside of it that would normally be manually filled in by the interviewer; but in this case we don't need to do that. We can just move into the site section; once it catches up. But in the site section it houses one of two sites; depending on whether or not this is a one or two site cluster, which is sort of NOAA creates these assignments, the danger of doing a live demo, so the internet connectivity.

CHAIRMAN FEGLEY: Maybe we can, if anyone is interested they can catch up with Alex, and we can do an offline demo in the interest of time.

MR. DiJOHNSON: That works perfectly.

CHAIRMAN FEGLEY: In the meantime and thank you guys very much. Are there any questions? Dee Lupton.

MS. KATHY KNOWLTON: Well it will be Kathy. Good morning. Just wanted to make sure I took a moment to congratulate and thank the ACCSP staff for this work. A few years ago we had the lovely discussions about state conduct of the APAIS; and now going into the for-hire telephone survey.

I firmly believe that none of what you're seeing now and the savings in time and efficiency; and the increase in the data quality, and the reduction of the possibility for so many errors would have been possible without the collaborative process between the Commission, the ACCSP, and the states. I know coming from the perspective of a state that very much enjoys working with the staff towards these kinds of products that this is pretty monumental.

It's not just seeing the data being collected electronically dockside, and moving into the next advancement with technology. It is an epic improvement in the potential for those data and their quality, and the increase in the data that are available, and the timeliness of the data. But I don't think any of that would have happened if it hadn't been for the state conduct, and the partnership between the Commission, ACCSP, and the states. I just wanted to say thank you and this is really incredible to see finally come true.

CHAIRMAN FEGLEY: Thank you for that Kathy. It is impressive, and it looks like we have a graph. Dan.

MR. DANIEL McKIERNAN: My question is is there any take-home points to one or more states clearly above the median; and some below. I know back home we have a lot of challenges with cooperation with some of the anglers, especially on charterboats. I'm just wondering if there is anything you can say from these trends.

MR. WHITE: Within each state, increasing over time shows more comfort and ability to make things happen; probably better outreach to the anglers. There are differences in fishing activity, other things that kind of are masked in this. But I will say that a lot of states that have consistent-long-term staff doing the project tend to get better at doing it overall. In larger states that have more seasonal staff, it's harder to get the level of proficiency and the interviewing skills to be able to go approach a bunch of people you don't know, and ask them how their fishing is going. To be a same face at the same kind of sites as to what's going on. The marine operators know you; different things happen out in the field. You know where states have been able to maintain consistent staff; they tend to do better in the long run.

CHAIRMAN FEGLEY: Are there any other questions, before we go into the CATI? Okay.

MR. WHITE: At the same time we're deploying the electronic tablets, there are three states that do the phone calls for the for-hire telephone survey. The amount of project work, the telephone calls are less staff time than going out in the field to do the angler interviews. There are three states that do that; North Carolina, Georgia, and Maine directly, and then all the other states are handled through the NOAA contractor, which is QuanTech.

This year with support from NOAA, we developed an online call-assisted-telephone interview, or CATI; that helps these three states make the telephone calls in a more efficient way than they had been doing in the past. It's being used by these three states in 2019, and the Executive Committee discussed earlier this morning about moving forward and exploring the options for full state conduct in 2020 that will depend on figuring out the resources, as well as approval from MRIP in figuring out their contracting.

The benefits are really increasing the state contact and relationships with your fishermen, more direct changes to the vessel directory; the list of what vessels are active in your state at that time and potential flexibility as the for-hire logbooks are implemented. But for 2019 the procedures remain; and North Carolina has already noted in January that it's saved them about 30 percent of their staff time by streamlining the processes around those phone calls.

The phone call itself takes about the same amount of time; but all the things about recording it on paper, transcribing it into electronic system. There is a bunch of back-end organizational pieces that this tool is already saving them about 30 percent of their time per week. I'm going to give you two screen shots of what this one looks like.

The first is as it enters the screen based on the login; it's a web tool, it is part of what Alex mentioned is the assignment tracking application. It automatically selects the current week for calling; and the little telephone icons are colored green, if you're supposed to be calling those people that week.

On the left hand side there is a circle for screens that it will be able to show you your completed surveys. There is also a pre-notification letter that goes out. In the past states would have to actually create their letters, do the mail merge and everything else. This system, you just push one button; it downloads the information, and you print it out and you're good to go, send those letters out to the states.

The next screen shows, so if you were to press a button to call a vessel representative, it goes to the next screen, and it basically walks you through the interview. At the top of the screen it shows who the person is that you're calling. There is a section to add notes, a section to add differences for the vessel. If they don't answer the phone there is a "did not answer," or "answering machine," or "call back at this time." There are some quick ways to get out of that call if there is nobody there. Then it puts them into the next round of calls. Then if they do pick up the phone, there is a script at the bottom of the screen, which leads the person making the phone calls to go through.

In this case it says; hello, my name is Geoff White, calling from the Atlantic States Marine Fisheries Commission on behalf of NOAA Fisheries Service and the for-hire telephone survey. May I speak with the vessel representative, and if you say yes it just walks you through all the questions. Click on yes/no if they did trips there is a log sheet that it enters all that information directly.

You need to be online; but it records it, and it has all the information right away. These kinds of process efficiencies should standardize how it's happening in these three states for 2019. We're really excited about it. North Carolina has been really positive about it, and Georgia is going to start up in March; so they're about ready to go too. They've all been through training and testing and modifications with the system with us. We're very excited about this development. Are there any questions on that part? Yes.

MR. ROY W. MILLER: Out of curiosity. If you were to call me, what would come up on my caller ID screen? I suspect that many people, like in my household. If it says anonymous or it says private caller, we're not even going to pick it up. Out of curiosity, what would come up?

MR. WHITE: At the moment the North Carolina phone number that is calling you pops up. If QuanTech is the contractor and they call you, and then their phone number comes up as QuanTech, it shows up on caller ID. It's the phone number that is being dialed, so whether it's coming from a state or whatever.

CHAIRMAN FEGLEY: Go ahead, Roy.

MR. MILLER: Is there a better way to do that? In other words, could more information be programmed in to pop up on caller ID?

MR. WHITE: It's possible; depending on the phone system that is being used. The computer doesn't actually dial the phone number. It shows you all the information, the phone number, and then you type in the numbers and dial it from your local phone. I think Dee has some input.

MS. DEE LUPTON: I think the for-hire fishermen get a letter the week before that the call is coming. In North Carolina, it's a good question; I don't know what it says. If it says Division of Marine Fisheries they may not answer; but if just says a local number from Washington, North Carolina, they may. But like I said, they are prompted to expect this call the next week.

CHAIRMAN FEGLEY: Cheri, did you have a question?

MS. CHERI PATTERSON: We had staff call the states that were conducting this and just get a general idea. We got the impression that the cost to do this was higher than what was budgeted.

Am I misrepresenting that somehow? If not, could one of the states that are conducting it explain this?

CHAIRMAN FEGLEY: Kathy.

MS. KNOWLTON: Did you just say that the staff indicated that the cost that was presented was lower than what they thought it took to do the work or higher? Would you repeat that again for me, please.

MS. PATTERSON: It was higher than budgeted.

MS. KNOWLTON: I would say that in Georgia we have indicated through the Rec Tech process that the estimated price that was presented was by far a minimum of what it takes to do the work. That was, I will say one caveat that table of information was without using the CATI system, so there could be obviously the improvements in that.

I know that both myself and Chris from North Carolina indicated that there could be a difference in the, shall we say ability to get off the phone quickly, when you are a state staff member that is calling a constituent, and they've got you on the line directly. We hope they would ask other questions and perhaps relay other opinions and concerns and issues.

That's a great opportunity to have bridge building with our constituents that you can't easily quantify in a monetary value. But I think that the information that is presented as cost information is a good starting point; because you have to have somewhere to start. I know that those data were applied equally in the states; so that you had a starting point.

But I would say that our staff spend more time per call when they make contact; because of the relationship building, and the access that person has to the staff members. Yes, definitely something to keep in mind, I feel as you proceed down the line of trying to figure out approximately how much money it might cost the states to do the work. But it's a good question.

1. CHAIRMAN FEGLEY: Yes, Bryan.

MR. BRYAN KING: I'm going to offer one possible suggestion to alleviate the caller ID. Would it be possible in the letter that goes out that you let them know what they're going to see; who it's going to be identified as and the telephone number it will be? That would maybe smooth the process a little bit; but it may not solve it completely.

MR. WHITE: Appreciate the suggestion. The desire is usually for flexibility. Some interviewers like to make the phone call from their cell phone while they're on assignment. Some people end up doing it at home. Sometimes the fishermen actually receive an answering machine message and call the staff member back. There is a high variability of how this actually happens. We've created a system that allows for a lot of that flexibility.

MR. McKIERNAN: In the spirit of suggestions. Has anyone considered sending a text message instead of a letter? I usually get a text message the week before my dentist appointment. It's brilliant, because I always forget. But getting that kind of puts me in the mode. I'm wondering if you would consider sending a text message saying; in the next two days expect a call from this number about this.

MR. WHITE: The current survey design requires a pre-notification letter. It's a great idea. We can talk to MRIP about it. The first questions become, of the three phone numbers that each vessel contact has, which one is the cell phone; so that you can actually send a text message. Do you have a valid cell phone for each vessel representative? There are hurdles, there are questions. But it's a good suggestion.

CHAIRMAN FEGLEY: Thank you for that Dan. My question just real quick is how much of a problem is the non-pick up? How much of a problem do you have with people not responding to the phone call? Is it a significant issue?

MR. WHITE: Overall no. The response in North Carolina has been about an 80 percent pick up rate. That is higher than I believe the historical is; which is around 60 percent. But the reason MRIP has continued the for-hire telephone survey, is they get a high response rate from the for-hire captains that are a known universe that know they need to respond. The survey from a percentage response rate still works.

CHAIRMAN FEGLEY: Any more questions on CATI before we go to Julie to take us home? Okay seeing none; Julie you're on, Confidentiality.

MS. JULIE DEFILIPPI SIMPSON: The spring load, we have started that process. The participants are due at the end of the week. We will start matching those at the beginning of next week. If you have the files ready to go you can e-mail them to us; and we are hoping to have the upload application for that up and running as soon as possible.

The data are going to be due in the beginning of March; and then we will be releasing those in mid to late April. The second round of standardizing for species in common names has been completed. The Standard Codes Committee is going to be talking about Round 4 in February meeting, and Round 3 is actually going to be released to the public in March.

We're going to talk about how we want to handle Round 4 in February with the standard codes folks. For our data warehouse enhancements, I'm going to talk about the improvements to the Confidential Account Application, and that management interface in a next slide, so I'll just keep going.

Since our last meeting we've actively worked on the FMP review for herring, the Commission stock assessment for black sea bass, the FMP Review for bluefish, and winter flounder. We've continued to work on other species such as shad and menhaden, and lobster and cobia, and red porgy, and some of the other species that you heard about at the last meeting.

Two custom data request highlights since the last meeting. One of them is the penaeid shrimp fishery in South Carolina and Georgia had a cold water event. We worked closely with both the states and the economist in the Southeast Fisheries Science Center to get him the data that he needed to write that report. He turned that around very quickly after the furlough; so he's got a draft report out to those states. The other sort of interesting request has been working with DFO in Canada on the American eel stock assessment. I said I would come back to this. For those of you that have ever applied for confidential access, especially if you did it a few years ago. You'll remember that you had to download the PDF, and if you needed coastal access you needed to print it out 16 times, and fill it out.

Then scan each one of them, and e-mail them to 16 different people. Those folks would print it out and sign it, and scan it, and e-mail it to us, and we would print it out and we would fill out the part that we had to fill out, and we would do the data entry in our system, and then we would file it in the file drawer in the hallway.

That was a lot of paper and a lot of printing and a lot of scanning and a lot of writing. The new process is there is an online form; and once you hit submit that online form sends e-mails with PDFs attached to the partner that you requested access to, and it copies you. That PDF has been electronically filled out and signed by you.

No one ever has to print it if they don't want to. But we do want to send it to the states; so that if they do want to print it for their records that they can. The security contact is then able to log into the system; and at that opportunity they can either approve or reject, and that includes certain options like if you want participant info and things like that.

If you feel that the applicant hasn't given you quite enough information to make a decision, you can actually put them on hold. When you choose hold you can have the opportunity to send a message. That is also true if you approve or reject. If you put someone on hold and say hey, I really want more information.

If you choose hold, put that information in the comment box, and then hit submit, it's actually going to e-mail the applicant and copy you and say; please provide me with this additional information. That is also stored in the database; so they can see the status of their application. One of the other things we've done is that when a person is applying they can see their current status.

We're hoping that this will alleviate people, and they can't choose boxes for things that they already have access to. If you only need two or three states, you're not clicking all the states that you already have and bugging those people, even though you don't need access to them. It kind of filters out what you can and can't do.

It also allows a security contact. When they log in they can maintain a request. If someone in your state has retired or moved on, you can actually go in and remove their confidential access to your state data, and you don't have to call anyone. You can just maintain the account within there. It also allows the partners, some of the partners have additional files that are either part of their state approval or that are a part of the request.

They are an additional form to fill out or a letter you get at the end; and there is a place where you can maintain those partner files, so if you change your file and you have a new letter. You can just upload that through the application. That means that the ACCSP staff is just serving as support to all of the electronic forms. We've had really good feedback on people thinking it is much easier. There have been a lot of bugs to work out; because it's a pretty complicated system, so we appreciate everybody's patience when they got a lot of testing e-mails with Daffy Duck applying for confidential access. Does anyone have questions?

CHAIRMAN FEGLEY: Matthew.

MR. MATTHEW P. GATES: Actually it's more of a comment. As someone who was an approver in both systems, the newer one is definitely more streamlined. It's probably a 99 percent savings in time. Thank you.

CHAIRMAN FEGLEY: Are there any other questions for Julie? All right well this is excellent work. It's impressive to see this all unfolding. Thank you, and with that would anybody oppose a motion to adjourn? Seeing none; thank you everyone.

(Whereupon the meeting adjourned at 11:00 o'clock a.m. on February 6, 2019)

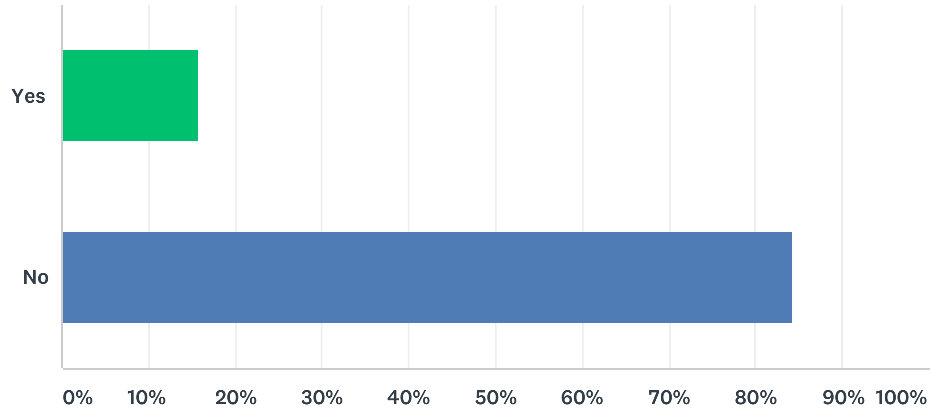
- - -

Q1 What agency do you represent?

Answered: 19 Skipped: 0

Q2 Does your agency use onboard observers to validate trip data?

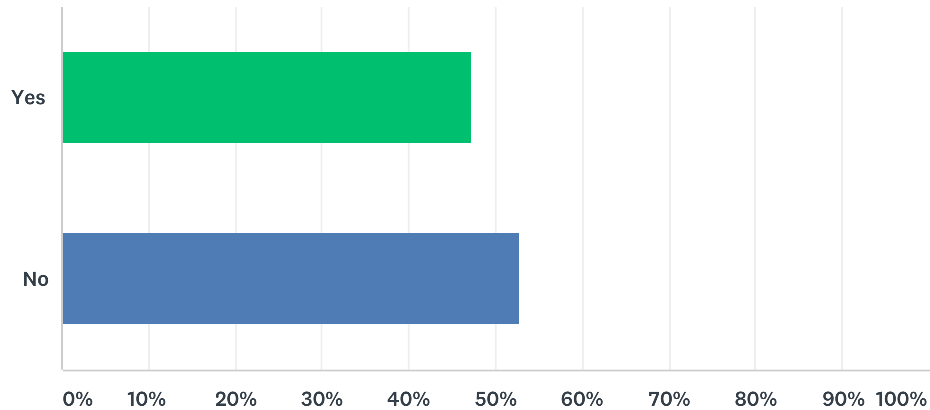
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	15.79%	3
No	84.21%	16
TOTAL		19

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

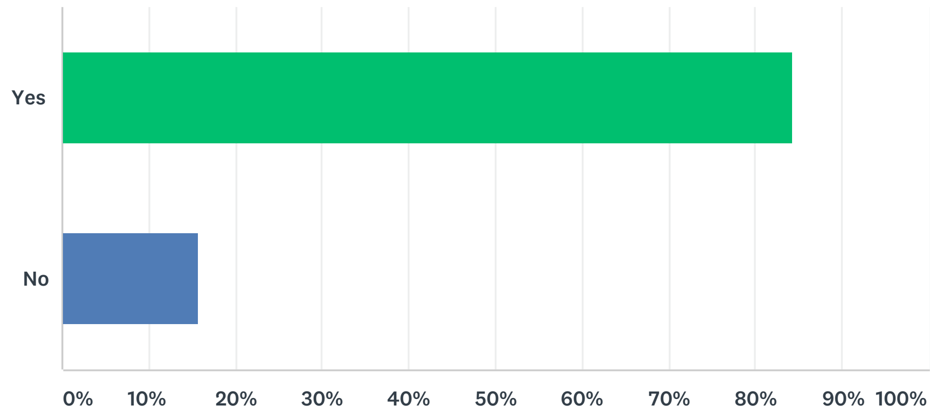
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	47.37%	9
No	52.63%	10
TOTAL		19

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

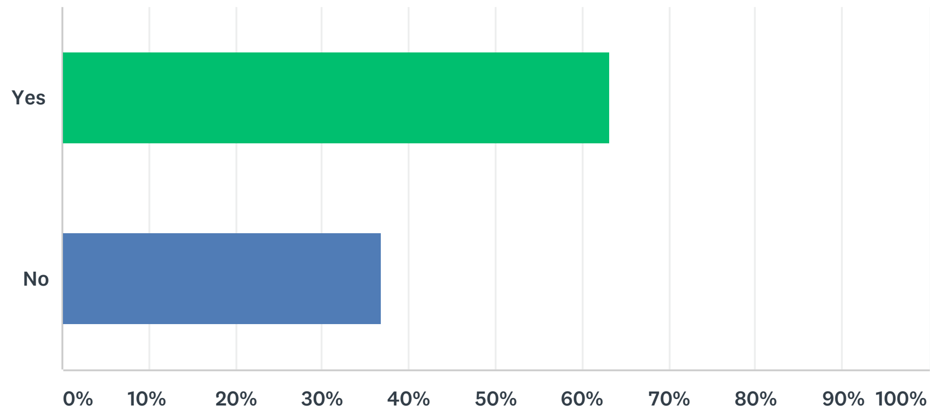
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	84.21%	16
No	15.79%	3
TOTAL		19

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

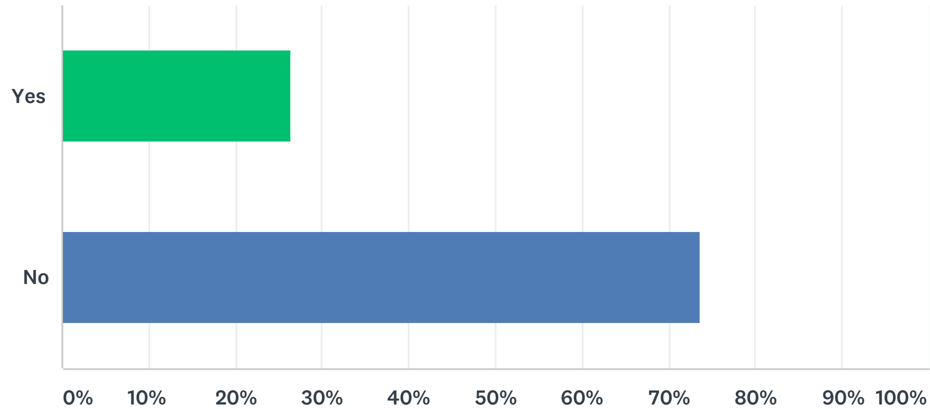
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	63.16%	12
No	36.84%	7
TOTAL		19

Q6 Does your agency use VMS to validate reported trip data?

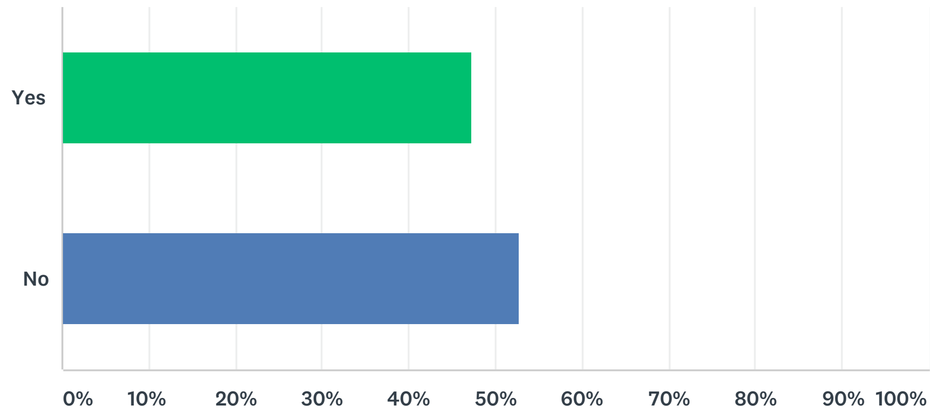
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	26.32%	5
No	73.68%	14
TOTAL		19

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

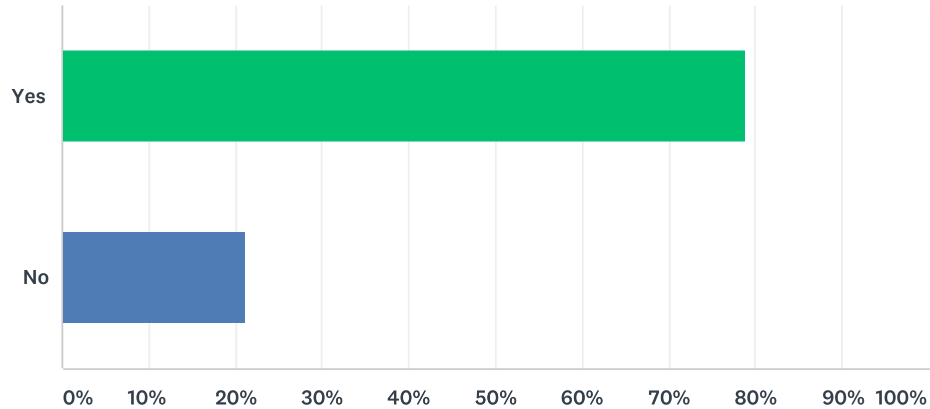
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	47.37%	9
No	52.63%	10
TOTAL		19

Q8 Does your agency require negative trip reports?

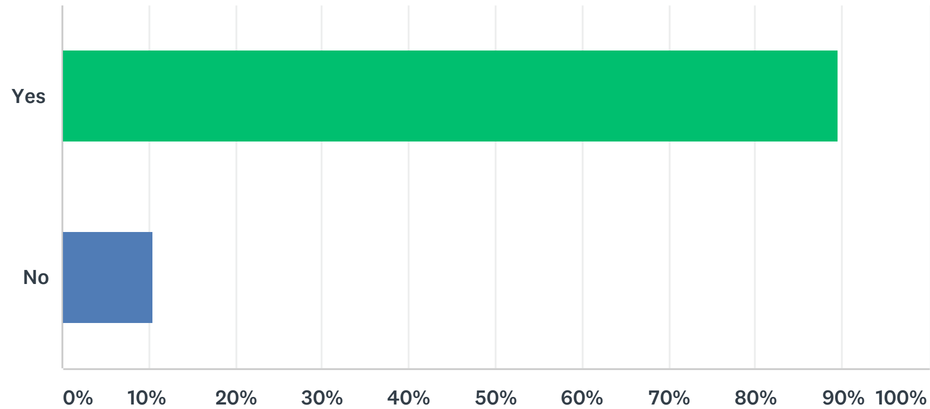
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	78.95%	15
No	21.05%	4
TOTAL		19

Q9 Does your agency conduct data audits?

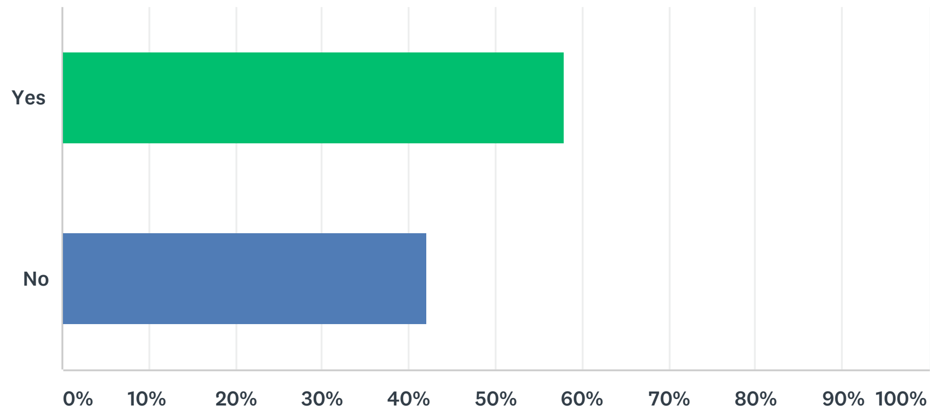
Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	89.47%	17
No	10.53%	2
TOTAL		19

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Answered: 19 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	57.89%	11
No	42.11%	8
TOTAL		19

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Answered: 12 Skipped: 7

#1

INCOMPLETE

Collector:	Web Link 1 (Web Link)
Started:	Thursday, January 10, 2019 9:57:45 AM
Last Modified:	Thursday, January 10, 2019 10:41:12 AM
Time Spent:	00:43:26
IP Address:	167.192.187.109

Page 1

Q1 What agency do you represent?

Georgia Department of Natural Resources

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

No,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Georgia uses a single trip-ticket. Harvesters provide the dealer with gear, effort, and area information at the time of the transaction.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Federally permitted dealers based in Georgia submit electronic reports to SAFIS are required by NOAA Fisheries. Georgia considers those reports to have met the state reporting requirement. As such, there is no state report for Federal dealers.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?	**No**
Q9 Does your agency conduct data audits?	**No**
Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?	**No**
Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.	**Respondent skipped this question**

#2

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 10, 2019 10:57:41 AM
Last Modified: Thursday, January 10, 2019 11:12:23 AM
Time Spent: 00:14:41
IP Address: 132.177.103.88

Page 1

Q1 What agency do you represent?

NH Fish and Game

Q2 Does your agency use onboard observers to validate trip data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We have sea samplers on a specific number of lobster trips in different areas, but that is to specifically obtain biological data on the total catch (kept and discards).

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We do dockside sampling to gather biological data for lobster and crab. These are checked against harvest data and landings data, but are not targeted specifically for validation.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
On an annual basis we combine state harvester, dealer, and federal vtr data to look for discrepancies and assign area to landings for later use in stock assessments. Resolution depends on the data set with the issue. Discrepancies of more than 10% are flagged for further review. Federal issues are sent to the statistics branch to be resolved. Landing issues are checked with the dealer in case of entry error. State harvest data are checked with the harvester. Other fisheries are predominantly federal or kept for personal use or bait.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
In our lobster fishery specifically because much of it is state only. Most other state waters fisheries are personal use or for bate and not sold. Other fisheries are prosecuted in federal waters and only appear on federal vtrs and federal dealer reports. We do not validate those. During our annual lobster resolution we compare state harvest reports, federal vtrs, and dealer reports.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We require negative reports for anyone possessing a state license or permit to fish in state and in state/federal joint waters. Federal reporters are still required to submit negative reports despite the feds not requiring it. We have no way of knowing if they are delinquent in their reporting or truly inactive without negative reports.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
All state harvest data are audited after entry. Comparisons are also made with dealer data. Data discrepancies for entry are simply resolved by using the number provided by the harvester. Electronic reports are check for values that are out of normal bounds. Discrepancies are resolved by checking with the harvester or the dealer then left or fixed accordingly.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

No

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Respondent skipped this question

#3

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, January 11, 2019 9:32:57 AM
Last Modified: Friday, January 11, 2019 9:59:17 AM
Time Spent: 00:26:19
IP Address: 158.123.91.30

Page 1

Q1 What agency do you represent?

RI Division of Marine Fisheries

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Subsets of state only data is audited, not every report. the percentage of data covered varies annually. discrepancies are corrected either via the dealer or JIRA depending on magnitude after the necessary correction has been confirmed through contact with the fishermen/dealer. Additionally, RI works with GARFO on port change audits monthly of federal data.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Work with GARFO though JIRA on both port change audits (GARFO submitted and RI checks for accuracy and approves the changes), and to correct other mistakes RI notices (mostly fishermen license corrections, but other things as required). federal dealers/vessel data is audited this way, which is a large portion of RI data.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

pre-trip notifications are required in specific fisheries only, namely fishing for menhaden in the menhaden management area. this is a very small subset of RI fishing activity, <1%. the fishermen is required to call RI Enforcement prior to engaging in any fishing activity, after fishing is complete, a call in from the fishermen with landings is required to RIDMF.

Q8 Does your agency require negative trip reports?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

both RI dealers and fishermen are required to submit negative reports. negative reports are required for dealers for gaps in purchasing activity of approximately 5 days or longer. fishermen are required to submit negative reports for gaps in fishing activity of 2 weeks or more.

Q9 Does your agency conduct data audits?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

All data is audited regularly. -Landings data is validated through 1. daily ACCSP audits - these prioritize duplicate reports and species concerns (strange grade/market codes, unit concerns) 2. Weekly audits of all current year data concentrate on fishermen license mistakes, missing data (price, vessel, license numbers), strange landings (very large, unlikely species), price concerns, and various other concerns. 3. Port validations in conjunction with GARFO monthly 4. Possession limit audits occur regularly (season dependent for each species) and look for typos in reported quantity. -Fishermen data is validated in 2 methods 1. paper logbooks are checked when received for missing data fields, or incorrectly completed logbooks. Anything small is confirmed with the fishermen via phone calls. Logbooks with multiple mistakes, or missing a majority of the required fields are returned to the fishermen for completion. 2. electronic reports are audited once every two months for inaccuracies and missing fields. fishermen are required to go back and edit their reports to rectify any mistakes.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
enforcement officers routinely board vessels for violations. seized fish from these cases are then sold to a licensed dealer and the landing is available in RI landings data.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

fishermen reports submitted to RIDMF are routinely checked against the dealer reports to ensure all fishing trips are accounted for in the effort data.

#4

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, January 11, 2019 2:59:30 PM
Last Modified: Friday, January 11, 2019 3:31:46 PM
Time Spent: 00:32:16
IP Address: 167.7.12.164

Page 1

Q1 What agency do you represent?

SCDNR

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
All federally managed species; staff participate in the federal TIP program, during these dockside intercepts staff interact with the dealer and fisher to collect trip information. Additionally staff asses and monitor species and volumes by trip. Penaeid Shrimp; Staff intercept shrimp trawlers to evaluate and collect shrimp composition data which is used to portion out shrimp landings to species.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
See question 3. Also, there are a few fisheries that fisherman are required to report trip level data and that data is compared to dealer reports.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Staff work closely with federal agencies to compare landings and discrepancies of federally managed species.

Q6 Does your agency use VMS to validate reported trip data?	**No**
Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?	**No**
Q8 Does your agency require negative trip reports?	**Yes**
Q9 Does your agency conduct data audits?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: Staff routinely conduct data audits for all fisheries data entered by staff and downloaded by the data manager. Data is also reviewed to identify erroneous data and data outliers based on historical data.
Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: only when intercepted for violations.
Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.	**Respondent skipped this question**

#5

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, January 14, 2019 9:09:45 AM
Last Modified: Monday, January 14, 2019 9:20:14 AM
Time Spent: 00:10:29
IP Address: 167.7.12.164

Page 1

Q1 What agency do you represent?

South Carolina Department of Natural Resources

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We do TIP sampling. Creel clerks also visit the dealers occasionally to check.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Only in eel harvest reports though. SCDNR uses a one ticket system so this would not be possible in most cases.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
This is just an indication that there were no trips in a given month. Not necessarily a trip when nothing was harvested.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We randomly sample 10 percent of entered reports and double check all of them. If we see any errors they are corrected and recorded. If there are any questions, the dealer is contacted to verify the data.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
They do inspections, but these are never used as a verification method.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

n/a

#6

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 24, 2019 2:00:33 PM
Last Modified: Thursday, January 24, 2019 2:35:34 PM
Time Spent: 00:35:00
IP Address: 167.102.37.34

Page 1

Q1 What agency do you represent?

Maryland DNR

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
For certain species, especially striped bass and yellow perch.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Maryland's dealer reports are summary reports of monthly purchase and dollar values. It's used to calculate an average price per pound per species.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
For commercial species, we compare our state reports with the federal dealer report on a trip level basis. Found that discrepancies are mostly from the dealer report not being as detail as the fisherman's report about the trip, i.e. gear type used. Discrepancies concerning poundage, we usually go with the federal dealer report.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

Participants in our Facts electronic reporting system, about 10% of the total commercial fisherman population in Maryland and 16% of the commercial harvest, both hail out at the start of a trip and then hail in at the end. Most discrepancies are resolved by going back to the fisherman with the problem.

Q8 Does your agency require negative trip reports?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

Every commercial fisherman is required to submit a monthly report irregardless that they actively fished or not. Fishermen missing reports can be penalized from a hold on renewing their license to suspension days.

Q9 Does your agency conduct data audits?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

The monthly reports are compared to data from the permitted species, quota monitoring data (summer flounder, black sea bass, striped bass, yellow perch, menhaden, and horseshoe crab).

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

No,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

The electronic reporting system does allow visibility of the hail out to NRP, so they could validate the landings. However, it has not yet been implemented.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Respondent skipped this question

#7

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 24, 2019 3:10:37 PM
Last Modified: Thursday, January 24, 2019 3:39:54 PM
Time Spent: 00:29:17
IP Address: 164.51.49.223

Page 1

Q1 What agency do you represent?

Florida Fish and Wildlife Conservation Commission

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
In addition to the NOAA Fisheries port agents in Florida, we have 9 field staff covering different regions of the state using the NOAA Fisheries Trip Interview Program for biostatistical sampling and data recording. About 2% of commercial fishing trips are intercepted by state and federal samplers. In addition to the intercepts, both state and federal field staff will routinely review commercial landings data for their region and report discrepancies to the state data manager.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We periodically compare NOAA Fisheries coastal logbook data to state dealer reports for those fisheries where a logbook is required (~75%). The state does not have a separate fisher logbook program. State staff communicate with the federal logbook staff on resolving any data issues.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
See answer in question
4.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Although not at trip level, dealers are required to notify the state of no activity for specific periods of time (weekly for federal dealers, monthly for state-only dealers).

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The state FWC has an auditor's office that conducts periodic dealer audits based on lack of reporting or reporting delinquency. Florida only have one auditor, so the annual coverage statewide is low.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We frequently get requests from officers for landings data to compare to their observations in the field, or because of an investigation being conducted. It may result in missing information being reported, or false information being omitted.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

We monitor reporting delinquency via a trip reporting tracking system by dealer year and month. We also use fisher landings requests to validate data reported by the dealer against the fisher's own records for the same period.

#8

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, January 25, 2019 9:10:58 AM
Last Modified: Friday, January 25, 2019 9:20:31 AM
Time Spent: 00:09:33
IP Address: 98.11.155.167

Page 1

Q1 What agency do you represent?

Maine Department of Marine Resources (MEDMR)

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

For sea urchin harvester/dealer data only and not all the time. The swipe card data received from urchin dealers are at times validated with our port sampling agents. The port agents information gathered in the field are compared to what a dealer reports. Harvester, pounds, price and market are validated. Less than 10% of all landings data are affected by this audit procedure.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

MEDMR has currently only compares dealer and harvester reports for our lobster and elver fishery. These comparisons are very time consuming but have shown to be very valuable to discover any misunderstanding with reporting harvesters and dealers. When a discrepancy is identified, both parties are contacted to determine which is at fault for the discrepancy. Most of the time it is a misunderstanding and the issue is resolved quickly. Only a few times have both parties insisted their values were correct and at that point the discrepancy is noted and left as each reported.

Approximately 75% of all harvester data and dealer data are covered by this check.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

MEDMR only compares VTR data to other harvester reported data for the quota monitoring of the Atlantic herring and menhaden fisheries. While monitoring Atlantic herring landings, MEDMR uses VTR, VMS, dealer data and MEDMR required industry emails to determine quota. Otherwise, harvesters required to report via VTR for other fisheries are not required to submit a second “state only” report. We accept their VTR as their report if all the state required information are included on the VTR. 100% of herring and menhaden reports are required to follow this process which account for less than 10% of landings collected.

Q6 Does your agency use VMS to validate reported trip data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

MEDMR only validates our quota monitored reporting (emailed data) for Atlantic herring to VMS data. This is a very limited comparison but still extremely valuable to ensure we are monitoring quotas with the most precise information possible. 100% of herring and menhaden reports are required to follow this process which account for less than 10% of landings collected.

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

MEDMR only requires pre-trip and hail out notifications for our Atlantic herring and Atlantic menhaden fisheries. Harvesters are required to declare into the fishery and email daily landings along with monthly landings reports. The emails are used to track quota and are later validated against their reporting logbook. 100% of herring and menhaden reports are required to follow this process which account for less than 10% of landings collected.

Q8 Does your agency require negative trip reports?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: MEDMR does required negative reports. If we did not we would have no way to validate whether a harvester decided not to report or forgot to report. Using dealer data to validate only works to a certain point since state only harvesters can sell their catch to whomever they choose and does not need to go through a licensed dealer.
Q9 Does your agency conduct data audits?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: MEDMR audits data entered into MARVIN (MEDMR's database) at least once a month. The audits included, but not limited to, checking for unknown harvesters, incorrect vessels, weights that exceeded a trip limit, high and low prices, wrong species-gear-disposition combinations, species caught outside of the season, area fished check (bad latitude/longitude or lobster zone/federal statistical area combos), gear quantity and configuration check and dealers who reported buying from unlicensed harvesters. Electronic audits on SAFIS data are completed weekly. These audits are built into the SAFIS system and are emailed to MEDMR staff daily. They include basic audits, such as high or low prices and over the trip limits. Staff also query and audit the SAFIS landings attributed to an "unknown harvester" each week. Dealers and harvesters are contacted as needed to correct reporting mistakes so that subsequent reports are submitted with the correct data. Once per month, MEDMR staff query all the SAFIS data to audit records with unusual species, high or low prices, harvesters without licenses, unknown vessels and wrong gears. Data submitted through the elver system (VESL) and urchin data submitted through "eDR/mobile" are audited daily. Staff looked for duplicate records (harvesters selling twice in one day, dealers creating two tickets if one had incorrect pounds or price, etc), high or low prices and quota monitoring.
Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?	**No**

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

All are covered in the above questions.

#9

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Tuesday, January 29, 2019 9:03:04 AM
Last Modified: Tuesday, January 29, 2019 9:10:40 AM
Time Spent: 00:07:36
IP Address: 155.206.136.19

Page 1

Q1 What agency do you represent?

NOAA Fisheries

Q2 Does your agency use onboard observers to validate trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The NE Fisheries Observer Program would be better able to provide the details of their activities.

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The NE Fisheries Observer Program would be better able to provide program details.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The GARFO has a team of data auditors who work within the APSD.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No

Q6 Does your agency use VMS to validate reported trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
This is included in the audits performed by GARFO.APSD staff.

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
All trips that are eligible for NEFOP observer coverage must file a pre-trip notice, but this is not a requirement for all fisheries.

Q8 Does your agency require negative trip reports?

No

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The GARFO.APSD audit team and NEFSC DMS staff perform data audits. Analysts who identify further data issues are expected to report them to APSD for investigation via JIRA as well.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
OLE can provide better information regarding their activities.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Respondent skipped this question

#10

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, January 30, 2019 8:48:29 AM
Last Modified: Wednesday, January 30, 2019 9:06:37 AM
Time Spent: 00:18:08
IP Address: 166.67.66.246

Page 1

Q1 What agency do you represent?

Virginia Marine Resources Commission

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We randomly select to audit VA licensed dealers, they can get a phase I which compares just dates, a phase II which targets specific species (ie oysters, crabs, etc) and all data is compared, or they can get a phase III audit which review all data purchased everyday for all harvesters. These audits will capture 50%, every other year the top ten dealers will be audited this will capture 80%. If found out of compliance letters are sent and harvesters have five business days to resolve or they may be brought before the Commission to face possible license suspension.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We compare all federal dealers harvest reports (Phase III described above) in SAFIS to data submitted to the state. The VA federal dealers are some of the largest dealers in VA these audits will capture 50% of data harvested. If harvesters are found out of compliance they will receive notice and have five business days to respond, if not resolved they may be bought before the commission to face possible license suspension

---

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
On some quota managed species. Small percentage, the agency quota managing coordinator will refer any found out of compliance to our mandatory reporting program and harvester will receive notice and has five business days to resolve or they may be bought before the commission to face possible license suspension

---

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
All harvesters have to report by the 5th of the following month whether they worked or not.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Explained above three types (Phase I, Phase II and Phase III)

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We use Marine police boarding logs to compare for any commercial harvest they may have intercepted. If harvester is found out of compliance they will receive notice and have five business days to resolve, if not resolved they may be bought before the commission to face possible license suspension.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

All methods have been described.

#11

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, January 30, 2019 3:35:04 PM
Last Modified: Wednesday, January 30, 2019 4:20:59 PM
Time Spent: 00:45:55
IP Address: 170.63.67.40

Page 1

Q1 What agency do you represent?

Massachusetts Division of Marine Fisheries

Q2 Does your agency use onboard observers to validate trip data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
In the past MA DMF has sea sampled the lobster, otter trawl, gillnet, fish pot, and weir fisheries that are conduct in state and adjacent waters. More recently we have reduced sampling to just lobster and an experimental small mesh otter trawl fishery. Data collected aboard these trips are used to inform management and support stock assessments. No trip validation is done.

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
MA DMF port samples specific fisheries to collect biological samples on a needed basis. Data are used to support specific in-house research and stock assessments. In addition, we are currently conducting a study to port sample the small pelagic mid-water trawl fishery landing in Massachusetts, with the purpose to quantify landings and inform a river herring bycatch avoidance system. Information collected is not used to validate landings.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Broad trends are analyzed annually for at least the lobster and striped bass fisheries. At a smaller scale, anomalies in data trends are compared to the matching dataset to identify the source of the problem if one exists. Staff will reach out to the party with an error for correction. A small example may be a dealer reporting an incorrect vessel for a harvester. A larger example includes using harvester data to identify two dealers who were not reporting inshore shellfish. In this example, the dealers were notified, historical data were obtained where possible, and the dealers began to report inshore shellfish moving forward.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Duplicate reporting is not required for any landing. Trips are reported to the appropriate authority so there would be no reason to have a state report and a federal VTR for the same trip. Additionally, there would be no reason for a state report to be reported to another state. In contrast to this, a state harvester report may have an equivalent federal dealer report. If so, comparisons may be made as indicated in question 4.

Q6 Does your agency use VMS to validate reported trip data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We are piloting two projects this summer that would incorporate elements of vessel tracking (outside of the federally approved VMS devices).

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We require reports for all months of the year regardless of whether or not the permit was fished, the permit issue date, the permit endorsements, etc. If a permit is not fished in a given month, the permit holder must submit a did not fish report for that month. Did not fish reports are only required for months in which no commercial fishing activity occurred. Vessels reporting to federal systems (VTR, surf clam, HMS) are exempt from this requirement.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Annually, we conduct extensive audits on 100% of the inshore shellfish and crustacean landings submitted by dealers. Finfish audits are run as needed, but we audit quota managed species weekly within season. These audits can include anything from identifying price anomalies, species issues, quantity issues, vessel or permit holder issues, etc. Harvester data are subjected to audits annually when feasible. These audits can include anything from identifying gear anomalies, species issues, quantity issues, dealer issues, vessel issues, etc. Additional one time audits are run on data used to fulfill any data request. Anomalies are addressed as needed.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We work closely with the Environmental Law Enforcement Officers to address data issues, and data inform or support certain enforcement actions. However, landings are not validated by officers.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

There are data validations built into all SAFIS applications to prevent major errors from entering the datastream. For paper harvester and/or dealer reporting, validations are placed on the forms and spreadsheets used for data entry to prevent errors from entering the dataset. For harvester paper-reporting, at least two individuals review data prior to loading into SAFIS.

#12

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, January 30, 2019 3:54:12 PM
Last Modified: Wednesday, January 30, 2019 4:35:23 PM
Time Spent: 00:41:10
IP Address: 99.120.10.156

Page 1

Q1 What agency do you represent?

Atlantic Highly Migratory Species Management Division, NMFS

Q2 Does your agency use onboard observers to validate trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
observer reports are used, at times, to verify landings on dealer reports, esp. prohibited species. It is done on a case by case basis. We go back to the dealer to make any necessary changes. We will work with the state during this process, depending on the state's wishes

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We work with the SEFSC in Miami to reconcile the vessel trip reports against the dealer reports, including the weigh out sheets. This helps identify missing vessel reports or dealer reports. The SEFSC has the documentation regarding this process. We also compare landings on vessel reports to what is reported on the dealer reports on a case by case basis. We go back to the dealer to make any corrections and work with the states depending on the state's wishes.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The science centers handle the VTR data; we so compare state dealer reports to federal dealer reports in the Gulf of Mexico region.

Q6 Does your agency use VMS to validate reported trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We have used VMS to verify where a vessel that was reported on a dealer report was fishing if there are questions regarding fishing in a closed region/area.

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The SEFSC requires No Fish reports for VTRs; our office requires negative reports if a dealer does not purchase fish for a given week

---

Q9 Does your agency conduct data audits?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We do have a number of checks that are done automatically by our HMS electronic dealer reporting program that looks for things like buying with an expired dealer permit, price and weight triggers, fishing in region/season that is currently closed, no VTR reported, prohibited species, sharks reported from the research fishery by unauthorized vessels. In addition, we have QA/QC checks where we look for missing vessel information, missing price information, missing VTRs (or suspect VTRs), and gear code issues

---

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We work with OLE esp. when there are cases where vessels are landing prohibited species and dealers are buying that product and/or vessels are fishing in areas after they have closed for the season and dealers are buying the product. However, OLE is using the VMS, trip reports, etc. to validate the landings. They very rarely board or intercept during an offloading at the dealer.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

We will use weight out sheets that are submitted to the SEFSC to verify landings and which dealer bought product. The SEFSC has a process where they use these data in the dealer report and vessel trip report reconciliation. We use the weight out reports on an ad hoc basis where we need to figure out if there are duplicate reports because one dealer packed product and reported it, and then the dealer who bought the product from the vessel also submitted a dealer report. This has been a small percentage of the overall landings. We always go back to the dealers to make changes to any discrepancies

---

#13

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 8:25:36 AM
Last Modified: Thursday, January 31, 2019 8:42:55 AM
Time Spent: 00:17:19
IP Address: 155.206.131.61

Page 1

Q1 What agency do you represent?

NMFS SERO - IFQ Program only

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

For the IFQ system only - Required advanced notification of landing, 3 to 24 hours prior to landing, through VMS or the IFQ system. Notifications are recorded in a database and sent to law enforcement and port side samplers. Only a portion of trips are met and validated.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

For the IFQ system only - The notifications are compared to the landing transaction. A landing transaction requires a link to the notification, although some are not linked due to VMS failures. Unlinked notifications/landings are audited by IFQ staff and linked manually. Any discrepancy is brought to fishermen's attention for correction. Failure of correction or failure to follow the regulations results in the case being forwarded to law enforcement.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No

Q6 Does your agency use VMS to validate reported trip data?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: For the IFQ system only - VMS is used to validate if a vessel left for a commercial reef fish trip. We have now instituted VMS notification requirements for all commercial vessels, not just IFQ. We are in beginning stages of utilzing notifications from VMS for validation.
Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: For IFQ system - All commercial reef fish permitted vessels are required to hail-out and submit pre-landing notifications. This is used to track and validate information in the IFQ system.
Q8 Does your agency require negative trip reports?	**No**
Q9 Does your agency conduct data audits?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: For the IFQ system - The data is audited daily to check for linkages between notifications and landings. This will catch any landing transaction that was not entered into the system as well as identify when VMS units are malfunctioning or user error in reporting a notification. Quarterly, we monitored for cost recovery fees. An annual report is created that describes the program including, users, user behavior, pounds landed, and price information.
Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: For the IFQ system - Both federal and joint enforcements agents (State JEA) are used to validate landings through the advanced landing notification system. Inspections are up to the agent/officer.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

We require offloadings to only occur between 6am and 6pm, in order to aid law enforcement in validation. Additionally, the IFQ system is fully electronic and fishermen must obtain allocation prior to fishing.

#14

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 9:12:16 AM
Last Modified: Thursday, January 31, 2019 11:07:25 AM
Time Spent: 01:55:09
IP Address: 161.11.160.156

Page 1

Q1 What agency do you represent?

NYS DEC

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We compare a small percentage of State trips to dealer reports when the species landed is uncommon or indecipherable. Discrepancies are resolved via telephone with the fisherman, dealer, or both. Federal dealer landings and federal trips are compared for quota-managed species to validate landing ports. Discrepancies are resolved via correction requests through NMFS's JIRA system.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
State reports/vessels are compared to federal VTRs to prevent double-reporting. Double-reported trips are deleted from the State's system.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?	**No**
Q8 Does your agency require negative trip reports?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: NY requires monthly "negative" trip reports from fishermen and weekly "negative" purchase reports from dealers.
Q9 Does your agency conduct data audits?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: All State trips are audited for blank/missing fields, impossible sail versus landing dates, impossible species versus gear types, etc.
Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?	**No**
Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.	**Respondent skipped this question**

#15

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 1:33:38 PM
Last Modified: Thursday, January 31, 2019 1:40:39 PM
Time Spent: 00:07:00
IP Address: 167.21.41.11

Page 1

Q1 What agency do you represent?

Delaware Fish and Wildlife

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

No

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

No

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
During the conversion from raw data to published data, the conversion program looks for missing data.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Our enforcement does boardings and inspections at their discretion. The primary fisheries are Striped Bass and Horseshoe Crabs.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

We validate landings for Striped Bass through Striped Bass weigh stations, and compare to IVR reports for Black Sea Bass and Horseshoe crabs.

#16

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 8:48:28 AM
Last Modified: Thursday, January 31, 2019 2:08:43 PM
Time Spent: 05:20:14
IP Address: 160.93.0.208

Page 1

Q1 What agency do you represent?

New Jersey Division Fish and Wildlife

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
All dockside monitoring/sampling is completed by the Bureau of Law Enforcement.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
This process is used for a variety of species during data request, but specifically applied to Atlantic menhaden quota monitoring. Comparing fisherman trips to dealer reports allows for easy identification of discrepancies and the appropriate methods to correct these outliers. Approximately 25% of our landings data is covered under this method of validation.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: We require all of our federal permitted fisherman to send in the blue "state" copy of their VTR. If these federally permitted fisherman have a no harvest for a given month they are still required to send in a no harvest on a NJ harvester trip report. VTR's make up about 10% of all reports submitted to NJ Fish and Wildlife.
Q6 Does your agency use VMS to validate reported trip data?	**No**
Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: NJ Fish and Wildlife requires vessels to contact the Bureau of Law Enforcement 2 hours prior to landing.
Q8 Does your agency require negative trip reports?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: NJ Fish and Wildlife requires both state and federal commercial fisherman to submit negative trip reports. Negative trip reports account for approximately 50% of all reports received. If a report is not received the fisherman is contacted.
Q9 Does your agency conduct data audits?	**Yes,** If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.: Bureau of Marine Fisheries enter all fisherman trips electronically when received. The database is QC'd by referencing the paper report at a later date. Dealer reports are compared and QC'd by referencing fishermen reports.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The bureau of law enforcement does validate landings data by performing boarding's and inspections.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Respondent skipped this question

#17

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 1:56:50 PM
Last Modified: Thursday, January 31, 2019 2:20:37 PM
Time Spent: 00:23:46
IP Address: 159.247.3.230

Page 1

Q1 What agency do you represent?

CT DEEP

Q2 Does your agency use onboard observers to validate trip data?

No

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Yes, all non-electronic dealer reports are entered into SAFIS by our staff and then manually compared to fisherman reports. All dealer reports are then compared and merged with the fisherman data to produce our final annual harvest estimates. We attempt a 100% records match.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
If there are reports submitted by 'state only' permitted dealers, they are compared with Federal VTR's if they purchased from a federally permitted boat. We attempt a 100% records match.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
It is species dependent. Generally, when trip limits are high, we have a call-in to our law enforcement dispatch. ie. Quota monitored species

---

Q8 Does your agency require negative trip reports?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
By the 10th of the following month, we require both state permitted dealers and fisherman to submit a monthly report regardless of fishing activity.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Yes, prior to a fisherman transferring their license, we conduct a data audit. If there are discrepancies we work to resolve them. Additionally, there are also audits conducted at the annual merge of logbook and dealer data.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Yes, law enforcement does conduct various inspections/boarding's with commercial fisherman. Less than 5%.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

None.

#18

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Thursday, January 31, 2019 3:06:04 PM
Last Modified: Thursday, January 31, 2019 4:23:07 PM
Time Spent: 01:17:03
IP Address: 155.206.49.100

Page 1

Q1 What agency do you represent?

NMFS

Q2 Does your agency use onboard observers to validate trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Data discrepancies discovered at the regional office are sent to the observer group at the center for investigation.

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

Yes

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
We utilize a trip matching application that compares federal vessel trip reports to dealer reported landings. Investigate the trips flagged with errors or omissions, confirm what was reported with industry and initiate corrections to the trips confirmed with errors. All federal trips are audited and audit output is prioritized for investigation by the QA team.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
State partners are involved in the regional audit program by reviewing certain audit outputs. Examples include dealer reported port / state combinations and unknown vessel information included in the dealer reports. When confirmed by the state or corrections are provided the data is then updated.

Q6 Does your agency use VMS to validate reported trip data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
VMS data is utilized to confirm areas fished as reported on the VTR. It is also used to confirm activity codes declared by the vessel.

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The regional QA team does not use these to validate landings data but other groups do use these reports to validate information submitted by vessels.

Q8 Does your agency require negative trip reports?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
only negative purchase reports by
dealers

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Federal dealer and vessel reports are data streams included in the matching application. Also included are AMS trip information, observer and sector where applicable. Trips flagged with errors are assigned to the QA team for investigation and outreach. Source streams that are identified with errors or omissions are then updated with the correct information.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
Not sure, that would need to be addressed by
OLE

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

The QA matching application is comprehensive, other end users such as the quota monitoring team using DMIS identify issues for investigation by the QA team. Science center staff also send issues to the QA team when something is identified through their analyses.

#19

INCOMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, January 16, 2019 9:15:32 AM
Last Modified: Thursday, January 31, 2019 4:41:16 PM
Time Spent: Over a week
IP Address: 149.168.204.10

Page 1

Q1 What agency do you represent?

North Carolina DMF, License and Statistics, Trip Ticketing Program

Q2 Does your agency use onboard observers to validate trip data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
NC has an Observer Program but their data is not used to validate Trip Ticket landings data.

Q3 Does your agency use dockside monitoring/sampling to validate landings data?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
NC has dockside biological sampling to obtain biological data (length frequency, weight, age, sex, etc.) from the commercial fishery but does not use this data to validate Trip Ticket Program landings data.

Q4 Does your agency compare fishermen trips to dealer reports to validate landings data?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
NC does have a small program that compares eel log book reporting to trip tickets. There is also a shellfish lease program that validates reports submitted from lease holders to their respective trip ticket data but these are not applied to all fisheries statewide. There are also several situations where a fisherman may request their associated data in trip tickets and if they find that the data is not what they expected the data is reviewed in a QA QC capacity normally at a trip level. Values are corrected/updated if necessary.

Q5 Does your agency conduct interagency comparisons to validate landings data (i.e., comparing a state report to a federal VTR)?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

NC does have a small program that directly compares eel log book reporting to trip tickets. For quota monitored species NC receives QM logs that are validated against received trip ticket data on a yearly basis. For Summer Flounder and Black Seabass North of Cape Hatteras, NMFS validates landings annually with our quota monitoring program. The shellfish lease program also uses trip tickets to validate production reports submitted from lease holders to their respective trip ticket data but these aren't applied to all fisheries statewide. All federal dealers report trip tickets electronically and the data they submit are sent to NC trip ticketing program and the federal database at the same time. Due to this validating all trip tickets with NMFS does not occur. However, NMFS can and does pull NC trip ticket data from ACCSP and SAFIS when needed. In all comparison situations if corrections are determined to be necessary, the trip ticketing data is updated.

Q6 Does your agency use VMS to validate reported trip data?

No

Q7 Does your agency require pre-trip notifications or hail outs to validate landings data?

No

Q8 Does your agency require negative trip reports?

Yes,

If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:

Submittal notifications are received when a dealer has not or will not be processing transactions. The absence of landings values or zeros are then verified with this submission. Seafood dealers also have the ability to close themselves out seasonally. NC does not obtain negative trip reports from fishermen.

Q9 Does your agency conduct data audits?

Yes,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
The Trip Ticket Program implements 4 major stages of editing. Prior to data entry we implement a screening procedure where data control clerks review all trip tickets submitted to make sure they are legible and clear to read. Any missing entries are forwarded to the port agents for further clarification. For electronic tickets there are basic rules built into the entry system that avoids allowing certain errors to be submitted. However, certain exceptions are allowed to be submitted so no data loss occurs. These tickets are flagged. There is a review and corrections are made on a daily to weekly basis. The second level is monthly warnings reports which are reviewed and critiqued by our port agents. The third and fourth levels are a 6month review and a final yearly review of all the data with multiple levels of audits that check the varying types of data collected with increased precision. When there are discrepancies NC port agents will investigate by reviewing other influential portions of the data to come to a decision on how the potential error shall be resolved and/or by contacting the dealer directly. Also ad hoc questions come up during non-formal reviews. These possible inconsistencies are dealt with on a case by case basis.

Q10 Does your agency use law enforcement to validate landings data (i.e., boardings/inspections by Natural Resources Police)?

No,
If yes, please briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.:
NC Marine Patrol does not truly validate landings with trip ticket database or vis versa but they do preform inspections at fish houses reviewing dealer recorded trip tickets compared to what is visible. Red Drum landings reported to the Trip Ticket Program are also given to Marine Patrol to spot check that transactions were accurate. NC also has an alternative platform observing program where Marine Patrol will report to the Observer Program what was landed.

Q11 Please briefly describe any validation methods used by your agency that were not previously included. Briefly explain your process, the percentage of landings data covered by this method, and how you resolve any data discrepancies.

Specie specific data reviews are done prior to stock assessments on the SEDAR and FMP levels regularly. If data are incorrect it is changed in the database. The portion of data reviewed is based on the need.
Other data review projects and questions arise throughout the year that may result in data being updated. For example, the NC Hurricane Florence assistance program has helped to validate some landings with dealers directly for three months of the last two years. If there was a dispute on the accuracy of the trip ticket data there was an effort to determine what the trip ticket records should be and corrections were made when necessary this included speaking with the dealers directly, reviewing the original submissions via log, determining value verification like license numbers and license transfer status etc.

Plan for Condensing Technical Committees

Why change the structure of ACCSP's Technical Committees?

- The TCs are burdensome for both Partners and Staff.
    - Members often represent their agency on multiple committees, meaning a heavier ACCSP-related workload and less time for each committee.
    - Staff spend a lot of time organizing meetings, putting together meeting materials, and getting new members up to speed.
    - As members of committees often overlap, time is wasted by all parties presenting the same information to each group so that the non-overlapping members are informed.

- They are an inefficient means of gathering input from partners.
    - Often only 1 employee's perspective is provided for an entire agency.
    - Each partner has a representative on each committee. Representation is sometimes unfamiliar with technical requirements, making it challenging to liaise with partner organizations.

- Progress on tasks is slow.
    - Infrequent communication/engagement (only 1-2 meetings/year) means the committees spend a lot of time reviewing tasks/projects and recapping previous decisions.
    - Passing issues between TC's delays response time.
    - Membership turnover slows committees down.

- The current division of the TCs is obsolete.
    - The modules used to be more separate than they are now. For-hire and commercial data collection needs and methods are converging, and integrated reporting vision includes linkages to biological and at-sea observer data.

How can we adjust the structure of the TCs to address these challenges?

- Condense all existing TCs (with current membership) into one broader TC to provide a broader range of perspectives at the outset of a project.
    - The Program will not be limited to working within the confines of one TC for a given project.

- Use a combination of ad-hoc and standing working groups to accomplish projects and routine tasks. Full TC will meet to discuss cross-disciplinary items and then standing and ad hoc workgroups will break out to cover specific items.

- Increase in efficiency in that discussions won't need to be passed from group to group and work will be able to happen faster.
- Examples of ad hoc WGs:
  - Integrated Reporting Group
  - Aquaculture WG

- Examples of standing WGs: (Provided only for illustrative purpose)
  - Trip Reporting
  - Dealer Reporting
  - Sampling (biological, bycatch, etc.)
  - IS policy (change management)
  - Standard Codes

- Solicit volunteers from the ACCSP Technical Committee for a project, rather than relying on a previously designated representative. This is intended to increase engagement.
  - This allows TC members to volunteer for projects that are either a) interesting to them and/or b) important to their respective agency.
  - This approach would further clarify partner priorities.
  - Additional volunteers from partners are welcome and flexibility in membership is key. Equal representation is not always paramount, because not all tasks are of equal importance to the partners.

- Adopt a more task-oriented and organized approach to projects.
  - Develop project charters at the outset to define the scope and objectives of the working group, and to identify relevant stakeholders.
  - Once projects are complete, report results to the broader TC. Then dissolve working group to provide closure.

Electronic Monitoring Standards Discussion at Commercial Technical Committee Meeting

The committee had been previously been tasked with discussing this, and it was determined that the time had not been right to move on this then, but it is now time. There is now movement at the federal level, at FIS and NFWF. The following points were noted during the discussion:

- The focus should be on the data collected from the videos, rather than the storage of the videos.
- There are a number of programs as alternatives to at-sea monitoring. There are multiple utilities across and within fisheries for EM.
- Some of the data currently being received are not standardized. Much of the data being collected are from another source, and that data standards exist there. It will be necessary to link these data to trips and other reports.
- The hope is that standards will help reduce the costs of developing projects and technology.
- HMS is using EM and matches up to the trip and dealer reports. There is a clear protocol defined for reviewing subset of videos, and a protocol for how the agency should use it. It is recommended to loop groups like OLE into any further discussion.
- The development of standards will be difficult, but will cut through the non-essentials for new programs.
- ACCSP wouldn't address protocols for how an agency reviewed their footage, but would focus on the standardization and storing of the information coming out of the video review.
- State EM was discussed.
    - S. Iverson: VA considered tracking VA vessels for oysters, but encountered significant pushback.
    - R. Watts: Noted that scallop and urchin fisheries require a location tracker, and that menhaden and herring might consider in the future.
    - A. Webb: MA is considering the use of location tracking, but not EM video cameras.
- The differences were highlighted between location tracking and EM. The question was posed whether the standards for location tracking and video sampling should be handled separately, or together as a unified standard. .

The committee is currently in the process of populating a workgroup to address this.

Atlantic Coastal Cooperative Statistics Program
1050 N. Highland Street, Suite 200A-N | Arlington, VA 22201
703.842.0780 | 703.842.0779 (fax) | www.accsp.org

TO: ACCSP Coordinating Council and All ACCSP Committees

FROM: Michael S. Cahall, ACCSP Director

SUBJECT: ACCSP Request for 2020 Proposals

The Atlantic Coastal Cooperative Statistics Program (Program or ACCSP) is issuing a Request for Proposals (RFP) to Program Partners and Committees for FY20 funding.

ACCSP's Funding Decision Document (FDD) provides an overview of the funding decision process, guidance for preparing and submitting proposals, and information on funding recipients' post-award responsibilities. Projects in areas not specifically addressed in the FDD may still be considered for funding if they help achieve Program goals. These goals, listed by priority, are improvements in:

1a. Catch, effort, and landings data (including licensing, permit and vessel registration data);
1b. Biological data (equal to 1a.);
2. Releases, discards and protected species data; and,
3. Economic and sociological data.

Project activities that will be considered according to priority may include:

- Partner implementation of data collection programs;
- Continuation of current Program-funded partner programs;
- Funding for personnel required to implement Program related projects/proposals; and
- Data management system upgrades or establishment of partner data feeds to the Data Warehouse and/or Standard Atlantic Fisheries Information System.

Proposals for biological sampling should target priority species in the top quartile (Attachment II) of the Biological Priority Matrix. Proposals for observer coverage should align with fisheries affecting the top quartile priority species (Attachment III) of the Bycatch Priority Matrix. Brief descriptions of the current levels of biological or bycatch sampling by any of the Partners would be helpful to the review process. Projects for recreational catch and effort data should target the priorities set by the Recreational Technical Committee (Attachment IV).

Proposals to continue Program-funded partner projects ("maintenance proposals") may not contain significant changes in scope (for example the addition of bycatch data collection to a dealer reporting project), and must include in the cover letter whether there are any changes in the current proposal from prior years' and, if so, provide a brief summary of those changes.

Additionally, in FY16 a long-term funding strategy policy was instituted to limit the duration of maintenance projects. Maintenance projects are now subject to a funding reduction following their fourth year of maintenance funding. For maintenance projects entering year 5 in FY20, a 33 percent funding cut will applied to whichever sum is larger: the project's prior two-year-average base funding as defined in FY16, or the average annual sum received during the project's subsequent four years of full maintenance funding. In year 6, a further 33 percent cut will be applied and funding will cease in year 7. See Appendix A of the FDD for a list of those maintenance projects entering year 5 and the maximum funding available to them for years 6 and 7.

All project submissions must comply with the Program Standards found here. Please consider using this successful project proposal as a template. Overhead rates may not exceed 25% of total costs unless mandated by law or policy. Items included within overhead should not also be listed as in-kind match.

Submissions will be reviewed in accordance with the FDD (Attachment I), ranking criteria (Attachment VI), and funding allocation. Current funding allocation guidelines are 75% for maintenance projects and 25% for new projects within the Program priorities.

Attachment V provides a timeline for the FY20 funding process. The final decision on proposals to be funded for FY20 will be made in October 2019. Project awards will be subject to funding availability and, if there is a funding shortfall, awards may be adjusted in accordance with the FDD. Successful applicants will be notified when funding becomes available.

Project Investigators will be required to report progress directly to the Program's Operations and Advisory Committees in addition to meeting the standard Federal reporting requirements.

Please submit initial proposals as Microsoft Word and Excel files no later than **June 10, 2019** by email to Mike Cahall (mike.cahall@accsp.org). If you have any questions about the funding decision process, please contact your agency's Operations Committee member (http://www.accsp.org/committees), Mike Cahall (703-842-0781), or Ali Schwaab (703-842-0780).

RELEVANT ATTACHMENTS

ATTACHMENT I	FY2020 Funding Decision Document
ATTACHMENT II	FY2020 Biological Priority Matrix
ATTACHMENT III	FY2020 Bycatch Priority Matrix
ATTACHMENT IV	FY2020 Recreational Technical Committee Priorities
ATTACHMENT V	FY2020 Timeline for Proposal Review
ATTACHMENT VI	FY2020 Ranking Criteria Document

Atlantic States Marine Fisheries Commission

Summener Flounder, Scup, and Black Sea Bass Management Board

May 1, 2019
10:45 a.m. - 12:15 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(R. Ballou)*	10:45 a.m.
2.	Board Consent • Approval of Agenda	10:45 a.m.
3.	Public Comment	10:45 a.m.
4.	Review Plan Development Team Analysis of Black Sea Bass Commercial Management Strategies to Address Fishery Shifts (*C. Starks*) **Possible Action** • Review Advisory Panel Report	11:00 a.m.
5.	Review and Populate Advisory Panel Membership (*T. Berger*) **Action**	12:10 p.m.
6.	Other Business/Adjourn	12:15 p.m.

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street, Arlington, Virginia; 703.486.1111

MEETING OVERVIEW

Summer Flounder, Scup, and Black Sea Bass Management Board
May 1, 2019
10:45 a.m. - 12:15 p.m.
Arlington, Virginia

Chair: Bob Ballou (RI) Assumed Chairmanship: 10/17	Technical Committee Chair: Greg Wojcik (CT)	Law Enforcement Committee Representative: Snellbaker (NJ)
Vice Chair: Adam Nowalsky (NJ)	Advisory Panel Chair: Vacant	Previous Board Meeting: March 6, 2019
Voting Members: MA, RI, CT, NY, NJ, DE, MD, PRFC, VA, NC, NMFS, USFWS (12 votes for Black Sea Bass; 12 votes for Summer Flounder and Scup)		

2. Board Consent

- Approval of Agenda

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Review Plan Development Team Analysis of Black Sea Bass Commercial Management Strategies to Address Fishery Shifts (11:00 a.m.-12:10 p.m.) Possible Action
Background • In February, the Black Sea Bass Commercial Working Group (WG) presented a proposed statement of the problem and commercial management objectives to the Board highlighting two key issues with regard to commercial black sea bass management, as well as several potential management strategies for Board consideration. The issues identified were: 1) state commercial quota allocations set in 2003 do not reflect the current distribution and abundance of black sea bass; and 2) coastwide commercial quota management can limit harvest opportunities for some states if another state's harvest overage results in a coastwide fishery closure. • The Board supported further development of the strategies proposed by the WG, as well as additional management options brought forward by Board members. The Board formed a Plan Development Team (PDT) to perform analyses and further develop potential management options proposed by the WG and as specified by the Board to address the issue of commercial allocations to the states. • The PDT has developed a report for Board consideration including additional analysis and potential management options to address changes in stock distribution and abundance. (**Supplemental Materials)**

• The Advisory Panels (APs) of the Commission and the Council met jointly on April 2, 2019 to review the work being developed by the PDT. The APs provided feedback on the potential management options being explored. (**Briefing Materials)**
Presentations • Plan Development Team Report on Black Sea Bass Commercial Management by C. Starks • Advisory Panel Report by C. Starks
Board Actions for Consideration • Initiate a management document to address commercial black sea bass management

5. Review and Populate Advisory Panel Membership (12:10-12:15 p.m.) Action
Background • Massachusetts has submitted a nomination to the Summer Flounder, Scup and Black Sea Bass Advisory Panel: Paul Caruso, a recreational angler. **(Briefing Materials)**
Presentation • Nominations by T. Berger (**Briefing Materials**)
Board Actions for Consideration • Consider approval of Advisory Panel nomination for Paul Caruso

6. Other Business/Adjourn

Summer Flounder, Scup, & Black Sea Bass 2019 TC Tasks

Activity level: High

Committee Overlap Score: High (Multi-species committees for this Board)

Committee Task List

- June 1st: Annual compliance reports due
- July 2019: In person meeting to develop recommendations on 2020 specifications (Coastwide Quota and RHLs) for summer flounder, scup and black sea bass
- November 2019: In person meeting on 2020 rec measures
- 2019 Scup Operational Assessment
    - TC – TBD 2019: Data Deadline and review of recreational data
- 2019 Black Sea Bass Operational Assessment
    - TC – TBD 2019: Data Deadline and review of recreational data

TC Members: Greg Wojcik (CT, TC Chair), Alex Aspinwall (VA), Julia Beaty (MAFMC), Joe Cimino (VA), Peter Clarke (NJ), Karson Coutre (MAFMC), Kiley Dancy (MAFMC), Steve Doctor (MD), Emily Gilbert (NOAA), Jeff Kipp (ASMFC), John Maniscalco (NY), Jason McNamee (RI), Kirby Rootes-Murdy (ASMFC), Gary Shepherd (NOAA), Caitlin Starks (ASMFC), Mark Terceiro (NOAA), Todd VanMiddlesworth (NC), Richard Wong (DE)

Summer Flounder SAW Working Group: Jason McNamee, Mark Terceiro

From:	David Dow
To:	Comments
Cc:	David Dow
Subject:	Comments on Summer Flounder and Atlantic Striped Bass Stock Assessments and Resulting Changes to Fishery Management Plans
Date:	Friday, March 22, 2019 6:45:47 AM

I have some concerns regarding the conversion of the Summer flounder and Atlantic striped bass stock assessments by the ASMFC/NOAA Fisheries into management advice for these stocks at the Spring ASMFC meeting. The Statistical Catch at Age equilibrium model ignores the effects of eutrophication and climate change on SSB in inshore breeding areas for Atlantic striped bass (Chesapeake Bay; Delaware Bay and Hudson River Estuary); changes in natural mortality associated with shifts in predator and prey species in space & time, alterations in the marine food chain (microbial food web and grazing food chain which were explored in the NOAA Fisheries EMaX model); and changes in the inshore "productive capacity" of Essential Fish Habitat and the shifting baseline in the ocean which has created a complex dynamic system which is not at equilibrium.

I would urge the ASMFC Technical Committee to consider the recent paper by Kristin N. Marshall et al. 2019. Inclusion of ecosystem information in the US stock assessments suggests progress toward ecosystem-based fisheries management. ICES Jour. Marine Sci. 76 (1): 1-9. The authors urge usage of ecosystem information for stocks which are both overfished (changes in Spawning Stock Biomass) and subject to overfishing (exceed fishing morality target). I feel that a backup adaptive. ecosystem-based fishery model for Atlantic striped bass recovery be developed in case the equiliibrium model predictions turn out not to useful. Certainly Nantucket Sound and Cape Cod Bay suggest that these systems are not at equilibrium which has effected stocks such as Sea herring and Gulf of Maine cod. and lead to great white sharks appearing off of our beaches to feed on seals which consume inshore forage fish migrating up from the Mid-Atlantic region.

Based on the EMAX (Energy Modeling and Analysis Exercise) carbon budget model for the Northeast Continental Shelf Ecosystem, I feel that the marine food chain should be included in the Essential Fish Habitat for pelagic fish species. The EMaX model had more primary production at the base of the food chain than yield of living marine resources at the top. so that we had to add the microbial food web to the grazing food chain to balance the carbon flow (i.e. the longer food chain lead to greater community respiration loses). Since the ocean has been warming rapidly in the waters surrounding Cape Cod where I live, this will include increased respiration at the base of the food chain and alter the role of forage fish in serving as prey for predators like Summer flounder and Atlantic striped bass. Summer flounder, black sea bass and scup are migrating into southern New England which could provide alternative targets to commercial and recreational fishing sectors.

Since Summer flounder are targeted by both the commercial and recreational sectors in state (0-3 miles) and federal (3-200 miles) waters, my major concern is in allocation of the quotas between the ASMFC; Mid-Atlantic and New England Fishery Management Councils using the best available science. The November 27-30, 2018 Northeast Fisheries Science Center's SAW/SARC summary suggested that Summer flounder stocks were declining, so that I don't want to see them get into the situation that Atlantic striped bass are facing. Five years is a long time between baseline stock assessments and changes in competition between predators feeding on forage fish and top down predation by Apex predators could change the marine food chain dynamics.

The Cape Cod Times published an Op-ed piece on March 5 entitled: "A Moratorium on the Horizon" which has generated some responses from saltwater anglers and Phil Coates (former Director of the Ma. Division of Marine Fisheries). It will take co-operation between commercial fishermen/women and saltwater anglers to develop a recovery plan for Atlantic striped bass and make sure that Summer flounder don't end up in a similar situation as the catch quotas are increased and shifts occur in the ocean ecosystem both inshore and offshore.
I have attached a Letter to the Editor that I had published in CapeCodToday.

Thanks for your consideration of these comments.

Dr. David Dow

East Falmouth, Ma.

Letter: Summer Flounder and Atlantic Striped Bass: Tale of Two Fisheries

from Dr. David Dow of East Falmouth

ARTICLE | **LETTERS TO THE EDITOR** | MARCH 17, 2019 04:45 AM | BY **CAPECODTODAY STAFF**

<letter-to-the-editor_17_260.jpg>

Letter to the Editor:

In November 27-30, 2018 the Northeast Fisheries Science Center conducted baseline stock assessments for these two species which are managed by the Atlantic States Marine Fisheries Commission inshore (0-3 miles) and Mid-Atlantic Fishery Management Council offshore (3-200 miles). Both Summer flounder and Atlantic striped bass are targeted inshore by commercial fishermen/women and saltwater anglers. Summer flounder are also harvested by both fishing groups in federal waters. Even though the final report from the November 2018 stock assessment has been delayed because of the furlough of federal employees/contractors in NOAA Fisheries, Atlantic striped bass were assessed to be both overfished (relates to targets for spawning stock biomass) and subject to overfishing (relates to fishing mortality targets), while Summer flounder stocks were viewed as healthy and proposed catch quotas could be increased for both commercial and recreational sectors.

The worsening situation for Atlantic striped bass will require some type of recovery plan by the management agencies working with constituents (environmentalists/animal rights activists; fishermen/women and concerned public). The ASMFC's Technical Committee is examining various recovery scenarios and will likely seek input from the Atlantic striped bass Management Board; NOAA Fisheries staff and academic scientists and key constituent groups. The Management Board includes some Cape Cod residents (like Rep. Sarah Peake).

There should be an opportunity for concerned citizens on Cape Cod to comment on how the proposed changes in the Atlantic striped bass recovery plan will effect them personally through some type of outreach program by the NOAA Fisheries Recreational Fisheries Coordinators/ASMFC or Massa. Division of Marine Fisheries Staff on the Management Board.

It is not my intention to get into the details of how all of this will be accomplished, but to make some comments based being the former Recreational Fisheries Coordinator in the Northeast and a member of the New England Fishery Management Council's Habitat Plan Development Team which helped develop Omnibus Habitat Amendment 2 which was approved in January 2018.

* Commercial and recreational fishing are important components of the "Blue Economy" on Cape Cod and important parts of our history which requires maintenance of our working waterfronts.

* There is a shifting baseline in the ocean surrounding Cape Cod from environmental stressors like nutrient enrichment; increased acidity in the water column and sediments and increased water temperature. One example is the interaction between forage fish/seals and Great White sharks which has caused concerns for swimming and skate boarding at beaches on the outer Cape. These large Apex predators have shifted in space and time and exert top down effects on the find chain supporting predators like Summer flounder and Atlantic striped bass. There has also been bottom up changes in the plankton/forage fish linkage that influences these first level predators.

* The production and recruitment of Summer flounder and Atlantic striped bass are supported by inshore Essential Fish Habitat

(eelgrass beds; salt marshes; shellfish beds; etc.) which is included as a component of the federal Magnuson-Stevens Sustainable Fisheries Act. EFH is included as a component of an adaptive, ecosystems-based fisheries management approach. In New England, EFH "productive capacity" doesn't include the marine food chain and the influence of environmental stressors like nutrient enrichment/climate change,

* Towns on Cape Cod are developing Comprehensive Wastewater Management Plans to reduce "N" loading from septic systems under section 208 of the Clean Water Act. This $4-6 billion investment over the next 20-30 years is intended to improve both water quality and restore habitat (i.e. link between bay scallop harvests and eelgrass beds).

* The ASMFC; MAFMC, and Massachusetts Division of Marine Fisheries have to work jointly on a recovery plan for Atlantic striped bass in state waters with the key constituent groups and to make sure that Summer flounder with declining stock sizes in recent years doesn't slip into a similar situation. The MAFMC manages the Summer flounder fishery in federal waters (3-200 miles) where Atlantic striped bass fishing is banned, while the ASMFC and Ma. DMF manage both species in state waters (0-3) miles.

* The New England Fishery Management Council will need to coordinate its activities in the management of forage fish; primary and Apex predators as they migrate into southern New England waters from the Mid-Atlantic region. This will include redistribution in the quotas between commercial and recreational fishing which were recently addressed at the ASMFC/MAFMC Management Board meeting in Virginia. This complex bureaucracy may be slow to change in how it links science and monitoring —> fisheries management plans and public policy development —> public outreach and education.

* Since the science and monitoring that supports the baseline stock assessments is data rich, but information poor for non-experts, perhaps the MIT/WHOI Sea Grant Program could explain this to policy makers and

elected officials in a more understandable fashion. The Waquoit Bay National Estuarine Research Reserve has been successful in such science translation efforts.

Dr. David Dow

East Falmouth, Ma.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

Atlantic States Marine Fisheries Commission and Mid-Atlantic Fishery Management Council
Joint Summer Flounder, Scup, and Black Sea Bass Advisory Panel
Meeting Summary

April 2, 2019

ASMFC Advisory Panel Members in Attendance:

- **Meade Amory** – VA (commercial)
- **Paul Caruso** – MA (recreational)
- **Greg DiDomenico** – NJ (commercial)
- **Aaron Gewirtz**, RI (commercial)
- **Michael Hall** – RI (commercial)
- **Marc Hoffman** – NY (recreational)
- **Mark Hodges** – VA (commercial)
- **Kurt Martin** – MA (commercial)
- ***Michael Plaia** – CT (recreational/commercial)
- **James Ruhle** – NC (commercial)
- **Buddy Seigel** – MD (recreational)
- **Wes Townsend** – DE (commercial)

MAFMC Advisory Panel members in attendance:

- **Katie Almeida** – MA (commercial)
- **Carl Benson** – NJ (commercial)
- **Joan Berko** – NJ (commercial)
- **Jeff Deem** – VA (recreational)
- **Skip Feller** – VA (recreational)
- **Carl Forsberg** – NY (recreational)
- **Jeffrey Gutman** – NJ (commercial/recreational)
- **Gregory Hueth** - NJ (recreational)
- **Howard King** – MD (recreational)
- **Arnold Leo** – NY (commercial)
- ***Michael Plaia** – CT (recreational/commercial)
- **Robert Ruhle** – NC (commercial)
- **Robin Scott** – NJ (recreational)
- **Christopher Spies** – NY (recreational)
- **Steven Witthuhn** – NY (commercial)
- **Harvey Yenkinson** – PA (recreational)

Additional attendees:

- **Chris Batsavage** (MAFMC & ASMFC member, NC)
- **Vincent Cavaleri**
- **Emily Gilbert** (NOAA)
- **Sonny Gwin** (MAMFC member)
- **Emerson Hasbrouck** (ASMFC member, NY)
- **Thomas Heimann**
- **Mike Luisi** (MAMFC & ASMFC member, MD)
- **Steve Newellman**
- **Rob O'Reilly** (MAMFC & ASMFC member, VA)
- **Philip Simon**

Staff: Caitlin Starks (ASMFC Staff), Julia Beaty (MAFMC Staff)
***** Indicates member of both Council and Commission APs

<u>Meeting Summary</u>

The Advisory Panels of the Atlantic States Marine Fisheries Commission (Commission) and the Mid-Atlantic Fishery Management Council (Council) met jointly via conference call and webinar on April 2, 2019 to review and provide feedback on ongoing work at the Commission related to black sea bass commercial management. At the Commission's August 2018 Meeting, the Summer Flounder, Scup, and Black Sea Bass Management Board (Board) established a Working Group to identify management issues related to changes in stock distribution and abundance, and propose potential management strategies for Board consideration. In February 2019, the Working Group reported to the Board and identified two issues: (1) state commercial allocations implemented in 2003 do not reflect the current distribution of the resource, which has expanded significantly north of Hudson Canyon, and (2) federal coastwide quota can limit harvest opportunities for some states if another state's harvest overage results in a coastwide fishery closure. The Board requested the Plan Development Team (PDT) perform additional analyses and develop management options to address these issues.

ASMFC Staff presented an overview of the potential management strategies being discussed and evaluated by the Commission's PDT, including status quo, and three new approaches to adjusting state by state commercial allocations:

1. A dynamic approach modeled after the Transboundary Management Guidance Committee (TMGC) approach
2. Trigger-based allocation approach
3. Auctioned seasonal quota (ASQ)

Advisors provided feedback on these potential management options, as well as general comments on black sea bass commercial management. The comments included in this summary do not represent consensus statements, but rather individual perspectives of AP members. Comments are not presented in their original order and were not transcribed verbatim. Additional comments submitted after the call by email are attached at the end of this summary, and are counted toward the totals for comments opposing or supporting each approach.

<u>Status Quo Comments</u>

10 supported status quo: Joan Berko (email comment), Steve Witthuhn (email comment), Jeffrey Gutman, Carl Benson, Robert Ruhle, Greg DiDomenico, Wes Townsend, Jim Ruhle, Katie Almeida, Jim Lovgren (email comment)

2 opposed status quo: Arnold Leo, Chris Spies (email comment)

Greg DiDomenico - We're in opposition to this whole thing. This seems to be an amendment out of pure convenience. It's counterproductive. There are competing interests regarding really important issues. Fairness. Investments. Bycatch. Discards. This continues to go from species to species without any real end to it. I'm in opposition to the approaches you've outlined.

Wes Townsend - I think we need status quo. There are so many unanswered questions and no economic impact studies. In Delaware 99% of the fish caught in the ocean are sea bass. This would devastate the few fishermen we have left. You're increasing Massachusetts and Rhode Island, two of the biggest dollar states. How is that equitable?

James Ruhle - I support status quo. If this conversation had taken place 2-3 years ago, I'd be reluctant to do that. I've been involved in this fishery for a long time. There is clear evidence that in the last 3 years the fishery has not shifted north, though it may have expanded its population. The traditional grounds of New Jersey, Maryland, and Virginia are still producing fish. The global warming effect in the mid-Atlantic has been reversed. The TMGC system is flawed. This is the wrong time to be allocating based on a distribution shift that has not occurred. You need to look at study fleet data and observer data to support what I'm saying. The science just caught up with the biomass that has been exploding for several years. I don't doubt for a minute that northern states need a higher allocation. But it's got to be based on facts. Look at smaller increments - 2-3 years instead of 7 - it will paint a very different picture. Be very cautious.

Jeffrey Guttman - I agree with the recommendation for status quo. You should throw out the auction approach and TMGC. The trigger approach is best of the three. It accounts for historic quota and investment. But overall, I'd say status quo and table the amendment.

Katie Almeida - Status quo is probably best at this point. Of the three options, the only viable one might be the trigger option. I don't support it right now, but it might be worth looking into it more if people want to.

<u>TMGC Comments</u>

6 opposed TMGC - Carl Benson, James Ruhle, Robert Ruhle, Jeffrey Gutman, Meade Amory, Carl Forsberg

2 supported TMGC – Paul Caruso (email comment), Chris Spies (email comment)

James Ruhle - The U.S. has never benefitted from TMGC discussions with Canada. Except maybe we've been provided more fish but we're only taking 60% of the TAC.

Robert Ruhle - You'll be pitting north against south in a similar manner as the U.S. and Canada. I'm on NTAP (Northeast Trawl Advisory Panel). There are lots of issues with gear performance and catchability of NEFSC trawl survey. 49.5% of tows are invalid by their own admission. They are outside of the optimal geometric range of gear since 2008. We don't know how to fix those issues. I'd be cautious about relying too heavily on the NEFSC survey alone.

Jeffrey Gutman - How low could a state's allocation go in the TMGC approach? For example, could Virginia go from 20% to 5%? Virginia and North Carolina are still catching their quotas despite any shift in fish. Even with the 3% control rule, they could still slowly lose their quota over time. What would a lower limit be? 50% of the original allocation? Some states have the potential to be clobbered, even if they have been catching their current allocations. The whole approach seems flawed. When do we get to discuss the floor for this?

Meade Amory - TMGC has the potential to ruin certain states. So many things can be tweaked, so maybe we keep discussing it a little bit.

Michael Plaia - Under the TMGC, we need to weight them so the time period on reaching an equilibrium is more like 5 years rather than 8 years in your example.

Jeffrey Guttman - There is a lot of uncertainty. Conflicting results could come out of this. The quota is too low. I'm not sure how quickly you can get current information applied in the TMGC model, so there would be a lag. The fish are much farther south this year. Overall, this is a bad idea. It does not take historical investments – livelihoods, permits, vessels - into account. In many places, summer flounder, black sea bass, and scallops are the majority of commercial catch and income. Southern states are not having trouble catching their quotas. Northern states have other things they can still fish for - pollock, haddock, redfish. You're going to really decimate southern states under the TMGC approach. The two primary trawl fisheries in southern region are fluke and sea bass.

Carl Forsberg – There are too many questions with TMGC approach. It would lead to unfairness for the southern states.

Robert Ruhle – The TMGC approach is unfounded. There is no evidence that it is practical, and no monitoring of what is happening in real time. There is no way to have real-time monitoring of trans-boundary shifts. You could only look retrospectively.

<u>Trigger Approach Comments</u>

3 supported the trigger approach: Marc Hoffman, Jeff Deem, Arnold Leo

6 supported continued evaluation of trigger approach though they didn’t necessarily prefer it: Katie Almeida, Carl Benson, Jim Ruhle, Carl Forsberg, Robert Ruhle, Jeffrey Guttman

Marc Hoffman - I’m conscious of states that are worried that their percent is going to change. You’re not losing anything under trigger approach. The trigger approach with some manipulation might work because everyone is getting what they are getting now plus an additional amount.

Jeff Deem - I support the trigger-based option; it protects investment. If there’s an expansion truly, then the expansion areas should get that excess.

Carl Benson – The trigger approach should be based on getting management to do what it is supposed to do: get to 100% of SSB target. After they get to 100%, then give to the states with less quota. That protects everyone who’s been in the fishery all along.

Jim Ruhle - The trigger approach has some merits, but needs more research and evaluation. The Council needs to be deeper into this because 85% of the resource is caught in federal waters. Status quo is my primary choice right now.

Carl Forsberg - Maybe more research into trigger option could help. It doesn’t seem like it would hurt anyone. Being from NY and having one of the smallest allocations, I’d like to see anything to help us up here.

Robert Ruhle - The trigger approach has merit but instead of trying to figure out how to divvy out possible increases, let’s try to get the science on the stock more up to date. We need to get a handle on the stock itself before we figure out how to divvy up the pieces of it. We don’t know what we’re divvying up yet.

Arnold Leo - We’re really in very dire need of greater flexibility in management tools. I think the options offered here, the trigger options, are very modest, but beginning to get flexibility. I would support the trigger option as a start towards flexibility. Sticking with status quo is not a good idea.

Jeffrey Gutman - Fisheries in the north weren’t left out, they were just in other fisheries at the time the allocations were made. I don’t know how much flexibility we need on the commercial side. It seems to be a manufactured crisis. I do hope the Council is listening. Most people were for status quo, some felt trigger was the only viable option of those put forth. And a lot of those who said trigger was viable also said they preferred status quo.

Meade Amory - Fluke took five years and we ended up with a compromise that was the trigger solution. We might end up with the same sort of result.

ASQ Comments

8 opposed ASQ - Michael Plaia, Jeffrey Gutman, Meade Amory, Marc Hoffman, Robert Ruhle, Carl Benson, Jim Ruhle, Carl Forsberg

1 supported ASQ – Kurt Martin (email comment)

Carl Benson - Auction is RSA - same issues, different name.

Jim Ruhle – The quota auction system is going to produce more Carlos Rafael’s. We don’t need that.

Carl Forsberg – The auction approach should be totally wiped off. I don’t think those with more money should be able to have more fish.

General Allocation Comments

Marc Hoffman – The southern range has been moving south as well as the northern range moving further north and east because the biomass is exploding. Guys in Maine are not fishing for sea bass because they don't have a quota. It's becoming an invasive species and threatening lobster catch. Guys are going out 100, 200 miles and getting black sea bass in their traps. The biomass is much larger than the numbers we're using. I think we need a drastic increase in the quotas. Maine and New Hampshire should be considered more equally; they need more quota. They don't fish because they don't have the quota.

Comments on Distribution Shift

Greg DiDomenico - Do you have specific information or evidence that the southern range of this fishery is moving? Can you do analysis on whether the change is due to anything but management changes? I personally believe that's having a much broader impact on the location of catch than abundance. If we don't have evidence for that, that's a big concern for me. Do you have any disposition for any other analysis regarding the reason for discards in these other regions? One thing I see as a conflict in the objectives of this is the issue of discards. Future management actions might decrease discards in one area and increase them in another. That's important. I'd be uncomfortable going ahead without an analysis of that. There are several parts of the document that mention investment. Is there any analysis of vessels that invested in landing permits in other areas to overcome their small allocations? The agency has gone on record and done numerous workshops about resiliency. Disadvantaging certain regions will be disadvantageous from a resiliency perspective.

Robert Ruhle - What are you using to quantify a shift in effort? What data and what years? Is there anything considering 2015-present? There have been different regulations over time which have impacted fishing practices. A changing distribution of effort could be due to management. You would need to look at directed black sea bass trips only, not those with incidental catch.

Meade Amory - This whole idea of a shift north I find very hard to believe. We just finished 5 years of allocation revisions with flounder. There's an overall expansion of the black sea bass stock, period. Commercial fishermen have been seeing it for years. This year, boats are catching sea bass further south than ever before. Look at observer and VTR data. The idea that it is shifting north is just a ruse to move allocations north.

Wes Townsend - We've been very conservative on sea bass. It's booming. They're expanding. When the stock goes down, I think they will concentrate in the mid-Atlantic again.

Marc Hoffman - I don't think biomass is shifting. People say it's global warming, and everything is moving north. That concept is bogus. This biomass is growing. The SSB that we have registered - everyone has told me those surveys are only within 3 miles. They are moving north because there's room there. They are moving further north and east to find food.

Michael Plaia - I want to address Marc Hoffman's comments on the survey data. I just spent a couple of days in Woods Hole. There are a number of state-based surveys, but the NEFCS vessel, the Bigelow, cannot sample in shallow waters and much of state waters.

Carl Benson - I think the assumption that black sea bass and summer flounder are moving north is flawed. What's moving from the south to take up that space that black sea bass and summer flounder are occupying? If nothing, then it could be expansion, not just moving north.

Other Comments

Michael Plaia - I want to raise another issue with current state by state quotas and any changes. For some background where I'm coming from is a bycatch reduction, reduction in bycatch mortality. I think the Commission should subdivide the quotas between the pot and trawl fisheries. The pot fishery has very little dead discards. Same thing with the miniscule hook and line fishery. I think we should use these quotas to try and encourage industry to shift more to a trap fishery. Maybe we could do that by subdividing quotas by gear and gradually increasing quotas for trap and hook and line more than quotas for other gear types.

Marc Hoffman - I think we need a doubling or tripling of quota because biomass is much higher than we think. Please check where the trawl surveys are taking place. They definitely don't go out past 20 miles. There are no inshore lobstermen south of Cape Cod because the black sea bass have eaten them. People need to go out very far to catch lobster.

Harvey Yenkinson - I'm a recreational fisherman. The commercial regulations affect us. We are not as mobile as commercial fishermen. If regional depletion occurs, the recreational fishery suffers tremendously. We've suffered in Cape May because the stocks are shifting. The fluke assessment couldn't determine why the stock has shifted. I think fishing pressure has an impact on distribution. We don't have a system of allocating where fishing is allowed to occur. If the southern region is depleted, it will majorly impact the recreational fishery. Not an immediate concern for black sea bass, but it is for fluke. For example, there have been some scallop closed areas to address localized depletion. The Board needs to consider how to manage these fisheries so as not to unfairly compromise the recreational fishery.

Chris Spies - I recall a map of where fish are caught based on VTR reports. As I recall, 4 of the 5 top statistical areas are located right off Long Island. People are saying the states are still catching their fish, but they are catching them up here. New York is arguing that we are not getting fair access based on that. We have 7% of the quota. There's been no consideration given to guys up here who have lost businesses. I want to see that restored.

Robin Scott - I agree with Greg DiDomenico. We need to protect investments. The state of New Jersey is hurtling down the pike towards wind farms in primary migratory areas for summer flounder. I'm not sure how that will impact black sea bass. Summer flounder have been documented as avoiding electromagnetic fields. I think it's poised to annihilate the commercial and recreational fisheries.

Greg DiDomenico - Harvey Yenkinson made some comments that I absolutely object to. They are misplaced in regards to this amendment and are baseless accusations that are counter current to precisely what has happened in New Jersey. I would remind him that there is no commercial fishing on 13 reefs in federal waters. If he's seeing regional depletion, it's not from commercial fishing. I would ask all other AP members to ask him to strike those comments from the record.

Comments from the Public

Rob O'Reilly – Abundance should be considered in addition to biomass. The current regulations should also be considered. I had such reservations and skepticism about the TMGC approach that I was motivated to put forward the trigger option. I couldn't believe there was only one option moving forward and that was TMGC. Effort has been talked about a lot. We got VTR info for Virginia. 62% of trips taken by Virginia ITQ fishermen occurred south of Hudson Canyon. I was trying to think how that would be weighted. This is not exactly like the commercial summer flounder fleet. Even if biomass is greater north of Hudson Canyon, the fishermen certainly aren't going to go north. That's a disconnect with the TMGC. There are caveats about using survey data. What is the timing of everything? I could see a situation where the assessment is not ready and we need to use surveys. I see the TMGC as bogging down management. It would be similar to what we went through with summer flounder. We need a more streamlined approach.

Mike Luisi - I've been listening intently since the beginning of call. The trigger approach could be thought about more in depth than just an even distribution across the states. I've thought about ways we could use that trigger-style management action to solve a problem, or to get closer to our ultimate goals.

Caitlin Starks

From: Beaty, Julia <jbeaty@mafmc.org>
Sent: Tuesday, April 02, 2019 3:17 PM
To: JOAN BERKO
Cc: Caitlin Starks
Subject: RE: BSB AP Meeting Comments

Thanks, Joan. We will add that to the summary.

Julia Beaty
Fishery Management Specialist
Mid-Atlantic Fishery Management Council
800 N. State Street, Suite 201
Dover, DE 19901
302-526-5250
jbeaty@mafmc.org

-----Original Message-----
From: Fishthewizard <fishthewizard@aol.com>
Sent: Tuesday, April 2, 2019 3:04 PM
To: Beaty, Julia <jbeaty@mafmc.org>
Subject: BSB AP Meeting Comments

Hello:

The fishery management should remain status quo.

Joan Berko
NJ

Caitlin Starks

From: PAUL CARUSO <pkcaruso@comcast.net>
Sent: Tuesday, April 02, 2019 5:12 PM
To: Caitlin Starks
Subject: Re: AP meeting today

Hello Caitlin,

Regrettably I had to leave the conference call early today. Very good job by the way.

If proper I would like to add the following comments:

I feel the TMGC methodology, as laid out in the WG Report Appendix I offers a reasonable solution to address the longstanding issue of stock biomass shift small commercial quota shares for some states that now have an abundance of available resource.

Regarding Appendix II, I do not support this proposal given that most states in the NE region have not traditionally participated in, or participate minimally, in the offshore winter fisheries.

Sincerely, Paul G. Caruso

Caitlin Starks

From: Jim Lovgren <jlovgren3@gmail.com>
Sent: Thursday, April 04, 2019 12:26 PM
To: Caitlin Starks
Cc: Julia Beaty
Subject: Re: AP Meeting Summary - Review by 4/10

Caitin Sorry I missed the call, I support Status Quo for the fishery, and still want the quota that the ASMFC stole from NJ back. When they did the original allocation plan NJ should have received 28 to 38 % of the quota, yet thanks to backroom dealing we got 20%. It sounds like there was a lively discussion about the proposals, Sorry I missed them, Jim

Caitlin Starks

From: Kurt Martin <timebandit100@hotmail.com>
Sent: Friday, April 05, 2019 12:51 PM
To: Caitlin Starks
Subject: Re: AP Meeting Summary - Review by 4/10

Follow Up Flag: Follow up
Flag Status: Completed

Hello Caitlin:
I wanted to submit the following comments. There was quite a bit of discussion going on during the webinar/ conference call. I will read over the meeting summary and submit suggestions if I have any.
Thanks,
Kurt Martin

I feel that it is important to wait for the new stock assessment to be approved prior to making any changes to quota distribution. Hopefully the stock assessment will take into account observer data, as not all the federal and state fish tows will accurately show population fluctuations pending time of year and sea temperature. Even though it seems that the population has increased and expanded its range, it is important to have scientific evidence that backs up this hypothesis. If the assessment shows that the population is more robust and the percentage of fish has fluctuated, than the quota distribution should be changed to reflect this.

Additionally observer data is important to account for live and dead discards and not just automatically assuming all fish discarded are dead. In shallow water, fish caught in pots, many of the fish thrown back over are still alive and swim off.

I would be in favor of hearing more ideas and options for having an auction. Comments from members on the phone call seemed to argue that it would be difficult to enforce. There are other fisheries such as monkfish that have a research set aside which allows fisherman to land more monkfish. With issuance of a Letter of Authorization to catch and land more fish, a fisherman could show it if he was checked by an Enforcement Officer.

In my experience, the Massachusetts sea bass fishery is robust and more quota would be easy to fill. In the past fisherman were required to decrease their catch. If the population is shown to be more robust the quota should be increased. It would be great to utilize more sustainable local fish.

Caitlin Starks

From: crispies@optonline.net
Sent: Monday, April 08, 2019 5:54 AM
To: Caitlin Starks
Cc: Julia Beaty
Subject: RE: Joint Summer Flounder, Scup, and Black Sea Bass AP Meeting scheduled for Tue 4/2 @1pm

Good morning Caitlin,

Below is what I would submit for my written comments:

I found the seabass report I mentioned during the webinar on Tues, April 2, and attached it to this email. The map I was referencing is on page 9 of the report, Figure 4.

The report shows that 77% of the seabass harvest comes from 6 Statistical Areas that are immediately adjacent to NY (areas 616, 613, 615, 537, 612 and 539). Despite this abundance of fish right off the shores of Long Island, NY gets only 7% of the quota. Also as noted in the January 17, BSB Working Group Report, CT gets only 1%, despite a growing population of the seabass in the LIS.

It was stated during the meeting that the other states, with larger quotas, but less fish in their immediate area (such as VA and NC) are still catching their quotas, as though they are catching them in their local waters. But that is not the case. Southern boats are traveling to northern waters to catch those fish, right next to NY boats, which cannot because of quota limitations. That is not fair and equitable access to the fishery.

Multiple times during the meeting I heard comments recommending "status quo." These came from fishermen in the states with the most quota, NC, VA, MA and RI. Of course, they recommend status quo, because they have the lion share of the fishery to enjoy to themselves. These fishermen suggest that NY fishermen historically fished for other species, while they had fished for seabass all along. It was suggested that NY's fishermen targeted species like cod, and then wiped them out, so now they are looking to seabass, and therefore they don't deserve additional access to the fishery. That's laughable, since the cod stock crash is up off of Massachusetts, which also happens to have a robust portion of the seabass quota. These fishermen are lobbying for status quo because they are trying to guard what has been theirs for 15 years (a disproportionate portion of the quota) which is understandable, and I don't begrudge them for doing so. I hope they in kind will understand that I am just looking for a fairer and more equitable share for NY's commercial fishermen.

Additionally, NY has 45 federal dealers. The next closest states are MA and RI with 29 each. Then there are hundreds more state licensed dealers as well. It was stated multiple times during the meeting that changing to a new system doesn't take into consideration the investments into the businesses that other states fishing industries have made. NY had investments into the fishing industry, which are all dying. No consideration has been given to them, with a paltry 7% quota of an abundant fishery, located directly off of our shores. We have the fish, the fishermen, the markets, the dealers and the surviving remnants of the infrastructure. The only thing limiting our fishermen's access to this plentiful fishery located literally right upon our shores, is our pitiful share of the quota.

As the Working Group Report indicates, the quotas set in 2003 were originally based off of historical landings during the 21 years between 1980 and 2001. It's been recognized that NY had a problem with reporting. Fair enough. However, NY fishermen have been punished for the last 15 years now for it, and it's time for a little relief. Therefore, I do not support status quo. I believe new options, to allow more equitable access to the fishery need to be explored.

I like the idea of the TMGC approach outlined in Appendix I, however I don't believe including NJ in the Southern zone makes any sense. NJ is fishing the same body of fish located in the NY bight, as all of the northern state boats. More than one third (35%) of the entire coastal commercial BSB harvest comes from Statistical Area 616, which is located equidistant from NY and NJ. It stands to reason that both states boats, and others, are harvesting fishing together here and it makes no sense to include NJ into the Southern region. If this method is chosen, NJ should be part of the Northern region.

I prefer the method outlined in Appendix II, which uses coastwide measures when the fish are primarily being targeted in the offshore federal waters, and then state measures when the fish are being targeted in the inshore state waters. This method implemented after a new survey of stock distribution, re-evaluation and re-allotment of the individual state quotas seems the most fair and equitable way to manage the states fishermen and access to the resource.

Additionally, for that stock distribution survey, survey methods need to be employed which allow the survey boat to fish in shallower waters during the times when the fish are in shallower (summer months). Missing the large body of fish due to equipment limitations and then not counting those fish, and calling it the best available science is not acceptable.

Thank you,

Chris Spies
NY Recreational Angler and AP member

Caitlin Starks

From: Top Hook <ssofabed@aol.com>
Sent: Tuesday, April 02, 2019 3:17 PM
To: Caitlin Starks
Subject: Fwd: AP Meeting Mar 1 2019

Hi Caitlin

Thank for your presentation.My vote would be at this time status quo,until we have better DATA..I'M also sending you a comment. I made regarding NEW YORK'S CATCH 22 dilemma on harvest mortality. just want make sure its on the record. AGAIN.

Steven R Witthuhn
AP
MRAC N.Y.

From: ssofabed@aol.com
To: kdancy@mafmc.org
Sent: 3/1/2019 12:20:57 PM Eastern Standard Time
Subject: AP Meeting Mar 1 2019

Good Morning Kiley

Thank you for your presentation: My concerns that I am writing to you about are the catch 22 that management as produce.The DISCARD RATE as now become a big part of my worries. THE AM'S are now more apart of the process.This practice is only one part of synergy that is adding to (recruitment) questions.Dealing with N.Y. commercial fluke quota. a 50lb daily limit presents a dilemma for the draggers that the harvest method its creating, is an unwanted DISCARD. We are using a bulldozer to fill up a flowerpot.400lbs on deck 50 lb limit. we know they are looking for quality, better price.(Female FISH). This also presents the same problem with black seabass. 50lb quota. I do not know if Mesh size is the answer or its a ROD AND REEL ONLY. N.Y. fisheries given the 50 lb daily quota.So I feel this catch 22 issue must be addressed, unwanted waste.

Thank you A.P. Member Steven R Witthuhn
N.Y. MRAC Council

Catch 22 50LBS = Discards = AM'S a.k.a pay back.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

April 11, 2019

To: **Summer Flounder, Scup and Black Sea Bass Management Board**

From: **Tina Berger, Director of Communications**

RE: **Advisory Panel Nomination**

Please find attached a new nomination to the Summer Flounder, Scup and Black Sea Bass Advisory Panel – Paul Caruso, a recreational angler from Massachusetts. Please review this nomination for action at the next Board meeting.

If you have any questions, please feel free to contact me at (703) 842-0749 or tberger@asmfc.org.

Enc.

cc: Caitlin Starks and Kirby Rootes-Murdy

M19-27

Summer Flounder, Scup and Black Sea Bass Advisory Panel

Bolded names await Board review and approval

Massachusetts

Joseph Huckemeyer (party/charter; targets both scup/sf)
137 Pleasant Street
Hyannis, MA 02601
Phone (day): 508.790.0660
Phone (eve): 508.428.4029
FAX: 508.790.1321
joseph@meganet.net
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/28/14; 8/18

James Tietje (charterboat; targets both scup and BSB)
227 Clinton Avenue.
Falmouth, MA 02540
Phone (day): 508.548.2626
FAX: 508.548.1569
patriottoo@aol.com
Appt. Confirmed 5/30/96
Appt. Reconfirmed 9/15/00
Appt. Reconfirmed: 3/20/07
Appt. Reconfirmed 10/28/14; 8/18

Kurt Martin (comm. fish weirs/traps/hand lines)
43 Rayber Road
Orleans, MA 02653
Phone: 508.237.5888
Timebandit100@hotmail.com
Appt. Confirmed 10/24/18

Paul G. Caruso (rec; targets SF and BSB)
42 Matthew Way
Marstons Mills, MA 02648
Phone: 774.238.6018
pkcaruso@comcast.net

Rhode Island

Frank W. Blount, Jr. (rec/comm/for-hire; targets all 3 species)
390 Bridgetown Road
Saunderstown, RI 02874
Phone (day): 401.783.4988
Phone (eve): 401.789.2374
francesflt@aol.com
Appt. Confirmed 10/28/14

Michael Hall (comm trawl offshore; targets all 3 species)
30 Old Richmond Townhouse Road
Carolina, RI 02812
Phone: 401.742.1353
Mikecaptn1@cox.net
Appt. Confirmed 10/28/14

Aaron Gewirtz (comm gillnet inshore; targets all 3 species)
360 Pine Hill Road
Wakefield, RI 02879
Phone: 401.218.5764
NBF05@verizon.net
Appt. Confirmed 10/28/14

Travis Barao (rec; targets SF and BSB)
15 Gibbs Street
Rumford, RI 02916
Phone (day): 401.301.7944
Phone (eve): 401.270.7161
travisbarao@gmail.com
Appt. Confirmed 10/28/14

Connecticut

John (Jack) Conway (rec; targets SF)
34 Edward Road
North Branford, CT 06471
JConway@sikorsky.com
Appt. Reconfirmed 9/14
Appt. Reconfirmed 10/17/14
Appt. Reconfirmed 10/28/14

Kyle Douton (for-hire/tackle shop owner; targets all 3 species)
5 Rockwell Street
Niantic, CT 06357
Phone (day): 860.739.7419
Phone (eve): 860.739.8899
FAX: 860.739.9208
kyle@jbtackle.com
Appt. Confirmed 10/28/14

Michael C. Plaia (rec/comm/for-hire; targets all 3 species)
119 Currituck Road
Newtown, CT 06470
Phone: 203.512.4280
Makomike333@yahoo.com
Appt. Confirmed 10/28/14

New York

Bob Busby (party/charter; targets SF)
375 Burtis Place
PO Box 129
Peconic, NY 11958
Phone: 631.765.1768
Rbusby@optonline.net
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/17/14
Appt. Reconfirmed 10/28/14

Paul Forsberg (party/charter; targets scup)
1133 Marina Drive
Tarpon Springs FL 34689
pgfviking1@gmail.com
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/28/14

Marc K. Hoffman (recreational; targets BSB)
140-A Union Avenue
Lynbrook, NY 11563
Phone: 516.887.8202
Phone (cell): 516.244.2146
FAX: 516.887.8113
MKHoffman@optonline.net
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/28/14

Mark King (comm; targets all 3 species)
PO BOX 1039
Mattituck, NY 11952
Phone: 631-298-8782
Phone (cell): 631-766-7299
d713k@aol.com
Appt. Confirmed 10/24/14

Arthur Kretschmer (comm; targets all 3 species)
P.O. Box 81
Mattituck, NY 11952
Phone (home): 631.298.5372
Phone (cell): 631.397.2533
marcialom@msn.com
Appt. Confirmed 10/24/14

New Jersey

James R. Lovgren (comm; targets all 3 species)
17 Laurelhurst Drive
Bricktown, NJ 08724
Phone (day): 732.899.1872
Phone (eve): 732.840.9560
FAX: 732.840.4496
JLOVGREN3@GMAIL.COM
Appt. Reconfirmed 10/28/14

Greg DiDomenico (commercial offshore; targets all 3 species)
1636 Delaware Avenue
Cape May, NJ 08204
Phone: 609.675.0202
FAX: 609.898.6070
gregdi@voicenet.com
Appt. Reconfirmed 10/28/14

Robert Meimbresse (for-hire; targets SF)
179 Mudjekeewis Trail
Medford Lakes, NJ 08055
Appt. Confirmed 5/9/07
Captbob626@comcast.net
Appt. Reconfirmed 10/28/14

Bill Shillingford (recreational; targets SF)
20 Pinewood Court
Swainton, NJ 08210
Phone: 609.287.4689
Appt. Confirmed 5/9/07
BUCKTAIL8@aol.com
Appt. Reconfirmed 10/28/14

Delaware

P. Wes Townsend (comm/pot; targets BSB
PO Box 207
Dagsboro, DE 19939
Phone: 302.542.1150
Pakafish1@yahoo.com
Appt. Confirmed 10/28/14

Jay Little (rec)
1641 Bowers Beach Road
Frederica, DE 19946
Phone: 302.632.4714
Lusefest@gmail.com
Appt. Confirmed 10/24/18

Robert Hass
RAHAAS@VERIZON.NET
302.236.2128
Appt. Confirmed 10/24/18

Vacancy – recreational bait/tackle; targets SF

Maryland
Victor Bunting Jr. (for-hire; targets BSB)
11123 Bell Road
Whaleyville, MD 21872
Phone: 443.614.6484
Victorbunting@rocketmail.com
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/28/14

Allen "Buddy" Seigel (rec; targets SF and BSB)
1091 Ocean Parkway
Berlin, MD 21811
Phone (day): 443.340.2833
Phone (eve): 410.208. 3887
buddyscrn@gmail.com
Appt. Confirmed 10/28/14

Jeff Eutsler (comm; target SF)
11933 Gray's Corner Road
Berlin, MD 21811
Phone (day): 443.497.3078
Phone (eve): 410.213.2436
Tandje1@comcast.com
Appt. Confirmed 2/2/16

Virginia
Mark Hodges (comm/pot; targets BSB)
2456 Bullock Trail
Virginia Beach, VA 23454-5219
Phone: (757) 463-5475
Email: mhodges@cox.net
Appt. Confirmed 5/9/07
Appt. Reconfirmed 10/28/14

Steven Wray (for-hire/bait & tackle; targets SF & BSB)
2109 West Great Neck Road, Suite 100
Virginia Beach, VA 23451
Phone: 757.237.7517
FAX: 757.481.4925
captstv@yahoo.com
Appt. Confirmed 10/28/14

C. Meade Amory (comm trawl; targets all 3 species)
101 South King Street
Hampton, VA 23669
Phone (day): 757.722.1915
Phone (eve): 757.876.6466
FAX: 757.723.1184
meade@amoryseafood.com
Appt. Confirmed 10/28/14

Dr. Ken Neill, III (rec; targets all 3 species)
117 Kenneth Drive
Seaford, VA 23696
Phone (day): 757.898.6832
Phone (eve): 757.890.2711
FAX: 757.890.0200
jackcrevelle@msn.com
Appt. Confirmed 10/28/14

Kevin Smith (rec; targets SF)
8007 Discovery Drive
Richmond VA 23229
Phone: 804.627.1575
kevin.m.smith@suez-na.com
Appt. Confirmed 10/24/18

North Carolina
Art Smith (processor; SF)
368 Hubs Rec Road
Belhaven, NC 27810
Phone (day): 252.721.0735
Phone (eve): 252.964.2195
artsmith@gotricounty.com
Appt. Confirmed 10/28/14
Appt. Reconfirmed 8/18

Brent Fulcher (comm. otter/bottom trawl; target all 3 species)
P.O. Box 3321

New Bern, NC 28564
Phone (cell): 252.514.7003
Phone (work): 252.637.1552
bjseafood@earthlink.net
Appt. Confirmed 10/24/18

James Ruhle (comm. otter/bottom trawl; target all 3 species)
P.O. Box 302
Wanchese, NC 27981
Phone: 252.423.0238
fvdaranar@aol.com
Appt. Confirmed 10/24/18

PRFC
John Dean (comm; targets SF)
49925 Hays Beach Road
Scotland, MD 20687
Phone: 301.904.8078
selbysuzi1121@aol.com
Appt. Confirmed: 11/25/96
Appt. Reconfirmed 7/26/00
Appt. Reconfirmed 2/07
Appt. Reconfirmed 10/28/14

Dandridge C. Crabbe (charterboat; targets SF)
51 Railway Drive
Heathsville, VA 22473
Phone: 804.453.3251
dcrabbe@crabbescharterfishing.com
Appt. Confirmed 12/11/01
Appt. Reconfirmed 2/07
Appt. Reconfirmed 10/28/14

Nontraditional Stakeholders
Roman Jesien (habitat; BSB interest)
MD Coastal Bays Program
9919 Stephen Decatur Highway, Suite 4
Ocean City, MD 21842
Phone (day): 410.213.2297
Phone (evening): 410.228.5193
science@mdcoastalbays.org
Appt. Confirmed 1/31/07

Vacancy

ATLANTIC STATES MARINE FISHERIES COMMISSION

Advisory Panel Nomination Form

This form is designed to help nominate Advisors to the Commission's Species Advisory Panels. The information on the returned form will be provided to the Commission's relevant species management board or section. Please answer the questions in the categories (All Nominees, Commercial Fisherman, Charter/Headboat Captain, Recreational Fisherman, Dealer/Processor, or Other Interested Parties) that pertain to the nominee's experience. If the nominee fits into more than one category, answer the questions for all categories that fit the situation. **Also, please fill in the sections which pertain to All Nominees (pages 1 and 2). In addition, nominee signatures are required to verify the provided information (page 4), and Commissioner signatures are requested to verify Commissioner consensus (page 4). Please print and use a black pen.**

Form submitted by: DAVID PIERCE State: MA
(your name)

Name of Nominee: Paul G. Caruso

Address: 42 Matthew Way

City, State, Zip: Marstons Mills, MA 02648

Please provide the appropriate numbers where the nominee can be reached:

Phone (day): 774-238-6018 Phone (evening): 508-428-3567

FAX: ______ Email: pkcaruso@comcast.net

<u>FOR ALL NOMINEES</u>:

1. Please list, in order of preference, the Advisory Panel for which you are nominating the above person.

   1. bluefish
   2. summer flounder, blacksea bass, scup
   3. ______
   4. ______

2. Has the nominee been found in violation of criminal or civil federal fishery law or regulation or convicted of any felony or crime over the last three years?

   yes ______ no X

3. Is the nominee a member of any fishermen's organizations or clubs?

   yes X no ______

   If "yes," please list them below by name.

Cape Cod Flyrodders Association ______________________

______________________ ______________________

______________________ ______________________

4. What kinds (species) of fish and/or shellfish has the nominee fished for during the past year?

Striped bass | blacksea bass
bluefish | false albacore / bonito
summer flounder | quahog, oyster, softshell clam

5. What kinds (species) of fish and/or shellfish has the nominee fished for in the past?

above plus | Atlantic mackerel
Atlantic cod | Haddock
Bluefin tuna | Tautog
| Lobster

FOR COMMERCIAL FISHERMEN:

1. How many years has the nominee been the commercial fishing business? ________ years

2. Is the nominee employed only in commercial fishing? yes______ no________

3. What is the predominant gear type used by the nominee?______________________

4. What is the predominant geographic area fished by the nominee (i.e., inshore, offshore)?______________________

FOR CHARTER/HEADBOAT CAPTAINS:

1. How long has the nominee been employed in the charter/headboat business? _______ years

2. Is the nominee employed only in the charter/headboat industry? yes ______ no_______

If "no," please list other type(s)of business(es) and/occupation(s):______________________

____

3. How many years has the nominee lived in the home port community? _______ years

If less than five years, please indicate the nominee's previous home port community.

____

FOR RECREATIONAL FISHERMEN:

1. How long has the nominee engaged in recreational fishing? 56 + years

2. Is the nominee working, or has the nominee ever worked in any area related to the fishing industry? yes X no ________

   If "yes," please explain.

   former Senior Marine Fisheries Biologist for MA DMF

   former Commercial Fisherman 20 years

FOR SEAFOOD PROCESSORS & DEALERS:

1. How long has the nominee been employed in the business of seafood processing/dealing? ________ years

2. Is the nominee employed only in the business of seafood processing/dealing?

   yes ______ no ______ If "no," please list other type(s) of business(es) and/or occupation(s):

3. How many years has the nominee lived in the home port community? ________ years

   If less than five years, please indicate the nominee's previous home port community.

FOR OTHER INTERESTED PARTIES:

1. How long has the nominee been interested in fishing and/or fisheries management? ________ years

2. Is the nominee employed in the fishing business or the field of fisheries management? yes _____ no _____

   If "no," please list other type(s) of business(es) and/or occupation(s):

FOR ALL NOMINEES:

In the space provided below, please provide the Commission with any additional information which you feel would assist us in making choosing new Advisors. You may use as many pages as needed.

Nominee Signature: Paul G. Caruso Date: 3-6-19

Name: Paul G. Caruso
(please print)

COMMISSIONERS SIGN-OFF (not required for non-traditional stakeholders)

David Pierce
State Director

State Legislator

Governor's Appointee

Atlantic States Marine Fisheries Commission

Business Session

Wednesday, May 1, 2019; 1:15 – 2:30 p.m.
Thursday May 2, 2019; 9:45 – 10:00 a.m.
Alexandria, Virginia

Draft Agenda

The order in which these items will be taken is subject to change;
other items may be added as necessary.

May 1

1.	Welcome/Introductions (*J. Gilmore*)	1:15 p.m.
2.	Committee Consent • Approval of Agenda • Approval of Proceedings from February 2019	1:20 p.m.
3.	Public Comment	1:25 p.m.
4.	Review and Consider Approval of 2019-2023 Strategic Plan **Final Action**	1:30 p.m.
5.	Consider Approval of the Summer Flounder Commercial Issues Amendment **Final Action**	2:00 p.m.
6.	Recess	2:30 p.m.

May 2

1.	Reconvene	9:45 a.m.
2.	Review Noncompliance Recommendations (If necessary) **Final Action**	9:50 a.m.
3.	Other Business/Adjourn	10:00 a.m.

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street Arlington, Virginia 22202; 703.486.1111

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

BUSINESS SESSION

The Roosevelt Hotel
New York, New York
October 23, 2018

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of Agenda** by consent (Page 1).

2. **Approval of Proceedings from October and November, 2017** by consent (Page 1).

3. **Move to adopt the 2019 Action Plan** (Page 12). Motion by David Borden; second by Robert Boyles. Motion adopted by consent (Page 12).

4. **Motion by the Nominating Committee to reelect Jim Gilmore as Chair and Pat Keliher as Vice-Chair of ASMFC** (Page 13). Motion approved by unanimous consent (Page 13).

5. **Move to Adjourn** by consent (Page 13).

ATTENDANCE

Board Members

Nick Popoff, ME, proxy for P. Keliher (AA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)
Doug Grout, NH (AA)
Ritchie White, NH (GA)
Raymond Kane, MA (GA)
David Pierce, MA (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Justin Davis, CT, proxy for P. Aarrestad (AA)
Bill Hyatt, CT (GA)
James Gilmore, NY (AA)
Emerson Hasbrouck, NY (GA)
Michael Falk, NY, proxy for Sen. Boyle (LA)
Joe Cimino, NJ, proxy for L. Herrighty (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Andy Shiels, PA, proxy for J. Arway (AA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
David Blazer, MD (AA)
Russell Dize, MD (GA)
Rob O'Reilly, VA, proxy for S. Bowman (AA)
Steve Murphey, NC (AA)
Robert Boyles, SC (AA)
Marcel Reichert, SC, proxy for M. Rhodes (GA)
Spud Woodward, GA (AA)
Doug Haymans, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Martin Gary, PRFC
Mike Millard, USFWS
Rachel Baker, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Staff

Bob Beal
Toni Kerns
Jessica Kuesel

Guests
(sign-in not available)

The Business Session of the Atlantic States Marine Fisheries Commission convened in the Terrace Ballroom of the Roosevelt Hotel, New York, New York; Tuesday, October 23, 2018, and was called to order at 10:45 o'clock a.m. by Chairman James J. Gilmore.

CALL TO ORDER

CHAIRMAN JAMES J. GILMORE: Welcome to the Business Session.

APPROVAL OF AGENDA

CHAIRMAN GILMORE: We're going to get going first with approval of the agenda; which is in your briefing package. Does anybody have any changes to the agenda? Okay seeing none; we'll adopt those by unanimous consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN GILMORE: The next item is we have approval of the proceedings from the October and November, 2017.

Are there any additions, changes to that? Seeing none; we'll adopt those by consent.

PUBLIC COMMENT

CHAIRMAN GILMORE: Item 3 is Public Comment. If there is anyone in the audience that would have a comment on any item not on the agenda, now is the time to come up to the public microphone.

REVIEW AND CONSIDER APPROVAL OF THE 2019 ACTION PLAN

CHAIRMAN GILMORE: Seeing none; we will move right along, and we'll go right into our first big item, which is to Review and Consider Approval of the 2019 Action Plan and Bob Beal is going to take us through that. Bob.

EXECUTIVE DIRECTOR ROBERT E. BEAL: I think most of you were at the Strategic Planning Session this morning. One of the things I mentioned there is that this draft Action Plan looks a lot different than the 2018 Action Plan and the previous year's Action Plan. In the past the document was about twice as long; it was 30 some pages of a lot of detail.

A lot of the tasks that were in there were ongoing activities that we did every year. For all the 27 species that we manage there was a task for each one of those that said, monitor compliance and develop an FMP review. Why write that 27 times? We do it for all the species and we do it every year; we have to do it.

When you went into all the other sections and goals there are a lot of things that we have to do every year; they are just part of the function of ASMFC. We decided there is no reason to spend 18 pages on those items. We'll pull most of those out; put them into sort of paragraph form. Let the Commissioners know and the public know what we're going to do from year-to-year; but really focus on the new activities and the big activities that we'll take on in 2019.

The other thing that we've done in here is highlight any tasks or projects that are going to roll over into next year, 2020. In the previous versions we would just say initiate a lobster stock assessment. That's kind of all it would say sometimes; and it wasn't clear. Obviously we were going to start it and not finish it; but when would it get finished wasn't included.

We tried to include details like that. Initiate the 2020 assessment, or initiate assessment for completion in 2020, or different ways to let the public and Commissioner know what the timeline is for some of these projects and what are the big ticket items that spill over into the subsequent year. That's the update on the format. The other format change that is fairly substantial is that a lot of information is captured in each of the species. For example, under lobster we'll see there is in Goal 1 for lobster there is management issues obviously, there are stock assessment issues, and there are data collection issues.

In the past those would have been scattered between Goal 1, Goal 2, and ACCSP Data Collection. Everything that's going on with lobster put it in one spot. That is one of the other formatting changes. Then the other big one is we've sort of binned all the species into two categories; high priority and medium-low priority.

The high priority ones are the ones that have a lot of activity during this year, and a lot of the big concerns and big issues that the Commission needs to work on. Medium and low priority does not mean that they are not ecologically important, economically important. It just means that the Commission is not going to put as much resources into those species this year as they might have in the past. We're going to focus on the high priority species.

We are going to take on some tasks for the medium and low priorities; but not as much, and really the focus will be on the high priority. I think the best way to go through this, Mr. Chairman, is I'll ask Toni to go through each of the species and the tasks associated with the species. Then I'll quickly go through the remaining seven goals; and just highlight some of the big work that will go on in the future. I think that will be an efficient way to do it; if you're okay with that.

CHAIRMAN GILMORE: Sounds good, Bob; so Toni, take it away.

MS. TONI KERNS: Starting with the high priority species is American lobster. We'll develop a strategy for management of the Gulf of Maine/Georges Bank stock that acknowledges the effects of changing ocean conditions. I should lead with; in lobster the Board yesterday talked about a lot of different issues, and we added some additional items to the Action Plan that you will not see in your document that I will verbally express.

I think the Lobster Board and several species boards potentially, may grapple with prioritizing some of these issues. Just to note that if the Board does prioritize over the year some of these issues; that some may get dropped from this year, or pushed back to 2020. The Board will also implement Addendum XXVI data elements to improve the data collection and characterization of the lobster fishery; develop a strategy to address large whale issues, which will likely continue into 2020.

This issue is also listed in several other Commission species. I won't repeat it when we get to those species; but Jonah crab, northern shrimp if the fishery were to open, black sea bass, scup, most of our pot fisheries that deal with end lines. Something that is not in your document, but was discussed yesterday is; develop a strategy to identify bait sources and protocols; to address concerns regarding biohazards.

Continue to work with enforcement on offshore enforcement; and also continue the development of the benchmark stock assessment that will be peer reviewed in 2020. Moving on to Atlantic herring; we'll work in conjunction with the Council to consider management responses to the 2018 benchmark assessment, and the outcome of the Council's Amendment 8 as it gets considered for approval by NOAA Fisheries, set specs for 2020 and 2021.

Not in your documents; but discussed yesterday was evaluate the efficacy of management goals and objectives of Gulf of Maine spawning closures, and consider expanding spawning closures to Area 3. This would be through multiple addenda. Also not in your document would be to consider tools to expand flexibility in setting the specifications for Area 1A.

Atlantic menhaden complete the menhaden specific and the ERP benchmark stock assessments for SEDAR peer review in 2019. Then moving into 2020 and the Board would review those benchmarks and consider a management response; also this year, resolve the implementation of the Chesapeake Bay cap. Atlantic striped bass –

MR. STEVEN G. BOWMAN: Mr. Chairman, not to interrupt Toni, but since we're on menhaden, can I make a comment if I could please? It may be of benefit as we proceed on through this.

CHAIRMAN GILMORE: Go ahead, Steve.

MR. BOWMAN: I'll be very brief. I note there; to resolve the implementation of the Chesapeake Bay cap as noted. Just as a heads up, this Commission has been very, very patient with the Commonwealth of Virginia; as far as the implementation of the Bay cap is concerned. There is no doubt about that. I just want to let you know that obviously the legislature did not take up the matter during the first leg of the continuance that you provided.

In talking with some members of the legislature it became very obvious to me that the legislature, and Senator Mason is here, and he may want to echo, again we won't belabor it. But there is some significant concern in the Virginia legislature about the science that is being provided in making their decision.

I believe that it's the feeling of a great number of members of the legislature that until the ecological reference point study is available, and has been provided to the public that the likelihood, by virtue of the fact that the science is not specific enough for them to make the decision that they may not take up the matter again in this legislative session, pending that science being made available. I just wanted to get that out there.

The other thing I just wanted to give you a head up as well; is we have continuously monitored as we promised, the fishery in the Chesapeake Bay. Without getting too specific, as far as the numbers, Omega Protein has not met the cap, the established cap that we have now, as a matter of fact they are well below that as far as the fishery is concerned. I'm not here to defend the fishery at all; I'm here to defend the process. Just to let you know that that is likely where I sit as Administrative Commissioner and the Marine Resources Commission sit; as far as this dilemma is concerned. I have that information; I wanted to get it out to members of the Commission, to let them know where we are and what's going on, and just to make sure that I keep you informed, because you all have been extremely patient, and I just want to give you the best information that I have at my avail at this time, Mr. Chairman, so thank you.

CHAIRMAN GILMORE: Thank you, Steve. Okay Toni, do you want to continue?

MS. KERNS: For Atlantic striped bass we'll work cooperatively with NOAA Fisheries to consider changes to striped bass fishing in the EEZ; including the Block Island Transit Zone, develop a long term strategy for collecting striped bass tagging data, including funding and the administration and at-sea support.

We'll also review the benchmark stock assessment and peer review in February; and consider a management response. For black sea bass we will complete an Operational Assessment; which will include the calibrated MRIP estimates. The Board and Council review that Operational Assessment and consider a management response; and possible changes to specifications in conjunction with the Council, if it were to be done early enough.

Then we will also set the 2020/2022 specifications. We will develop in coordination with the Council an addendum and amendment on reforming recreational management and commercial and recreational allocation. That activity would likely extend into 2020; and that action would also carry over to summer flounder as well as scup, and we'll consider changes to the commercial fishery management program.

For cobia we'll finalize and implement Amendment 1 to the cobia FMP; and work with the Council and NOAA Fisheries to ensure complementary regulations are put in federal waters. We'll also work through SEDAR to finalize the benchmark stock assessment; review that assessment and consider a management response if necessary.

For horseshoe crab we'll have a benchmark stock assessment for peer review in March of 2019. We'll review that report and consider a management response if necessary; and set the specifications for Delaware Bay in 2020. The red drum, we'll continue to work with the Assessment Science Committee to develop a road map for the next benchmark stock assessment; including consideration of the calibrated MRIP data.

For summer flounder, we will work with the Council to review the benchmark stock assessment that is being completed this year; review that peer review report and consider a management response, and changes to the 2019 specifications. We will also set the 2020 through 2022 specifications with the Council. We will in coordination with the Council finalize the comprehensive summer flounder amendment for implementation in 2020.

We'll also have a working group meet with the Council's Research Steering Committee; to examine the possibility of reestablishing recreational set-aside programs. Now moving on to the medium to low priority species, American eel, we'll monitor and respond if necessary, to the classification of eel under the CITES; and we will also review data sources to determine the next assessment timeline, which is not in your document but was added yesterday through the Eel Board meeting. For Atlantic croaker as well as spot, we'll consider management alternatives to address stock conditions; based on the updated traffic light. For bluefish, we will continue the development of an allocation amendment in collaboration with the Mid-Atlantic Council. We'll complete an operational assessment; which will include the calibrated MRIP estimates, and we'll review that assessment and then consider management response and set the 2020 to 2022 specifications with the Council.

For northern shrimp, we will conduct a stock assessment update; and then set specifications for 2020, 2021 season, and also consider industry Test Tows to collect biological data if necessary as resources allow. For scup, we'll complete an operational assessment; which will also include the MRIP estimates, and then review that operational assessment with the Council, consider a management response, and set the 2020 to 2022 specifications.

For shad and river herring, we'll complete the shad benchmark stock assessment in 2019; and then in 2020 review that assessment and consider a management response. For Spanish mackerel, we'll work through SEDAR to prepare a benchmark assessment for peer review in 2020; and then review that and consider a management response in conjunction with the South Atlantic Council.

For spiny dogfish, depending on the direction that the Board takes next week, we may add a task to look at trip limits; but that will depend on the outcome of the Board. For tautaug, we'll finalize the commercial harvest tagging program; as required by Amendment 1 for implementation in 2020.

For weakfish, we will complete a stock assessment update in 2019; and then consider a management response and set the 2020 specifications. Looking at cost cutting issues, we'll monitor developments related to changing ocean conditions, ocean acidification and stock distributions, ecosystem services, ocean planning, and potential fishery reallocations.

We'll respond to MRIP estimates as needed across Commission species management plans; and examine allocation strategies and provide recommendations to the management boards if necessary. Are there any questions or concerns regarding the prioritization of the species as laid out; or additions to the Action Plan?

CHAIRMAN GILMORE: No comments for Toni on this? Okay, seeing none; I think Bob is going to take the next section. Bob.

EXECUTIVE DIRECTOR BEAL: Goal Number 2 is the science activities of the Commission. Toni hit a lot of the highlights with the stock assessments that are going to be completed and worked on next year. Just very quickly, the science program continues to have a really busy, busy schedule for next year; and in fact they've got a lot of stock assessment work going on.

In addition to the stock assessment activities, they're going to go through a number of new tasks that are highlighted in Goal 2. The Science Committee activities detail the Management Science Committee, Assessment Science Committee; the final bullet under Science Committee activities is the finalization of the Risk and Uncertainty Policy at the Commission. This is something that was started this year; well actually started a number of years ago, but we'll finalize that in 2019.

Under data collection there is a number of new tasks. SEAMAP and NEAMAP are obviously under there; but under collect new data to address data deficiencies, the second and third bullets there deal with lobster fishery and collecting more detailed effort and spatial information to address some of the Right Whale and gear interactions.

The SEAMAP and NEAMAP program are detailed lower in that; which is key data collection programs in the southeast and northeast. Under fisheries research, there are a number of new activities; but the final bullet there which is partner with USGS to identify shared research priorities. We've been working a lot with former Commissioner Tom O'Connell, he's in a new position over in West Virginia with USGS; and we've been trying to partner with him.

It seems very successful in highlighting some of the research capabilities that they have; to link up to ASMFC species and priorities. We're going to hopefully continue to foster that relationship and get some more needed research done for the Commission. Ecosystem-based management highlights a number of the activities; and the Ecosystem Status Reports and incorporating ASMFC species.

Under Competing Ocean Uses, this is where we highlight the aquaculture activity and the formation of a new Aquaculture Committee; that will be considered and approved tomorrow morning at the Executive Committee. There is a number of aquaculture activities going on that the Commission will be involved with. Those are the quick highlight, Mr. Chairman of the Goal Number 2; happy to answer any questions if there are any.

CHAIRMAN GILMORE: Any questions for Bob on Goal Number 2? Seeing none; we'll go right into Goal 3.

EXECUTIVE DIRECTOR BEAL: We'll keep going. All right, Goal 3 is what we call Compliance. It has a lot to do with the Law Enforcement Committee and their activities from year-to-year. Under the compliance heading, you know I should have said this, there are paragraphs at the beginning that is sort of the form of a preamble, and those are the activities that are going to be repeated from year-to-year.

Get down into the compliance section; we talked about aquaculture again, and asked the Law Enforcement folks to provide some feedback on enforcement issues associated with the aquaculture issues, especially American eel and the interactions of wild caught product and aquaculture product, and how we track those differently, and how we can make sure we're not creating any legal loopholes by the aquaculture activities that the Commission is supporting.

We are also working toward enhancing traceability of fishery products across jurisdictional boundaries. There are a lot of questions about importing and exporting animals, and different size limits and seasons and other things up and down the east coast, and how can the Law Enforcement folks help out with traceability to minimize those interactions across borders, and Partnerships, a couple bullets there highlighting JEAs and other important partnerships that we have to support Law Enforcement activities.

Stakeholder Awareness is the final category there; and it's just using different platforms to communicate real time information about laws and enforcement activities that are going on up and down the east coast. That is the quick summary of Goal Number 3; the Law Enforcement Activities.

CHAIRMAN GILMORE: Yes go ahead, Eric Reid.

MR. ERIC REID: Not that long ago there was a decision about who could and could not be involved in managing or enforcing aquaculture. Are we outside that loop as a Commission? There was a discussion about whether National Marine Fisheries or NOAA could actually manage aquaculture. Where are we; as far as that decision was made?

EXECUTIVE DIRECTOR BEAL: Eric, I think you're referring to a legal decision in the Gulf of Mexico that essentially said aquaculture activities could not be managed under the Magnuson Stevens Act. Interestingly, there is a court in California that said the exact opposite thing not too long ago; they said yes, you can absolutely manage aquaculture activities under Magnuson Stevens Act.

We've got two different District Court opinions on that. But regardless; ASMFC is a little bit outside that. ASMFC itself doesn't really have much authority in aquaculture. It's the individual states that have the authority. I think our role moving forward is not really clearly defined yet. But as it gets defined, I don't think it's going to be heavy on policy; but it will be much more focused on coordination and just bringing the states together to talk about their experiences.

CHAIRMAN GILMORE: Other questions for Bob. Emerson.

MR. EMERSON C. HASBROUCK: Actually, I did have a couple of questions under Goal 2; so with your permission I wonder if we could back up a little bit, back to Goal 2.

CHAIRMAN GILMORE: Yes, go ahead, Emerson.

MR. HASBROUCK: Under Data Collection. Collect new fishery dependent data using black sea bass research fleet. How is that going to be conducted? Who is doing that and how is it being conducted? That's my first question.

EXECUTIVE DIRECTOR BEAL: Pat will come up and answer that one if that's okay, Emerson.

MR. PATRICK A. CAMPFIELD: There is a project that CFRF has been supporting in collaboration with Jay's group in Rhode Island for the past couple of years; to simply get fishery dependent data using vessels that are out in the field. Last year it was funded through ACCSP; so that's a new initiative to improve some of the data gaps for black sea bass assessment.

CHAIRMAN GILMORE: Yes, go ahead, Emerson.

MR. HASBROUCK: My second question is the last bullet under that section; Collect New Data. Increased bycatch monitoring of sturgeon, shad and river herring and sciaenids in state waters as resources allow. How is that going to be accomplished if resources are available?

CHAIRMAN GILMORE: Go ahead, Pat.

MR. CAMPFIELD: The "as resources allow" part is important. Those are science needs that have been identified for those listed species in the last several stock assessments; notably for sturgeon in the 2017 assessment. I think North Carolina is one state that has had a successful sort of inshore bycatch program, observer program. We would like to explore doing that in other estuaries, other state waters for additional states; because it is a major deficiency.

MR. HASBROUCK: It's going to be through an expansion of an observer program if funds are available; is that right?

MR. CAMPFIELD: Yes, potentially. But I think it's things that we need to work through our Science Committees, and of course the states, to see if it's feasible or not.

CHAIRMAN GILMORE: All right, back to Goal 3. Are there any questions for Bob on Goal 3? Okay seeing none; we'll move on to Goal 4.

EXECUTIVE DIRECTOR BEAL: Goal 4 is Habitat. This encompasses ASMFC Habitat Committee activities, as well as the Atlantic Coastal Fish Habitat Partnership; and all this work is generally coordinated by Dr. Lisa Havel. Under education or educate, the final bullet there is to evaluate ecosystem health for consideration by Technical Committees and Boards; just looking at new ways to look at overall ecosystem health.

Integrate is the Habitat Committee is working on developing a list of fish habitats of concern, and describing those with the goal of incorporating those into the fishery management plans. Continuing on to leveraging partnerships, this is really the foundation of our Habitat Program, which is getting the state, local, and regional governments to work together to benefit the habitat protection for the species that we're trying to manage and restore.

Under ACFHP there are a number of important activities coming up for this year. They're going to continue to work on the Southeast Fish Habitat Mapping Project; and identify data gaps there, and initiate the northeast component of the fish mapping project and complete that in 2020. The third bullet is to adopt a business plan for the Atlantic Coastal Fish Habitat Program; and implement action plans to network with the partners, and solicit donations from private sectors to support habitat recovery and restoration.

The final bullet is Restoring Habitats by Funding Fish Passage and non-fish passage projects; SAV, oyster reefs, and salt marshes. Pretty busy agenda for the Habitat Program, and ambitious, but hopefully we'll be able to find some funding and get some of that work done this year.

CHAIRMAN GILMORE: Questions on Goal 4. Wow, we're on a roll, Goal 5.

EXECUTIVE DIRECTOR BEAL: All right, we'll keep going then. Goal 5 is outreach; primarily run through Tina's shop and the activities that she undertakes from year-to-year. A lot of her activities are ongoing. Obviously she's going to continue to do press releases and Fish Focus; and all the other things that we have to do and want to do to notify the public of what's going on.

There are some new activities and things to highlight in the portfolio of outreach activities; increased public understanding and support of the Commission. There is the 2019 and 2020 list of species that we're going to develop the stock assessment documents; and highlight the stock assessment results for a series of species this year.

As you can see, the 2019 list is pretty long. That goes back to what I said earlier about the busy Science Program; and then that translates into a busy outreach program, which translates into a busy management program, so a lot of species we're going to have stock assessment results in the next calendar year.

Maximizing use of current new technologies, as folks talked about in the earlier Strategic Planning Session, people are communicating differently. There is social media; there are all sorts of blogs and other things that folks are using to share information. How do we engage in that and what should we be doing a little bit differently to focus our outreach efforts on the kind of new world that we live in; given the new technology.

We use story mapping; which is kind of like pictures and words to work together to describe an issue, short video clips, and the same thing to provide some information on what the Commission is up to. Stakeholder participation, obviously this was talked about a little bit earlier; as far as public hearings and other things.

But we're going to work outreach materials that highlight opportunities for public engagement. We're going to work with the Advisory Panels. Again, we've got the two years, 2019 and 2020 with the list of species; and we're going to get those advisory panels together and provide some input to the managers as we get the results of the new stock assessment for that long list of species.

Media relations and networking is ongoing activity obviously for the Outreach Program. But the very last bullet there on the bottom, the indented bullet, is exploring mechanisms to better inform fishing blogs and other external communication platforms. This is kind of going back to what I said earlier that the people are getting their information differently than they used to; and how should we be sort of positioned to deal with that and realize that people are communicating differently than they used to. That is the quick summary of Outreach Activities, Mr. Chairman.

CHAIRMAN GILMORE: Questions on Goal 5. Everybody is awake, right? Okay good, just checking. Bob, Goal 6.

EXECUTIVE DIRECTOR BEAL: Goal 6 is Legislative Policy Agenda, Capitol Hill activities Deke and I engage in, and a number of Commissioners engage in. Primarily one of the things we're going to focus on next year. You may have heard, or you may not have heard there is going to be an election in about a week or so. There are going to be some new folks on Capitol Hill; and we're going to engage with those folks, and anytime Capitol Hill, a new Congress is put in place, committee structure changes. The Chairmanship and leadership of the committees that we're interested in may change. We'll engage those folks; and make sure they are aware of ASMFC and the activities of the Commission.

We'll continue to monitor all fishery related legislation. We don't' anticipate much action with Magnuson Stevens Act before the end of this Congress; next Congress may take that up and try to make some progress there. We'll monitor that; well obviously, any other fishery activity will make the Commissioners fully aware of that.

The second to final series of bullets there is funding. We're going to continue to highlight the priorities at ASMFC at the Congressional level; and with our federal partners, to make sure we have the resources needed to support all the activities that the Commission wants to engage in. There is a series of priorities; projects that are listed that we will highlight.

The continuing Regional Council and Fishery Commission line and trying to enhance the funding there as well as work on the allocation of the funding that is provided between the Councils and the three interstate commissions. We'll do that. Partnerships are the last bullet under Goal 6.

That is basically ASMFC working with the Great Lakes, the Pacific Commission and the Gulf States Commission to highlight mutual interstate issues, and bring those to Capitol Hill with sort of a collective voice of all the coastal states around the country. That has been very successful in the past; and we'll continue to do that as best we can. That is Goal 6, Mr. Chairman.

CHAIRMAN GILMORE: Any questions on Goal 6? Okay, Goal 7.

EXECUTIVE DIRECTOR BEAL: Goal 7 is Administration of the Commission. This is Laura's shop; and all the activities within her staff. Obviously there is a whole lot going on to keep the lights on and keep these meetings happening, and reimbursing folks and administering our grants, but there are a few, and those go on every year.

There are a couple areas worth highlighting; we're working on improving our job classifications and salary information for each of the positions at the Commission, working on sort of honing in the salary ranges that are available, to be more transparent there. The second bullet there is managing the Fishery Management, Science and Administration and Logistical Support Cooperative Agreement that we have with NOAA Fisheries.

This is the cooperative agreement; it's a multimillion dollar agreement where we move a lot of money to a number of different projects, and it takes a lot of administrative support to keep that going. It's been a great partnership between ASMFC and NOAA Fisheries; to tackle a number of shared projects and we're able to very efficiently move a lot of money around and get a lot of projects done. It highlights the current information technology, human resources activities within Laura's shop.

Human Resources have grown a lot in the recent years; with all the APAIS staff that we've hired. We've got folks in seven or eight different states up and down the coast; and that creates a lot of additional work to track all those different states and all the requirements that each state has, and payment schedules and other things.

Laura's shop will continue to do all those things. We'll look for training opportunities for Commission staff on the commonly used software programs that we use in our office. We'll work supporting new Commissioners; and then we'll also ensure legal compliance of Commission actions. In other words, if we get sued we will respond to that pretty quickly. Those are the administrative highlights for 2019.

CHAIRMAN GILMORE: Any Goal 7 questions? Ritchie.

MR. G. RITCHIE WHITE: I served on AOC some time ago; it was under a different Executive Director. At that time there was kind of a rule of thumb about the reserve fund, and how much should be in the reserve. At that time the rule of thumb was six months of operating expense; and then I think as excess money beyond that started to accumulate, we paid down the mortgage on the building, which I think was an excellent investment.

I guess I would ask if there is not written policy on the reserve fund that the AOC and Executive Committee, whoever you would think would be looking at that; maybe come up with something in writing, because obviously there are needs, scientific needs for funds and it's important to have a well adequate reserve fund. I'm not saying that what we have done is not correct; but I just think looking at that and having some written policy might be good.

CHAIRMAN GILMORE: Actually Laura, do you want to respond to that if you could?

MS. LAURA C. LEACH: Yes, we do have a written policy on the reserve fund. The good news is that our operating expenses will be going down. Two years from now we will be done with our mortgage; which is a great thing, so our operating expenses are going to be quite a bit less.

EXECUTIVE DIRECTOR BEAL: Just to drive Laura crazy, I say we're going to move into the new office in one year and six months; so we'll never get ahead of that. Goal 8?

CHAIRMAN GILMORE: Goal 8.

EXECUTIVE DIRECTOR BEAL: Goal 8, all right.

CHAIRMAN GILMORE: Oh, sorry, Eric.

MR. REID: I suppose this is a good a time as any. I really appreciate what Robert has done for me as a Commissioner; and Laura and her shop, and Tina and her shop, and all the staff. When the circus is in town, especially in the big city, you know the work that they do for us I think deserves at least a couple of applause in my opinion, so if it's okay with you, Mr. Chairman.

CHAIRMAN GILMORE: Please proceed. (Applause) Yes, and trust me, we all have conversations about how professionally speaking, screwed we would be if we didn't really have the staff. They just do an outstanding job, and really keep us moving forward, so yes well said. Go ahead, Bob.

EXECUTIVE DIRECTOR BEAL: Thank you all and the staff appreciate that. One of my primary jobs is to get out of the way a lot of times and let them do what they do. With that Goal 8 is Data Collection; it's ACCSP. As I mentioned earlier, the current Strategic Plan doesn't have a goal for ACCSP. We kind of slipped this one in and called it Goal 8.

We'll incorporate ACCSP into the new plan. But there are a number of paragraphs there that detail the ongoing activities for the data collection and data warehousing activities within ACCSP. They've got a lot going on over there. They've got a pretty big staff; and they're moving a whole lot of data up and down the east coast.

It's becoming more and more of a critical data program, and more and more the data program for stock assessment and management up and down the coast. That's the goal of the program; to be the one repository for all Atlantic coastal data. We're heading that way. It's just a pretty complex system to move fully in that direction. With that there are a couple activities that are worth highlighting.

Under Program Management on the last page, you know review and select funded projects for 2019 and 2020. It's worth noting that there is a policy within ACCSP that was approved by the Coordinating Council that all projects that have been what we call maintenance projects, which is ongoing projects. Once you get to year five of maintenance funding.

If you had a proposal submitted and funded for five years, your funding starts tapering off at 33 percent for the next three years, then you no longer can be funded through ACCSP. The 2019 funding will be full funding, and 2020 will be the first year where those projects were dropped by 33 percent.

That is worth noting that that is going to impact a number of projects up and down the coast.

Under fishery dependent monitoring, the SAFIS activities expand mandatory trip reporting. There is a lot of mandatory trip reporting activities going on up and down the coast; some initiated by the Council, some potentially initiated by this Commission, and ACCSP is going to stay on top of that.

They are also going through a major redesign of the SAFIS database and all the interfaces, and the way folks will be able to get data out of SAFIS. Under APAIS, which is the Access Point Angler Intercept Survey, which is sort of half of the MRIP program that the states are now conducting through the Commission; you know a busy program.

One of the significant things that they're hoping to do this year, and they're well on their way to doing this, is transitioning from paper-based survey to electronic intercept software. Right now we get lots and lots of FedEx packages at our office with paper surveys. They're going to switch over; hopefully to tablet-based data collection, so that we don't have to scan all those documents in. It will go straight into the database, so it will be a big improvement. They'll work on developing and approving for-hire survey validation methodology; data distribution and use, expanded data warehouse, and start to include biological data. They're going to work to improve data integrity; which is consistency of data that is reported from the states, and make that improving the data integrity improves the usefulness and amount of use that the overall program will get.

Bycatch is another area that ACCSP is considering. The last bullet there is a security audit of ACCSP. What this is, since ACCSP houses federal data, we have to go through an audit to make sure all the appropriate firewalls and security systems are in place; so that no one from the outside can access that data, and it's properly insulated from any Russian hacking or anything else that might go on. That is what the audit is all about; so happy to answer any questions on Goal 8, or anything else within the Action Plan.

CHAIRMAN GILMORE: Any questions on Goal 8? David.

DR. DAVID PIERCE: I was following on Bob's invite to comment on the Action Plan itself; so if I may. Going back to the high priority item of the task for summer flounder, the third bullet says; request an ASMFC Working Group meet with the Council's Research Steering Committee to examine the possibility of reestablishing the Research Set-Aside Program, so just a clarification.

Is the Council moving forward now? Should we establish that program, and we are requesting participation, or are we requesting the Council to start it up again? I asked the question, because this will be a key task for 2019, especially for New England states that are not part of Mid-Atlantic Council debates.

MS. KERNS: David, what we, I'm going to have Mike come to, Mike can either nod or not. But I believe, David that we may have tweaked the wording here to make this a little confusing. They have their Research Steering Committee is established, and are meeting. We are asking them to examine.

I don't know if it's to examine establishing the Research Set-Aside Program; because I think that Committee takes on other tasks as well these days, and so we're asking them to look at Research Set-Aside. I did bring it up at the August joint meeting; and Chris had said that they would take that back to the Council when they discussed priorities for 2019. I'm not sure the outcome of that discussion; and Mike could speak to that.

CHAIRMAN GILMORE: Go ahead, Mike.

MR. MICHAEL LUISI: To that point. That topic is on our list of priorities for 2019; which will be discussed and finalized at our December meeting. It is on there now. I assume it will go forward.

CHAIRMAN GILMORE: Thanks, Mike. David, are you good? David Borden.

MR. DAVID V. BORDEN: Two points, one under Item 1, winter flounder. I thought we had agreed to try to set up a dialogue with the New England Council on the issue of working on standardizing the winter flounder regulations; but somebody can correct that if that is incorrect. Then the second point is a minor point.

Under a lot of these tasks you've got this statement relative to whales about the need to respond to the large whale issues. That actually applies to every fishery where there is a fixed-gear fishery. In other words, potential regulations are going to be cross cutting. You may be better off putting that into the cross-cutting section. Thank you.

MS. KERNS: In response to the winter flounder portion of that issue. We agreed to have conversations with the Council. I don't believe we specifically said to have consistent regulations. But if that is something that the Commission wants us to do; we can add that task to that working group.

MR. BORDEN: I mean in my own case, I would be happy with setting up a dialogue about the problem, and working towards that as an eventual resolution of it. I think it's in the best interest of the stock to do that.

MS. KERNS: We can have that as a task then, David.

CHAIRMAN GILMORE: Other questions. Personally that last table that Bob didn't go over, I love that thing, because it's kind of the good cheat sheet for seeing what's going on, in terms of the big priority issues. I think staff did a great job on this. **We are going to need a motion for the lean, mean action plan that we have in front of us; so if we could have that to adopt it.**

David Borden. I've got a second by Robert Boyles. Is there any discussion on the motion? Seeing none; is there any objection to the motion? We don't have a motion up there. But I think we're just adopting. I'll wait until we get it up there; just so we make sure we're not violating parliamentary procedures.

Move to adopt the 2019 Action Plan, was a motion by Mr. Borden and seconded by Mr. Boyles. Is there any objection to the motion? Seeing none; we will adopt that by unanimous consent.

ELECTION OF COMMISSION CHAIR AND VICE-CHAIR

CHAIRMAN GILMORE: Thanks everybody, and thanks for the work for the Commission staff. Our next agenda item, I actually have to take a leave; and Bob is going to take the meeting over, because we're going to have an election. Bob, it's all yours.

EXECUTIVE DIRECTOR BEAL: At this time I would like to call on Doug Grout as the Chairman of the Nominating Committee to report out on nominations for Chair of the Atlantic States Marine Fisheries Commission. Doug.

MR. DOUGLAS E. GROUT: Thank you, Mr. Chair, and I would also like to thank the members of the Nominating Committee; Dave Borden and Robert Boyles, along with myself. We contacted the various jurisdictions within the Commission, the states within the Commission looking for nominations for both Chair and Vice-Chair this year. I am pleased to announce for Chair, I would like to nominate Jim Gilmore from the host state of New York for Chair this year.

EXECUTIVE DIRECTOR BEAL: Thank you, Doug. **We have a nomination from the Nominating Committee to reelect Jim Gilmore as the Chair of ASMFC.** The Commission's election process allows any other nominations from the floor, before a vote is taken. Are there any other nominations from the floor for Chair of ASMFC? Yes, Robert.

MR. ROBERT H. BOYLES, JR.: **Mr. Chairman, I was going to ask if you wanted a motion to close nominations, and approve by acclamation Jim Gilmore, as presented by the Nominations Committee.**

EXECUTIVE DIRECTOR BEAL: That would be perfect if you're willing to do that.

MR. BOYLES: **Yes sir, so moved**.

EXECUTIVE DIRECTOR BEAL: We've got a motion to close nominations; and approve Jim Gilmore as the Chair of ASMFC by proclamation. Is there a second to that? I see Loren Lustig. **Are there any objections to the motion, seeing none; congratulations, Jim for another year of being the Chair of ASMFC?** I would like to go back to Doug as the Chair of the Nominating Committee for nominations for Vice-Chair of the Commission.

MR. GROUT: Thank you, Bob. **We have one nomination and that is to nominate Pat Keliher, form the state of Maine as Vice-Chair of the Commission.**

EXECUTIVE DIRECTOR BEAL: Thank you, Doug. Nomination from the Nominating Committee for Pat Keliher to serve another year as Vice-Chair, are there any other nominations from the floor? Seeing none; any motions? Robert Boyles.

MR. BOYLES: **I would move that we close the nominations for Vice-Chair; and that we would approve by acclamation Pat Keliher as Vice-Chair.**

EXECUTIVE DIRECTOR BEAL: Thank you, Robert, is there a second? Emerson Hasbrouck, thank you. **Are there any objections to the motion of Pat Keliher staying as the Vice-Chair of the Atlantic States Marine Fisheries Commission for another year? Seeing none; congratulations, Pat.** I think that concludes the business of this session, Jim. Would you like to comment on closing this meeting?

CHAIRMAN GILMORE: Thank you again for the honor of serving as Chairman; it's actually been a real eye opener. I must say, in terms of an Assistant Chair, Pat Keliher, I would probably be screwing up if it wasn't for him, so it's great having a great assistant chairman also. Thanks again, and I hope to continue on and do a good job with all the extraordinary issues we have facing us over the next year, so thank you, and Pat, do you have any comments you want to add?

MR. PATRICK C. KELIHER: I just received a text from an anonymous person around the table that just told me not to screw it up. I think that says it all. Thank you very much.

ADJOURNMENT

CHAIRMAN GILMORE: Let me see; my first action for this coming year is to recess this meeting. Unless there is other business before the Business Session, we stand adjourned.

(Whereupon the meeting adjourned at 11:40 o'clock a.m. on October 23, 2018)

ATLANTIC STATES MARINE FISHERIES COMMISSION

Draft Five-Year Strategic Plan 2019-2023
for Consideration and Approval by the Business Session

The nation behaves well if it treats the natural resources
as assets which it must turn over to the next generation
increased and not impaired in value.

Theodore Roosevelt

Introduction

Each state has a fundamental responsibility to safeguard the public trust with respect to its natural resources. Fishery managers are faced with many challenges in carrying out that responsibility. Living marine resources inhabit ecosystems that cross state and federal jurisdictions. Thus, no state, by itself, can effectively protect the interests of its citizens. Each state must work with its sister states and the federal government to conserve and manage natural resources.

Beginning in the late 1930s, the 15 Atlantic coastal states from Maine to Florida took steps to develop cooperative mechanisms to define and achieve their mutual interests in coastal fisheries. The most notable of these was their commitment to form the Atlantic States Marine Fisheries Commission (Commission) in 1942, and to work together through the Commission to promote the conservation and management of shared marine fishery resources. Over the years, the Commission has remained an effective forum for fishery managers to pursue concerted management actions. Through the Commission, states cooperate in a broad range of programs including interstate fisheries management, fisheries science, habitat conservation, and law enforcement.

Congress has long recognized the critical role of the states and the need to support their mutual efforts. Most notably, it enacted the Atlantic Coastal Fisheries Cooperative Management Act (Atlantic Coastal Act) in 1993, which built on the success of the Atlantic Striped Bass Conservation Act of 1984. Acknowledging that no single governmental entity has exclusive management authority for Atlantic coastal fishery resources, the Atlantic Coastal Act recognizes the states' responsibility for cooperative fisheries management through the Commission. The Atlantic Coastal Act charges all Atlantic states with implementing coastal fishery management plans that will safeguard the future of Atlantic coastal fisheries in the interest of both fishermen and the nation.

Accepting these challenges and maintaining their mutual commitment to success, the Atlantic coastal states have adopted this five-year Strategic Plan. The states recognize circumstances today make the work of the Commission more important than ever before. The Strategic Plan articulates the mission, vision, goals, and strategies needed to accomplish the Commission's mission. It serves as the basis for annual action planning, whereby Commissioners identify the highest priority issues and activities to be addressed in the upcoming year. With 27 species currently managed by the Commission, finite staff time, Commissioner time and funding, as well as a myriad of other factors impacting marine resources (e.g., changing ocean conditions, protected species interactions, offshore energy, and aquaculture), Commissioners recognize the absolute need to prioritize activities, dedicating staff time and resources where they are needed most and addressing less pressing issues as resources allow. Efforts will be made to streamline management by using multi-year specifications where possible and increase stability/predictability in fisheries management through less frequent regulatory changes. A key to prioritizing issues and maximizing efficiencies will be working closely with the three East Coast Regional Management Councils and NOAA Fisheries.

Mission

The Commission's mission, as stated in its 1942 Compact, is:

> *To promote the better utilization of the fisheries, marine, shell and anadromous, of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries, and by the prevention of physical waste of the fisheries from any cause.*

The mission grounds the Commission in history. It reminds every one of the Commission's sense of purpose that has been in place for over 77 years. The constantly changing physical, political, social, and economic environments led the Commission to restate the mission in more modern terms:

> *To promote cooperative management of marine, shell and diadromous fisheries of the Atlantic coast of the United States by the protection and enhancement of such fisheries, and by the avoidance of physical waste of the fisheries from any cause.*

The mission and nature of the Commission as a mutual interstate body incorporate several guiding principles. They include:

- States are sovereign entities, each having its own laws and responsibilities for managing fishery resources within its jurisdiction
- States serve the broad public interest and represent the common good
- Multi-state resource management is complex and dependent upon cooperative efforts by all states involved
- The Commission provides a critical sounding board on issues requiring cross-jurisdictional action, coordinating cooperation, and collaboration among the states and federal government

Vision

The long-term vision of the Commission is:

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

Values

The Commission and its member states have adopted the following values to guide its operations and activities. These values affirm the Commission's commitment to sustainable fisheries management for the benefit of recreational and commercial fishermen and coastal communities. They also acknowledge the growing importance of managing fisheries in a more holistic and adaptive way, seeking solutions to cross cutting resource issues that lead to long-term ecological and socio-economic sustainability.

- Effective stewardship of marine resources through strong partnerships
- Decisions based on sound science
- Long-term ecological sustainability
- Transparency and accountability in all actions
- Timely response to new information through adaptive management
- Balancing resource conservation with the economic success of coastal communities
- Efficient use of time and fiscal resources
- Work cooperatively with honesty, integrity, and fairness

Driving Forces

The Commission and its actions are influenced by a multitude of factors. These factors are constantly evolving and will most likely change over the time period of this Strategic Plan. However, the most pressing factors affecting the Commission today are changing ocean conditions, resource allocation, the quality and quantity of scientific information, competing ocean uses, a growing demand to address ecosystem functions, and interactions between fisheries and protected species. The Strategic Plan, through its goals and broad objectives, will seek to address each of these issues over the next five years.

Changing Ocean Conditions

Changes in ocean temperature, currents, acidification, and sea level rise are affecting nearly every facet of fisheries resources and management at the state, interstate, and federal levels. Potential impacts to marine species include prey and habitat availability, water quality, susceptibility to disease, and spawning and reproductive potential. The distribution and productivity of fishery stocks are often changing at a rate faster than fisheries ~~science~~ stock assessments and management can keep pace with. Several Commission species, such as northern shrimp, Southern New England lobster, Atlantic cobia, black sea bass, and summer flounder are already responding to changes in the ocean. In the case of northern shrimp and Southern New England lobster, warming ocean waters have created inhospitable environments for species reproduction and survivability. For cobia, black sea bass, and summer flounder, changing ocean conditions have contributed to shifts in ~~ed~~ species distributions, with ~~the~~ some species expanding their ranges and others ~~species~~ moving into deeper and/or more northern waters to stay within preferred temperature ranges. Where shifts are occurring, the Commission ~~will~~ may need to reconsider state-by-state allocation schemes and make adjustments to our fishery management plans. For other species depleted due to factors other than fishing mortality (e.g., habitat degradation and availability, predation), the states will need to explore steps that can be taken to aid in species recovery. And, if a stock's viability is compromised, Commission resources and efforts should be shifted to other species that can be recovered or maintained as a rebuilt stock.

Allocation

As noted above, resource allocation among the states and between various user groups will continue to be an important issue over the next five years. Many of the Commission FMPs divvy up the available harvestable resource through various types of allocation schemes, such as by state, region, season, or gear type. The changing distribution of many species has further complicated the issue of resource allocation with traditional allocation schemes being challenged and a finite amount of fishery resources to be shared. Discussion may be difficult and divisive, with some states (and their stakeholders) wanting to maintain their historic (traditional) allocations, while others are seeking a greater share of the resource given increased abundance and availability in their waters. States will need to seek innovative ways to reallocate species so that collectively all states feel their needs are met. What will be required to successfully navigate these discussions and decisions is the commitment of the states to work through the issues with honesty, integrity, and fairness, seeking outcomes that balance the needs of the states and their stakeholders with the ever changing realities of shifting resource abundance and availability.

Science as the Foundation

Accurate and timely scientific information form the basis of the Commission's fisheries management decision-making. Continued investments in the collection and management of fishery-dependent and -independent data remain a high priority for the Commission and its member states. The challenge will be to maintain and expand data collection efforts in the face of shrinking state and federal budgets. Past and current investments by state, regional and federal partners of the Atlantic Coastal Cooperative Statistics Program (ACCSP) have established the program as the principal source of marine fishery statistics for the Atlantic coast. State and regional fishery-independent data collection programs, in combination with fishery statistics, provide the scientific foundation for stock assessments. Many data collection programs will continue to be strained by budget restrictions, scientists' workload capacities, and competing priorities. The Commission remains committed to pursuing long-term support for research surveys and monitoring programs that are critical to informing management decisions and resource sustainability.

Ecosystem Functions

Nationally, there has been a growing demand for fisheries managers to address broader ecosystem functions such as predator-prey interactions and environmental factors during their fisheries management planning. Ecosystem science has improved in recent years, though the challenges of comprehensive data collection continue. A majority of the Commission's species are managed and assessed on a single species basis. When ecosystem information is available, the Commission has managed accordingly to provide ecosystem services. The Commission remains committed to seeking ecological sustainability over the long-term through continuing its work on multispecies assessment modeling and the development of ecosystem-based reference points in its fisheries management planning process.

Competing Ocean Uses

Marine spatial planning has become an increasingly popular method of balancing the growing demands on valuable ocean resources. More specifically, the competing interests of commercial and recreational fishing, renewable energy development, aquaculture, marine transportation, offshore oil exploration and drilling, military needs, and habitat restoration are all components that must be integrated into successful ocean use policies. The Commission has always emphasized cooperative management with our federal partners; however, the states' authorities in their marine jurisdictions must be preserved and respected. The Commission will continue to prioritize the successful operation of its fisheries, but it will be imperative to work closely with federal, state, and local governments on emerging ocean use conflicts as they diversify into the future.

Protected Species

Like coastal fishery resources, protected species, such as marine mammals, sea turtles, and listed and candidate fish species, traverse both state and federal waters. The protections afforded these species under the Marine Mammal Protection Act and Endangered Species Act can play a significant role in the management and prosecution of Atlantic coastal fisheries. The Commission and the states have a long history of supporting our federal partners to minimize interactions with and bycatch of marine mammals and sea turtles. The listing of Atlantic sturgeon under the Endangered Species Act has added a whole new level of complexity in the ability of the Commission and its member states to carry out their stewardship responsibilities for these important diadromous species. The species spends the majority of its life in state waters and depend on estuarine and riverine habitat for their survival. Listing has the potential to jeopardize the states' ability to effectively monitor and assess stock condition, as well as impact fisheries that may encounter listed species. It is incumbent upon the Commission and its federal partners to work jointly to assess stock health, identify threats, and implement effective rebuilding programs for listed and candidate species.

More recently, the depleted status of the Northern right whale population and the potential impacts to this population by entanglement in fishing gear, particularly lobster and crab gear, has heighted concern for both whales and the lobster industry.

Increased Cooperation and Collaboration among the States and between the States and Our Federal Partners

Demands for ecosystem-based fisheries management, competing and often conflicting ocean uses, and legislative mandates to protect marine mammals and other protected species, further complicate fisheries management and require quality scientific information to help guide management decisions. There is a growing concern among fishery managers that some "control" over fisheries decisions and status has been diminished due to political intervention and our inability to effect changing ocean conditions and other environmental factors that impact marine resources. Fisheries management has never been more complex or politically charged. State members are pulled between what is best for their stakeholders versus what is best for the resource and the states as a whole.

While the issues may seem daunting, they are not insurmountable. In order for the Commission to be successful, the states must recommit to their collective vision of “Sustainable and Cooperative Management of Atlantic Coastal Fisheries,” recognizing that their strength lies in working together to address the fisheries issues that lie ahead. Given today’s political and environmental realities, the need for cooperation among the states has never been more important. It is also critical the states and their federal partners seek to strengthen their cooperation and working relationships, providing for efficient and effective fisheries management across all agencies. No one state or federal agency has the resources, authority, or ability to do it alone.

GOALS & OBJECTIVES

The Commission will pursue the following eight goals and their related strategies during the five-year planning period, from 2019 through 2023. It will pursue these goals through specific objectives, targets, and milestones outlined in an annual Action Plan, which is adopted each year at the Commission’s Annual Meeting to guide the subsequent year’s activities. Throughout the year, the Commission and its staff will monitor progress in meeting the Commission’s goals, and evaluate the effectiveness of the strategies. While committed to the objectives included in this plan, the Commission is ready to adopt additional objectives to take advantage of new opportunities and address emerging issues as they arise.

Goal 1 - Rebuild, maintain, fairly allocate, and promote sustainable Atlantic coastal fisheries

Goal 1 focuses on the responsibility of the states to conserve and manage Atlantic coastal fishery resources for sustainable use. Commission members will advocate decisions to achieve the long-term benefits of conservation, while balancing the socio-economic interests and needs of coastal communities. Inherent in this is the recognition that healthy and vibrant resources benefit stakeholders. The states are committed to proactive management, with a focus on integrating ecosystem services, socio-economic impacts, habitat issues, bycatch and discard reduction measures, and protected species interactions into well-defined fishery management plans. Fishery management plans will also address fair allocation of fishery resources among the states. Understanding changing ocean conditions and their impact on fishery productivity and distribution is an elevated priority. Successful management under changing ocean conditions will depend not only on adjusting management strategies, but also in reevaluating and revising, as necessary, the underlying conservation goals and objectives of fishery management plans. Improving cooperation and coordination with federal partners and stakeholders can streamline efficiency, transparency, and, ultimately, success. In the next five years, the Commission is committed to ending overfishing and working to rebuild overfished ~~or depleted~~ Atlantic coast fish stocks, while promoting sustainable harvest of and access to rebuilt fisheries. Where possible, the Commission will seek to aid in the rebuilding of depleted stocks, whose recovery is hindered by factors other than fishing pressure.

Annual action planning will be guided by the following objectives:

- Manage interstate resources that provide for productive, sustainable fisheries using sound science
- Strengthen state and federal partnerships to improve comprehensive management of shared fishery resources
- Adapt management to address emerging issues
- Practice efficient, transparent, and accountable management processes
- Evaluate progress towards rebuilding fisheries
- Promote sustainable harvest of and access to rebuilt fisheries
- Strengthen interactions and input among stakeholders, technical, advisory, and management groups

Goal 2 – Provide sound, actionable science to support informed management actions

Sustainable management of fisheries relies on accurate and timely scientific advice. The Commission strives to produce sound, actionable science through a technically rigorous, independently peer-reviewed stock assessment process. Assessments are developed using a broad suite of fishery-independent surveys and fishery-dependent monitoring, as well as research products developed by a broad network of fisheries scientists at state, federal, and academic institutions along the coast. The goal encompasses the development of new, innovative scientific research and methodology, and the enhancement of the states' stock assessment capabilities. It provides for the administration, coordination, and expansion of collaborative research and data collection programs. Achieving the goal will ensure sound science is available to serve as the foundation for the Commission's evaluation of stock status and adaptive management actions.

Annual action planning will be guided by the following objectives:

- Conduct stock assessments based on comprehensive data sources and rigorous technical analysis;
- Characterize the risk and uncertainty associated with the scientific advice provided to decision-makers
- Provide training to enhance the expertise and involvement of state and staff scientists in the development of stock assessments
- Streamline data assimilation within individual states, and among states and ASMFC
- Proactively address research priorities through cooperative state and regional data collection programs and collaborative research projects, including stakeholder involvement
- Explore the use of new technologies to improve surveys, monitoring, and the timeliness of scientific products
- Promote effective communication with stakeholders to ensure on-the-water observations and science are consistent

- Utilize ecosystem and climate science products to inform fisheries management decisions

Goal 3 - Produce dependable and timely marine fishery statistics for Atlantic coast fisheries

Effective management depends on quality fishery-dependent data and fishery-independent data to inform stock assessments and fisheries management decisions. While Goal 2 of this Action Plan focuses on providing sound, actionable science and fishery-independent data to support fisheries management, Goal 3 focuses on providing timely, accurate catch and effort data on Atlantic coast recreational, for-hire, and commercial fisheries.

Goal 3 seeks to accomplish this through the activities of the Atlantic Coastal Cooperative Statistics Program (ACCSP), a cooperative state-federal program that designs, implements, and conducts marine fisheries statistics data collection programs and integrates those data into data management systems that will meet the needs of fishery managers, scientists, and fishermen. ACCSP partners include the 15 Atlantic coast state fishery agencies, the three Atlantic Fishery Management Councils, the Potomac River Fisheries Commission, NOAA Fisheries, and the U.S. Fish and Wildlife Service.

Annual action planning will be guided by the following objectives:

- Focus on activities that maximize benefits, are responsive and accountable to partner and end-user needs, and are based on available resources.
- Cooperatively develop, implement, and maintain coastwide data standards through cooperation with all program partners
- Provide electronic applications that improve partner data collection
- Integrate and provide access to partner data via a coastwide repository
- Facilitate fisheries data access through an on-line, user-friendly, system while protecting confidentiality
- Support technological innovation

Goal 4 – Protect and enhance fish habitat and ecosystem health through partnerships and education

Goal 4 aims to conserve and improve coastal, marine, and riverine habitat to enhance the benefits of sustainable Atlantic coastal fisheries and resilient coastal communities in the face of changing ecosystems. Habitat loss and degradation have been identified as significant factors affecting the long-term sustainability and productivity of our nation’s fisheries. The Commission’s Habitat Program develops objectives, sets priorities, and produces tools to guide fisheries habitat conservation efforts directed towards ecosystem-based management.

The challenge for the Commission and its state members is maintaining fish habitat under limited regulatory authority for habitat protection or enhancement. Therefore, the Commission will work cooperatively with state, federal, and stakeholder partnerships to achieve this goal. Much of the work to address habitat is conducted through the Commission's Habitat and Artificial Reef Committees. In order to identify fish habitats of concern for Commission managed species, each year the Habitat Committee reviews existing reference documents for Commission-managed species to identify gaps or updates needed to describe important habitat types and review and revise species habitat factsheets. The Habitat Committee also publishes an annual issue of the *Habitat Hotline Atlantic*, highlighting topical issues that affect all the states.

The Commission and its Habitat Program endorses the National Fish Habitat Partnership, and will continue to work cooperatively with the partnership to improve aquatic habitat along the Atlantic coast. Since 2008, the Commission has invested considerable resources, as both a partner and administrative home, to the Atlantic Coastal Fish Habitat Partnership (ACFHP), a coastwide collaborative effort to accelerate the conservation and restoration of habitat for native Atlantic coastal, estuarine-dependent, and diadromous fishes. As part of this goal, the Commission will continue to provide support for ACFHP, under the direction of the National Fish Habitat Partnership Board.

Annual action planning will be guided by the following objectives:

- Identify fish habitats of concerns through fisheries management programs and partnerships
- Educate Commissioners, stakeholders, and the general public about the importance of habitat to healthy fisheries and ecosystems
- Better integrate habitat information and data into fishery management plans and stock assessments
- Engage local state, and regional governments in mutually beneficial habitat protection and enhancement programs
- Foster partnerships with management agencies, researchers, and habitat stakeholders to leverage scientific, regulatory, political, and financial support
- Work with ACFHP to foster partnerships with like-minded organizations at local levels to further common habitat goals

Goal 5 – Promote compliance with fishery management plans to ensure sustainable use of Atlantic coast fisheries

Fisheries managers, law enforcement personnel, and stakeholders have a shared responsibility to promote compliance with fisheries management measures. Activities under the goal seek to increase and improve compliance with fishery management plans. This requires the successful coordination of both management and enforcement activities among state and federal agencies. Commission members recognize that adequate and consistent enforcement of fisheries rules is required to keep pace with increasingly complex management activity and emerging technologies. Achieving the goal will improve the effectiveness of the Commission's fishery management plans.

Annual action planning will be guided by the following objectives:

- Develop practical compliance requirements that foster stakeholder buy-in
- Evaluate the enforceability of management measures and the effectiveness of law enforcement programs
- Promote coordination and expand existing partnerships with state and federal natural resource law enforcement agencies
- Enhance stakeholder awareness of management measures through education and outreach
- Use emerging communication platforms to deliver real time information regarding regulations and the outcomes of law enforcement investigations

Goal 6 – Strengthen stakeholder and public support for the Commission

Stakeholder and public acceptance of Commission decisions are critical to our ultimate success. For the Commission to be effective, these groups must have a clear understanding of our mission, vision, and decision-making processes. The goal seeks to do so through expanded outreach and education efforts about Commission programs, decision-making processes, and its management successes and challenges. It aims to engage stakeholders in the process of fisheries management, and promote the activities and accomplishments of the Commission. Achieving the goal will increase stakeholder participation, understanding, and acceptance of Commission activities.

Annual action planning will be guided by the following objectives:

- Increase public understanding and support of activities through expanded outreach at the local, state, and federal levels
- Clearly define Commission processes to facilitate stakeholder participation, as well as transparency and accountability
- Strengthen national, regional, and local media relations to increase coverage of Commission actions
- Use new technologies and communication platforms to more fully engage the broader public in the Commission's activities and actions

Goal 7 – Advance Commission and member states' priorities through a proactive legislative policy agenda

Although states are positioned to achieve many of the national goals for marine fisheries through cooperative efforts, state fisheries interests are often underrepresented at the national level. This is due, in part, to the fact that policy formulation is often disconnected from the processes that provide the support, organization, and resources necessary to implement the policies. The capabilities and input of the states are an important aspect of developing national fisheries policy, and the goal seeks to increase the states' role in national policy formulation. Additionally, the goal emphasizes the importance of achieving management goals consistent with productive commercial and recreational fisheries and healthy ecosystems.

The Commission recognizes the need to work with Congress in all phases of policy formulation. Several important fishery-related laws will be reauthorized over the next couple of years (i.e., Atlantic Coastal Act, Magnuson-Stevens Fishery Conservation and Management Act, Interjurisdictional Fisheries Act, Atlantic Striped Bass Conservation Act, and Anadromous Fish Conservation Act). The Commission will be vigilant in advancing the states' interests to Congress as these laws are reauthorized and other fishery-related pieces of legislation are considered.

Annual action planning will be guided by the following objectives:

- Increase the Commission's profile and support in the U.S. Congress by developing relationships between Members and their staff and Commissioners, the Executive Director, and Commission staff
- Maintain or increase long term funding for Commission programs through the federal appropriations process and other available sources.
- Engage Congress on fishery-related legislation affecting the Atlantic coast
- Promote member states' collective interests at the regional and national levels
- Promote economic benefits of the Commission's actions (return on investment)

Goal 8 – Ensure the fiscal stability & efficient administration of the Commission

Goal 8 will ensure that the business affairs of the Commission are managed effectively and efficiently, including workload balancing through the development of annual action plans to support the Commission's management process. It also highlights the need for the Commission to efficiently manage its resources. The goal promotes the efficient use of legal advice to proactively review policies and react to litigation as necessary. It also promotes human resource policies that attract talented and committed individuals to conduct the work of the Commission. The goal highlights the need for the Commission as an organization to continually expand its skill set through training and educational opportunities. It calls for Commissioners and Commission staff to maintain and increase the institutional knowledge of the Commission through periods of transition. Achieving this goal will build core strengths, enabling the Commission to respond to increasingly difficult and complex fisheries management issues.

Annual action planning will be guided by the following objectives:

- Conservatively manage the Commission's operations and budgets to ensure fiscal stability
- Utilize new information technology to improve meeting and workload efficiencies, and enhance communications

- Refine strategies to recruit professional staff, and enhance growth and learning opportunities for Commission and state personnel
- Fully engage new Commissioners in the Commission process and document institutional knowledge.
- Utilize legal advice on new management strategies and policies, and respond to litigation as necessary.

NOTES: The following two issues were raised at the Strategic Planning Workshop in May though staff was unclear as to whether there was agreement among Commissioners to include these issues in the Strategic Plan.

1. An assessment of overall fishery compliance – It was suggested that the Law Enforcement Committee conduct an assessment of compliance to FMP measures across all species. It was suggested some constituents have the view that measures are not consistently enforced across state and jurisdictional lines. Further, those states/jurisdictions that are doing a good job of enforcement are actually penalizing their constituents. Staff agreed that it was an important issue and would follow up with the Law Enforcement Committee on the task. However, it would make sense from a workload standpoint to identify a handful of species to focus on rather than assessing enforcement of 27 species FMP measures. **Should this issue be included in the Strategic Plan or added to the 2019 or 2020 Action Plan?**

~~1.~~**2.** Remove barriers that preclude the free flow of seafood commerce between the states – It was suggested that the ASMFC needs to address outdated laws that impede the free flow of seafood commerce between the states and jurisdictions. **Should this issue be included in the Strategic Plan and, if so, under which Goal and what would be the best committee to address the issue (i.e., MSC, LEC, newly created Work Group)?**

DRAFT DOCUMENT FOR PUBLIC COMMENT

Atlantic States Marine Fisheries Commission

Draft Amendment to the Interstate Fishery Management Plan for Summer Flounder, Scup, and Black Sea Bass for Public Comment

Summer Flounder Commercial Issues and FMP Goals and Objectives

August 2018

Vision: Sustainably Managing Atlantic Coastal Fisheries

DRAFT DOCUMENT FOR PUBLIC COMMENT

Draft Amendment to the Interstate Fishery Management Plan for Summer Flounder, Scup, and Black Sea Bass

Prepared by

Atlantic States Marine Fisheries Commission and
Mid-Atlantic Fishery Management Council's Fishery Management Action Team

Fishery Management Action Team Members:
Mark Terceiro, Northeast Fisheries Science Center
Gregory Ardini, National Marine Fisheries Service
Emily Gilbert, National Marine Fisheries Service
Marianne Ferguson, National Marine Fisheries Service
Kiley Dancy, Mid-Atlantic Fishery Management Council
Kirby Rootes-Murdy, Atlantic States Marine Fisheries Commission

This is a report of the Atlantic States Marine Fisheries Commission pursuant to U.S. Department of Commerce, National Oceanic and Atmospheric Administration Award No. NA15NMF4740069.

The Atlantic States Marine Fisheries Commission (Commission) and Mid-Atlantic Fishery Management Council (Council) seek your input on the following Draft Amendment to the Summer Flounder Fishery Management Plan.

The public is encouraged to submit comments regarding this document during the public comment period. Comments must be received by **11:59 PM (EST) on October 12, 2018.** Regardless of when they were sent, comments received after that time will not be included in the official record**.** The Commission and Council will consider public comment on this document before finalizing the Amendment.

You may submit public comment by attending a public hearing held in your state or jurisdiction or mailing, faxing, or emailing written comments to the address below. Comments can also be referred to your state's members on the Summer Flounder Management Board or Summer Flounder Advisory Panel; however, only comments received at a public hearing or written comments submitted to the Council will become part of the public comment record.

Written comments may be sent by any of the following methods:

1. **Online** at www.mafmc.org/comments/summer-flounder-amendment
2. **Email** to the following addresses: nmfs.gar.FlukeAmendment@noaa.gov
3. **Mail or Fax** to:

   Chris Moore, Ph.D, Executive Director
   Mid-Atlantic Fishery Management Council
   North State Street, Suite 201
   Dover, DE 19901
   FAX: 302.674.5399

If your organization is planning to release an action alert in response to this Draft Amendment, or if you have questions, please contact either Kirby Rootes-Murdy (email: krootes-murdy@asmfc.org; phone: (703.842.0740) or Kiley Dancy (email: kdancy@mafmc.org; phone at (302.526.5257)

The timeline for completion of the Summer Flounder Commercial Issues and Goals and Objectives is a follows:

	Aug 2014	Sept–Oct 2014	Dec 2014	Jan 2015 – April 2018	Apr 2018	Aug – Oct 2018	Dec 2018
Approval of Draft PID by Board and Council	**X**						
Public review and comment on PID		**X**					
Board and Council review of public comment; Board direction on what to include in the Draft Amendment			**X**				
Preparation of Draft Amendment				**X**			
Review and approval of Draft Amendment by Board and Council for public comment					**X**		
Public review and comment on Draft Amendment ***Current Step***						**X**	
Board review of public comment on Draft Amendment							**X**
Review and approval of the final Amendment by the Council, Board, Policy Board, and Commission							**X**

TABLE OF CONTENTS

1.0 INTRODUCTION

The summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*) and black sea bass (*Centropristis striata*) fisheries are managed under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (FMP) that was prepared cooperatively by the Mid-Atlantic Fishery Management Council (Council) and the Atlantic States Marine Fisheries Commission (Commission).

This amendment is applicable only to the summer flounder fisheries, and could: 1) implement requalifying criteria for federal commercial moratorium permits, 2) modify the allocation of commercial summer flounder quota, and 3) add framework provisions to the FMP that would allow for commercial landings flexibility policies for summer flounder to be developed through later framework actions. Additionally, this amendment proposes revisions to the existing FMP management objectives for summer flounder.

1.1 BACKGROUND INFORMATION

In the years leading up to the initiation of this action in December 2013, a number of issues and concerns relative to summer flounder management were raised by Council and Commission members, advisors, and other interested stakeholders. The Council received significant input on summer flounder management during the Council's Visioning and Strategic Planning process, conducted from 2011-2013. During this process, input gathered from surveys, port meetings, and other comment opportunities indicated there was significant stakeholder interest in re-examining and updating summer flounder management strategies.

The Council and Commission proposed this action to evaluate the need for management response to changing conditions in the summer flounder fishery. This includes addressing apparent shifts in the distribution and center of biomass for the summer flounder stock (possibly related to the effects of rebuilding and/or climate change), as well as changing social and economic drivers for these fisheries. This action was proposed so that the FMP goals, objectives, and management strategies could be assessed in light of these changing fishery conditions, and can be better aligned with stakeholder priorities. In December 2013, the Council moved:

> "…that the Council, pursuant to its strategic plan, develop an amendment to the FMP for summer flounder that will review & update the goals and objectives of the plan and re-examine the fishery management strategies for the commercial & recreational fisheries."

In June 2014, the Council moved to request that NMFS revise the control date for the commercial summer flounder fishery, for potential use in development of federal permit requalification alternatives. In August, NMFS published an advanced notice of proposed rulemaking, establishing August 1, 2014 as the new control date for the commercial summer flounder fishery (79 FR 44737). A notice of intent to prepare an EIS was published in the Federal Register on September 16, 2014 (79 FR 55432). NEPA requires that the Council conduct one or more scoping meetings to inform interested parties of the proposed action and alternatives, and to solicit comments on the range and type of analysis to be included in the EIS. A scoping process was conducted from September 16, 2014 through October 31, 2014. Fourteen public scoping hearings were held from Massachusetts through North Carolina.[1] Hearings were attended by approximately 200 people in total. In addition, a total of 100 written comments were received via email (49), web form (31), mail (17), or fax (3).

Based on the scoping comments received, in December 2014 the Council and Board identified general categories of issues to be explored through the amendment process as possible alternative sets, including 1) FMP goals and objectives, 2) the allocation between the commercial and recreational fisheries, 3) recreational management measures and strategies, and 4) commercial measures and strategies. In addition, under the umbrella of those categories, the Council and Board indicated that they wished to explore summer flounder discards in the commercial and recreational fisheries; ecosystem, habitat, bycatch, and protected species issues, and data collection requirements and protocols.

However, later in the amendment process, the Council and Board began to consider splitting the action to delay development of FMP modifications involving recreational fishery issues. This decision was due to changes in the Marine Recreational Information Program (MRIP) that were expected to substantially change the time series of recreational catch and harvest. Because this data would be relied upon for analysis of recreational issues, the Council and Board eventually determined that it was problematic to pursue major changes to recreational FMP elements until the MRIP revisions were finalized and the new datasets were publicly available. Thus, the Council and Board chose to delay action on any issues that would rely heavily on recreational data, including: 1) quota allocation between the commercial and recreational sectors and 2) recreational management measures and strategies.

In May 2017, the Council and Board considered the full range of remaining issues (FMP goals and objectives and commercial issues) and identified the following priority issues for further development within this action.

Section 2.5 Fishery Management Plan (FMP) goals and objectives for summer flounder

Section 4.2 Commercial management measures and strategies, including:

1. Federal commercial moratorium permit requalification
2. Commercial allocation
3. Landings flexibility

In August 2017, landings flexibility was further identified as a framework provision item, not an immediate management option within this amendment. Draft options for the above issues were developed by staff and FMAT members following the May 2017 meeting, and refined by the Demersal Committee through their meetings in July 2017 and November 2017. The Council and

[1] Scoping documents, including schedule and scoping comment summary, are available at: http://www.mafmc.org/actions/summer-flounder-amendment.

Board approved a range of alternatives for public hearings, based on the Demersal Committee recommendations, at the December 2017 meeting.

1.1.1 Statement of Problem

1.1.1.1 Federal Moratorium Permit Requalification (Issue 1)

Federal permit qualification criteria have not changed since establishment in 1993. Stakeholders believe lenient original qualifications criteria resulted in more permits than the fishery could profitably support in the long term. Recent lower quotas and concerns about inactive vessels re-entering the fishery led to a perceived need to adjust fleet size to more closely reflect current stock and fishery conditions. The purpose of alternatives for Issue 1 is to consider whether a reduction in the number of commercial moratorium permits for summer flounder is appropriate, and if so, how qualifying criteria should be revised.

1.1.1.2 Commercial Quota Allocation (Issue 2)

Current commercial allocation was last modified in 1993 and is perceived by many as outdated given its basis in 1980-1989 landings data. Summer flounder distribution, biomass, and fishing effort have changed since then, and some believe initial allocations may not have been equitable or were based on flawed data; therefore, stakeholders requested evaluation of alternative allocation systems. The purpose of alternatives for Issue 2 is to consider whether modifications to the commercial quota allocation are appropriate, and if so, how the quota should be re-allocated.

1.1.1.3 Landings Flexibility Framework Provisions (Issue 3)

Landings flexibility policies would give commercial vessels greater freedom to land or possess summer flounder in the state(s) of their choice. Although such policies may be more effectively developed by state level agreements, the Council and Board are interested in having the option to pursue these policies via framework action/addenda in the future if necessary. This action **does not** consider implementing landings flexibility policies at this time but **does** consider adding landings flexibility policies as a frameworkable item in the Council's FMP, which would allow a future landings flexibility action to be completed through a framework action instead of a full amendment. The Board already has the ability to implement these policies via an addendum to the Commission's FMP, and thus this alternative set is applicable only to the Council's FMP. The purpose of alternatives for Issue 3 is to consider adding landings flexibility policies to the list of management measures in the Council's FMP that could be modified via framework action.

In addition, **this action proposes revisions to the FMP objectives for summer flounder**, although these revisions are not proposed as an explicit alternative set in this amendment. These proposed revisions are described in section 2.5

1.1.2 Benefits of Implementation

This Amendment is designed to address the three commercial issue areas (federal moratorium permits; commercial quota allocations; and landings flexibility) described above. Additionally, this Amendment proposes revisions to the FMP objectives for summer flounder to better align with current management goals. In combination these issue items aim to provide equitable access of the resource to the commercial fishery and sustainable use.

1.1.2.1 Ecological Benefits

Throughout its range, summer flounder occupy an important role in the coastal marine food chain. As adults, flounder feed on a variety of fish species (including windowpane, winter flounder, Atlantic menhaden, bay anchovy, hake, scup, and Atlantic silverside), small crustaceans, and marine worms. As a prey species, summer flounder are consumed by spiny dogfish, monkfish, winter skate, and bluefish. Thus, maintaining a healthy summer flounder population contributes to a balanced marine ecosystem (see *Section 1.2.5 Feeding, Prey, and Predators* for additional information).

1.1.2.2 Social/Economic Benefits

Summer flounder supports a valuable and culturally significant commercial fishery along the Atlantic coast. Addressing federal permit requalification criteria and establishing new quota allocation that provide fair and equitable access to commercial fishery participants may enhance social and economic benefits by increasing derived value and economic returns. This in turn could improve resilience in fishery-dependent communities along the Atlantic coast.

1.2 DESCRIPTION OF THE RESOURCE

1.2.1 Species Life History

Summer flounder, *Paralichthys dentatus*, is a demersal flatfish that occurs in the western North Atlantic from the southern Gulf of Maine to South Carolina. The geographical range of the summer flounder encompasses the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida. The center of abundance of the stock lies within the Middle Atlantic Bight from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (Packer et al. 1999).

1.2.2 Stock Structure and Distribution

Summer flounder is managed and assessed as a single stock. In the past, there have been several attempts to identify separate stocks of summer flounder that may exist throughout its range. The stock definition provided by Wilk et al. (1980) of a unit stock extending from Cape Hatteras north to New England was used in the most recent benchmark assessment (NEFSC 2013), as well as in previous assessments. A consideration of summer flounder stock structure incorporating tagging data concluded that most evidence supported the existence of stocks north and south of Cape Hatteras, with the stock north of Cape Hatteras possibly composed of two distinct spawning aggregations, off New Jersey and Virginia-North Carolina (Kraus and Musick 2001).

The current assessment stock unit is consistent with the conclusions of Kraus and Musick (2001). The management unit within the FMP is summer flounder in US waters in the western Atlantic Ocean from the US-Canadian border southward to the southern border of North Carolina. The management unit is consistent with the conclusions a summer flounder genetics study that revealed no population subdivision at Cape Hatteras (Jones and Quattro 1999).

1.2.3 Age and Growth

Ageing and Age Structure

Historical studies of summer flounder age and growth include those of Poole (1961), Eldridge (1962), Powell (1974), Smith and Daiber (1977), Henderson (1979), and Shepherd (1980). A summer flounder aging workshop held in 1980 (Smith *et al.* 1981) noted that these early studies provided differing interpretations of the growth zones on summer flounder scales and otoliths. After comparative study by fisheries biologists from along the Atlantic coast, the workshop concluded that both structures followed the generalized temperate waters pattern of rapid growth during early summer through early winter. Scales were identified as the better structure for ageing, being preferred over otoliths due to the possibility of poor otolith calcification and/or resorption. Spawning was noted to occur to from early September in the north through the following March in the south. For uniformity, January 1 was considered the birthday, with fish not considered one year old until passing their first summer, to eliminate the possibility of fall spawn fish being classified as age 1 the following January. The 1980 workshop effectively set the first coast-wide conventions for ageing summer flounder, and importantly concluded that the minimum observed mean length of age 1 fish should be at about 17-18 cm and of age 2 fish at about 28-29 cm (Smith *et al*. 1981).

Growth

The length-weight relationship for summer flounder was described by Lux and Porter (1966), which used individual fish lengths and weights from 2,051 fish collected during 1956-1962 to compute the parameters by calendar quarters. Wigley et al. (2003) updated the length-weight parameters used in audits of the NEFSC trawl survey data, using individual length and weight information from 9,373 fish for 1992-1999. For development of the 2018 benchmark stock assessment for summer flounder, individual length and weight information from 32,507 fish for 1992-2017 were used to estimate length-weight parameters for comparison with earlier studies. This comparison indicated very little difference in the estimated length-weight relationships between Lux and Porter (1966), Wigley *et al.* (2003), and the current examination for the NEFSC trawl survey data. The curves are virtually identical through a total length of 62 cm (the combined surveys mean length of age 7 fish; age 7 and older fish compose the assessment 'plus group'), a threshold below which over 95% of the fishery catch has occurred. These studies have shown that there are both seasonal and sexual differences in the length-weight relationship. This difference between the sexes was also noted by Smith and Daiber (1977), Eldridge (1962), and Wilk et al. (1978).

Parameters of the von Bertalanffy growth equation were explored for summer flounder for the 2018 stock assessment using NEFSC trawl survey data for 1976-2016 for males, females, and sexes combined for the full time series and for seven multi-year bins. Female summer flounder attain a significantly larger asymptotic size than males. The von Bertalanffy asymptotic length parameter, L_{inf}, was estimated for males (n = 19,424) at 63.9 cm, with maximum length of 67 cm (age 6) and maximum age of 15 (length 56-57 cm). Parameters for females (n = 20,689) included L_{inf} = 80.6 cm, with maximum length of 82 cm (age 11) and age of 14 (length 76 cm). For sexes combined (n = 40,942, including small fish of undetermined sex) estimated parameters included L_{inf} = 83.6, with maximum age of 15 (Figure 1).

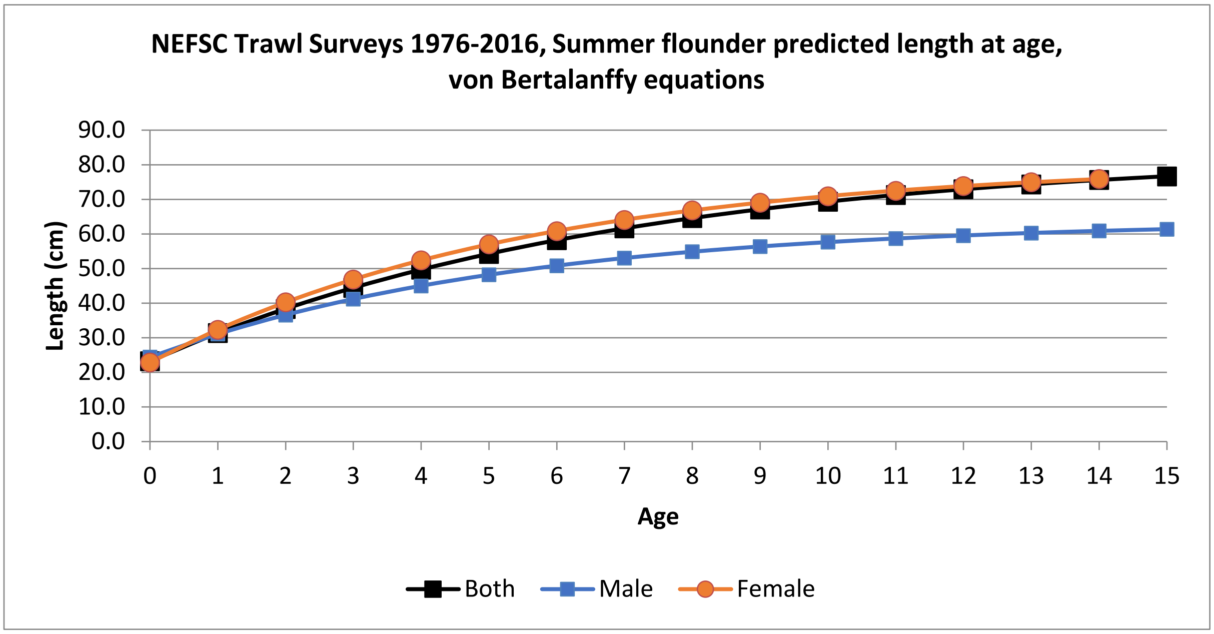


Figure 1: Predicted length at age from von Bertalanffy equations parameters estimated from NEFSC trawl survey data for 1976-2016. Maximum observed age for males is age 15; for females is age 14.

1.2.4 Spawning and Reproduction

Summer flounder spawn during the fall and winter as they migrate offshore or are at their wintering grounds. Smith (1973) found that spawning starts in mid-September between southern New England and New Jersey. As the season progresses spawning moves southward, and by October spawning takes place nearly as far south as Chesapeake Bay. Spawning has been reported to continue into March (Morse 1981). Spawning habitat occurs over the entire shelf between Cape Cod, Massachusetts, and Cape Lookout, North Carolina.

Morse (1981) documented that summer flounder are serial spawners and that egg batches are continuously matured and shed during a protracted spawning season. Morse (1981) also calculated the percent of ovary weight to total fish weight as an index for maturity. The mean maturity index increased rapidly from August to September, peaked in October to November, then gradually decreased to a low in July. The wide range in the maturity indices during the spawning season indicates nonsynchronous maturation of females and a relatively extended spawning season. The length and peak spawning time as indicated by the maturity index agree with results determined by egg and larvae occurrence (Smith 1973; Herman 1963).

Fecundity of summer flounder is relatively high. Morse (1981) calculated fecundity estimates ranging from 463,000 to 4,188,000 eggs for fish between 14 inches and 27 inches. A high egg production to body weight ratio is maintained by serial spawning, that is, batches of eggs are shed rather than all eggs shed at one time (Morse 1981).

Fertilized eggs are buoyant, floating at or near the surface, and are spherical with a transparent rigid shell of about 0.04 inch. Smith (1973) reported that the heaviest concentrations of eggs and larvae were found between Long Island and Cape Hatteras; most eggs were taken within 17 miles of shore and larvae were most abundant 12 to 45 miles from shore. Larvae were found in the northern part of the Middle Atlantic Bight from September to February, and in the southern part from November to May. Mid-Atlantic Region Monitoring and Assessment Program (MARMAP) survey data (Able et al. 1990) indicate that peak egg abundance occurs in October through December with October and November being the two months when most eggs were collected.

The reproductive strategy of summer flounder tends to maximize reproductive potential and avoid catastrophe. The strategy is a combination of extended spawning season with variable duration, early maturation (age 1 or 2), high fecundity, serial spawning, and extensive migrations across the continental shelf during spawning. The half year spawning season reduces larval crowding and decreases the impact of predators and adverse environmental conditions on egg and larval survival. The migration pattern disperses the eggs over large areas of the shelf and probably aids in maintaining spawning fish in areas where bottom temperatures are between 54o and 66o F (Smith 1973). The October/November spawning peak coincides with the breakdown of thermal stratification on the continental shelf and the maximum production of autumn plankton which is characteristic of temperate ocean waters of the northern hemisphere. Thus, the timing of peak spawning assures a high probability of adequate larval food supplies (Morse 1981).

Summer flounder are opportunistic feeders; their prey includes a variety of fish and crustaceans. The NEFSC trawl survey foods habits database contains information from 18,862 summer flounder stomachs sampled on 5,365 tows, over 70% of which were found to be empty. ‘Other fish’ (fish which could not be identified to family) were found in about 10% of the stomachs, followed by squids (6%), decapod shrimp (4%), ‘animal remains’ (3%; partially digested stomach contents), anchovies (2%), and other gadids, porgies, mysids, and other small crustaceans. The data were summarized into 4 multi-year blocks to look for temporal patterns. The frequency of ‘Other fish’ and decapod shrimp consumption by summer flounder decreased by about 50% over the time series, while the frequency of consumption of squid slightly increased. The frequency of consumption of anchovies peaked in the 1980s. The calculation of total absolute consumption of prey by summer flounder has not been attempted (NEFSC 2013).

1.2.5 Ecological Roles

Previous studies have inferred that larval and postlarval summer flounder initially feed on zooplankton and small crustaceans (Peters and Angelovic 1971, Powell 1974, Morse 1981, Timmons 1995). Food habits studies on late larval and juvenile estuarine summer flounder reveal that while they are opportunistic feeders and differences in diet are often related to the availability of prey, there also appears to be ontogenetic changes in diet. Smaller flounder (usually less than 4 inches; 100 mm) seem to focus on crustaceans and polychaetes while fish become a little more important in the diets of the larger juveniles (MAFMC 2002).

Adult flounder are most active during daylight hours and may be found well up in the water column as well as on the bottom (Olla et al. 1972). Included in their diet are: windowpane, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, American sand lance, bluefish, weakfish, mummichog, rock crabs, squids, shrimps, small bivalve and gastropod molluscs, small crustaceans, marine worms and sand dollars (NEFSC2013; Packer et al. 1999, MAFMC2002).

The NEFSC trawl survey foods habits database includes summer flounder as a prey item in 65 predator stomachs over the period 1973-2011. Spiny dogfish was the predator in 35 cases (54%), followed by monkfish (11 cases, 17%), winter skate (7 cases, 11%). and bluefish (4 cases, 6%), with other fish species accounting for the other 9 cases and 12%, including 1 case (2%) of summer flounder cannibalism. All of the natural predators of adult summer flounder are not fully documented, and these data are insufficient to calculate total absolute predator consumption of summer flounder (NEFSC 2013).

1.2.6 Mortality

The 2008 SAW 47 assessment assumed a natural mortality rate (M) of 0.20 for females and 0.30 for males, based mainly on recently observed maximum ages in the NEFSC survey data of 14 years (76 cm, in NEFSC Winter Survey 2005) for females and 12 years (63 cm, in NEFSC Spring Survey 2007) for males, and the expectation that larger and older fish are likely if fishing mortality rates were maintained at low rates in the future. A combined sex M-schedule at age was developed by assuming these initial M rates by sex, an initial proportion of females at age 0 of 40% derived from the NEFSC Fall survey indices by age and sex, and population abundance decline over time at the sex specific M rates. The final abundance weighted combined sex M-schedule at age ranged from 0.26 at age 0 to 0.24 at age 7+, with a mean of 0.25 (NEFSC 2008). This M-schedule was retained in the subsequent 2009-2016 benchmark and updated assessments (NEFSC 2013; Terceiro 2012, 2015, 2016).

Fishing mortality (F) on fully selected age 4 summer flounder ranged between 0.799 and 1.775 during 1982-1996 and then decreased from 0.871 in 1997 to 0.288 in 2007. Since 2007 the fishing mortality rate has increased and was 0.390 in 2015, 26% above the 2013 SAW 57 FMSY proxy = F35% = 0.309 (see Figure 3). The 90% confidence interval for F in 2015 was 0.292 to 0.490 (Terceiro 2016).

Fishing mortality (F) on fully selected age 4 summer flounder ranged between 0.799 and 1.775 during 1982-1996 and then decreased from 0.871 in 1997 to 0.288 in 2007. Since 2007 the fishing mortality rate has increased and was 0.390 in 2015, 26% above the 2013 SAW 57 FMSY proxy =

F35% = 0.309 (see Figure 3). The 90% confidence interval for F in 2015 was 0.292 to 0.490 (Terceiro 2016).

1.2.7 Distribution and Center of Biomass

As described in section 1.2.2, the geographical range of the summer flounder encompasses the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida, with the center of abundance lying within the Middle Atlantic Bight from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. The management unit is summer flounder in US waters in the western Atlantic Ocean from the US-Canadian border southward to the southern border of North Carolina.

In recent years, emerging evidence has indicated that summer flounder have experienced changes in distribution and/or center of biomass relative to recent decades, with the changes generally described as a northward/eastward shift in biomass. Describing distribution shifts is complicated, as multiple studies have used different methods to evaluate summer flounder distribution changes and each have characterized these changes somewhat differently, as described below. In addition, it can be difficult to determine the driving factors behind distribution changes, given the challenge in distinguishing between the effects of climate change related drivers, stock rebuilding, and/or other factors such as regional fishing pressure or habitat impacts. Bell et al. (2015) notes that understanding the mechanisms regulating species distribution should be considered as part of any potential change to the quota allocation system. An overview of information on summer flounder distribution changes and potential explanatory factors is provided below.

Nye et al. (2009) evaluated summer flounder distributional changes and concluded that there has been a significant change in the maximum latitude for summer flounder. This study analyzed trends from 1968 to 2007 in mean center of biomass, mean depth, mean temperature of occurrence, maximum latitude, minimum latitude, and area occupied for 36 fish stocks in the Greater Atlantic region. Overall, 24 of the 36 stocks showed statistically significant changes in at least one of these metrics, many of them exhibiting a poleward shift in the center of biomass. For summer flounder, no significant changes were found in the center of biomass or area occupied, but there was an observed significant change in maximum latitude (0.029 degrees latitude per year). Nye et al. conclude that this provides "preliminary evidence that the range of summer flounder, also termed a 'sedentary' species, has expanded over time, that its abundance increased, and that the center of biomass was displaced poleward within the survey area."

Nye et al. (2009) did not, however, investigate the effects of size structure or fishing mortality on distributional response; thus, the extent that these results are confounded with or explained by fishing mortality decreases from the late 1980s to the early 2010s is not addressed. The authors did find a close relationship between species abundance and area occupied, hypothesizing that changes in abundance may manifest more in the total area occupied by each species, while changes in the center of biomass may be more in response to changes in environmental conditions.

Bell et al. (2015) examined the distributions of summer flounder using NEFSC trawl data to determine if the center of biomass along-the continental shelf had changed over time and if these changes were attributed to temperature changes or fishing pressure (via changes in overall abundance and/or fishing related changes in length structure of the stock). The authors note that shifts in distribution can be driven by habitat and environmental factors, when fish attempting to remain within the best possible habitat conditions by migrating to more optimal environments and/or declining in numbers in less idea environments. Range shifts can also be caused by simple changes in overall abundance, in that when there are less individuals of a particular species, those fish tend to occupy the highest value habitat. Population increases can lead to expansion into inferior habitat to avoid increased competition in ideal habitats. Finally, fishing mortality can affect distribution through changes in length-age structure of a population, by removing larger individuals which may tend to be located at higher latitudes.

Bell et al. (2015) used NEFSC bottom trawl survey data to examine changes in along-shelf biomass from 1972-2008, finding that summer flounder showed a significant northward trend in the fall, but no change in distribution in the spring. Interannual changes in the along-shelf center of biomass for summer flounder for both the spring and the fall showed a significant relationship with the interannual changes in mean length, but not with temperature or overall abundance. The authors provide evidence that larger summer flounder tend to occupy habitat further north, meaning that as the age structure of the population has expanded, the proportion of larger fish in the population has increased and the center of stock biomass in weight has thus shifted north.

The trends noted are particularly pronounced since the early 1990s, shortly after the population reached historic lows and had a severely truncated age structure. While evidence for other species (e.g., black sea bass and scup) suggests that temperature is a significant driver of distribution shifts, this study did not support this conclusion for summer flounder. This study also found no significant change in along-shelf distance occupied, suggesting that a range expansion does not appear to provide a strong explanation for distribution changes. Bell et al. suggest that a change in the length-age structure, driven by population recovery caused by reduced fishing mortality rates over time (see Figure 2, section 1.26) is the main driver of interannual shifts in summer flounder distribution.

The 2013 summer flounder benchmark assessment (SAW/SARC 57) describes similar conclusions. The assessment report notes that a progressive northward shift in distribution is evident with increases in length. Both spring and fall NEFSC trawl surveys show an increase in the average along-shelf position of summer flounder with increasing size. The average annual along-shelf center of biomass increased from the late 1960s to mid-1980s, then declined to the mid-1990s before reaching high levels again around 2007. Length-predicted along-shelf center of biomass declined from the 1960s to early 1990s, then increased until around 2008 and subsequently declined slightly. Larval distribution changed little throughout the time series, while mature adult distributions substantially shifted northward.

The OceanAdapt web portal, a collaboration between NMFS and the Pinsky Lab of Rutgers University, also provides information about the impacts of changing climate and other factors on species distribution. This website hosts an annually updated database of scientific surveys in the United States and provides tools for exploring changes in marine fish and invertebrate distributions. For the indicators displayed on this website, a mean location (the centroid) is calculated for each species in each year of each survey, after the surveys have been standardized to a consistent spatial footprint through time. The centroid is the mean latitude and mean depth of catch in the survey, weighted by biomass. Figure 2 shows the centroid latitude for summer flounder over time based on NEFSC trawl survey data, indicating that the center of survey biomass for summer flounder has shifted northward over time (see Pinsky et al. 2013 and http://oceanadapt.rutgers.edu/).

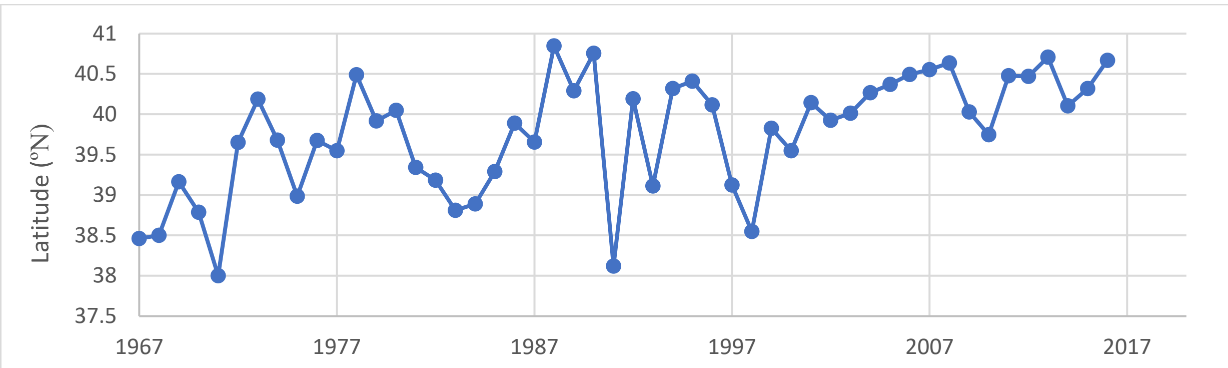


Figure 2. Mean biomass-weighted centroid latitude for summer flounder, 1967-2016, based on NEFSC trawl survey data. Data source: OceanAdapt portal, http://oceanadapt.rutgers.edu/.

An animation of summer flounder distribution changes over time from the NEFSC spring trawl survey from 1968 to 2014 can be viewed at: https://www.nefsc.noaa.gov/ecosys/climate-change/summer-flounder.html.

While observations of summer flounder north of Cape Cod have historically been rare, this may be changing as the stock distribution changes over time. In June 2012, scientists reported the first observations of young of the year (YOY) summer flounder in a southern Maine estuary, capturing two YOY individuals at the mouth of the Saco River estuary. Because YOY specimens have not previously been recorded at the northern extent of the summer flounder range, a northward range expansion is a possible explanation for this observation (Rudnicky et al. 2016).

Both changes in environmental conditions and changes in fishing mortality, along with other factors, are likely to be important mechanisms affecting the distribution of summer flounder. The exact mechanism causing a distributional shift in any given species is not always clear and is likely to differ by species. Furthermore, as noted above, multiple mechanisms may be contributing to changes in distribution, confounding efforts to attribute changes in abundance and distribution to only one cause.

1.2.8 Stock Assessment Summary

Summer flounder was under a rebuilding plan from 1993 through 2011. An F-reduction schedule was first put in place in 1993 through Amendment 2, and this schedule was modified via Amendment 7. After the MSA was reauthorized in 1996 with time certain rebuilding requirements and required rebuilding plans, Amendment 12 (1999) started the ten-year rebuilding clock for summer flounder for 2000-2010. Following the 2007 reauthorization of the MSA, which required the implementation of ACLs and AMs, the rebuilding deadline was extended to 2013. However, the summer flounder stock was declared rebuilt in the fall of 2011, based on the most recently modeled year, 2010.

The last peer-reviewed benchmark stock assessment was conducted in the summer of 2013 at the Stock Assessment Workshop/Stock Assessment Review Committee (SAW/SARC 57; NEFSC 2013), which identified revised biological reference points for the summer flounder stock. Overfishing for summer flounder is defined to occur when the fishing mortality rate (F) exceeds the threshold fishing mortality rate of F_{MSY}. Since F_{MSY} cannot be reliably estimated, F_{MAX} is used as a proxy for F_{MSY}. SARC 57 identified the maximum fishing mortality threshold (MFMT) as $F_{MSY\ PROXY} = F_{35\%} = 0.309$ (CV=15%) and associated estimates from long-term stochastic projections of MSY = 12,945 mt (28.539 million lbs; CV = 13%) and SSB_{MSY} = 62,394 mt (137.555 million lbs; CV = 13%). The biomass is specified to equal spawning stock biomass at maximum sustainable yield (SSB_{MSY}). Since SSB_{MSY} cannot be reliably estimated, the maximum biomass based on yield per recruit (YPR) analysis and average recruitment is used a proxy. The summer flounder stock is overfished when the biomass falls below the minimum biomass threshold, identified in SARC 57 as ½ SSB_{MSY} = 31,197 mt (68.8 million lbs; CV = 13%; NEFSC 2013).

1.2.9 Current Stock Status

The most recent update to the SARC 57 model was completed in June 2016, using data through 2015 (Terceiro 2016). Results from the 2016 assessment update indicate that the summer flounder stock was not overfished, but overfishing was occurring in 2015 relative to the SSB and F biological reference points from the 2013 benchmark assessment. Fishing mortality on fully selected age 4 fish was estimated to be 0.390 in 2015, 26% above the 2013 SAW 57 F_{MSY} proxy = $F_{35\%}$ = 0.309 (Figure 3). Spawning stock biomass (SSB) was estimated to be 79.90 million lb (36,240 mt) in 2015, about 58% of SSB_{MSY} = 137.6 million lb (62,394 mt), and 16% above the overfished threshold of ½ SSB_{MSY} proxy = ½ $SSB_{35\%}$ = 68.78 million lb (31,197 mt; Figure 4).

The 2016 update shows that recruitment of age 0 fish was below the time series average (41 million fish at age 0; 1982-2015) each year from 2010 through 2015. Recruitment has also been overestimated in several of the most recent years. For example, in the 2015 update, 2014 recruitment appeared average, but has since been adjusted downward with the most recent update. Recruitment in 2015 is also estimated to be below average at 23 million fish.

The 2016 assessment update indicates that while catch in recent years has not been substantially over the ABCs, the projected fishing mortality rates have been exceeded and projected spawning stock biomass has not been achieved. For the past several years the assessment has shown retrospective patterns in fishing mortality rates, spawning stock biomass, and recruitment. In this case, the assessment in recent years has been underestimating fishing mortality rates, overestimating spawning stock biomass, and overestimating recruitment. In other words, when the assessment is updated, it reveals that past projections of fishing mortality rates have been exceeded, while projections of spawning stock biomass and recruitment have not been reached. This result is likely in part due to below-average recruitment to the stock for year classes from 2010-2015, and could also be due to mortality that is not being properly accounted for the assessment. Nearly all fishery-independent federal and state survey indices (including recruitment indices) have been decreasing from their most recent peaks over the 5-7 years prior to the 2016 update, some substantially.

Reports on stock status, including annual assessment and reference point update reports, Stock Assessment Workshop (SAW) reports, Stock Assessment Review Committee (SARC) reports, are available online at the Northeast Fisheries Science Center (NEFSC) website: http://www.nefsc.noaa.gov/. A detailed description of the history of past summer flounder stock assessments can be found in Terceiro (2001) and Terceiro (2011).

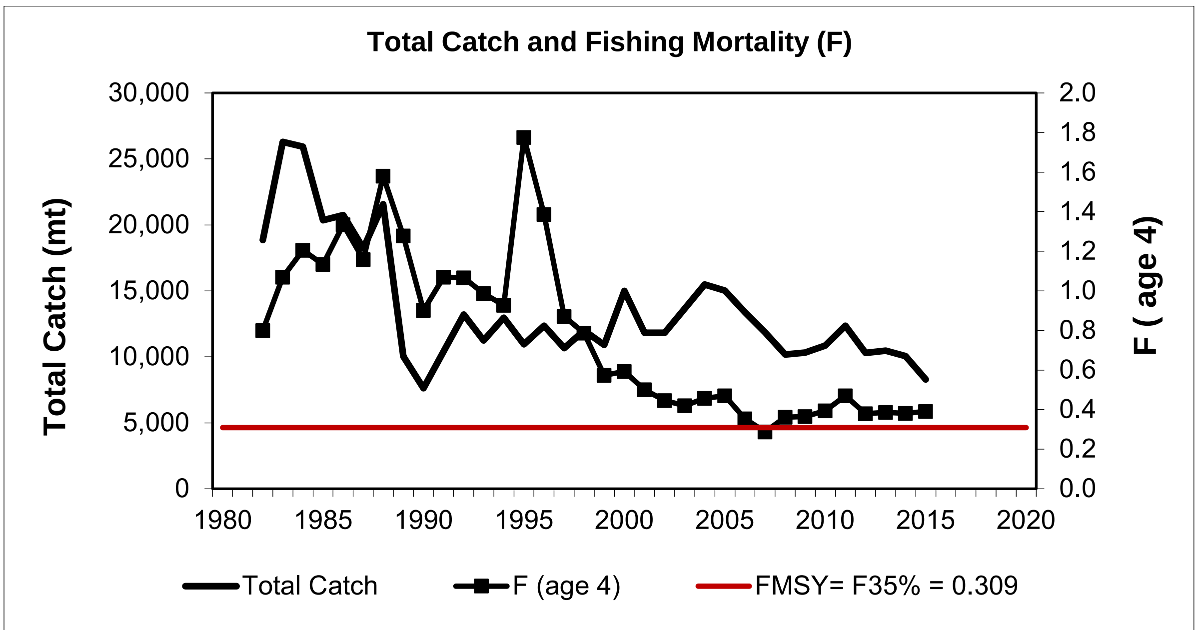


Figure 3: Total fishery catch and fully-recruited fishing mortality (F, peak at age 4) of summer flounder, 1982-2015. The horizontal dashed red line is the 2013 SAW 57 fishing mortality threshold reference point proxy.

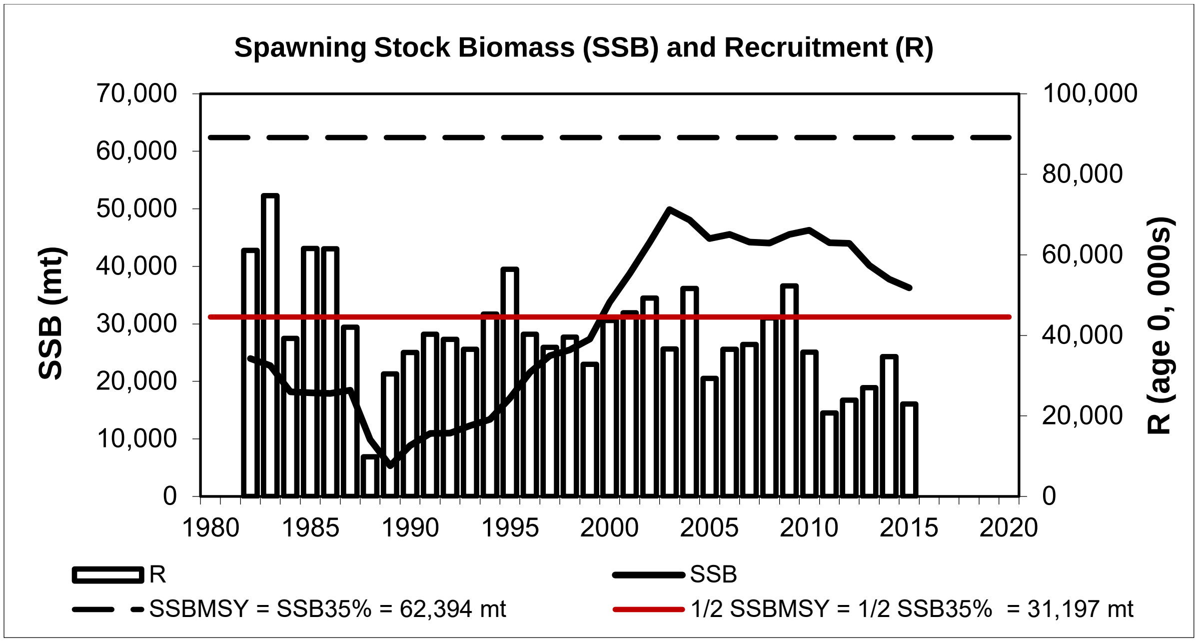


Figure 4: Summer flounder spawning stock biomass (SSB; solid line) and recruitment at age 0 (R; vertical bars) by calendar year, 1982-2015. The horizontal dashed line is the 2013 SAW 57 biomass target reference point proxy, the horizontal red line is the biomass threshold reference point proxy.

1.3 DESCRIPTION OF THE FISHERY

1.3.1 Total Catch Composition

Commercial landings have accounted for 52% of the total catch since 1993, with recreational landings accounting for 36%, commercial dead discards about 10%, and recreational dead discards about 8%. Over the more recent time period of 2012-2016, the comparable percentages are 53% commercial landings, 31% recreational landings, 8% commercial dead discards, and 8% recreational dead discards (Figure 5).

Commercial discard losses in the fish trawl and scallop dredge fisheries have accounted for about 13% of the total *commercial* catch 2012-2016, assuming a discard mortality rate of 80%. Recreational discard losses have accounted for 20% of the total *recreational* catch over 2012-2016, assuming a discard mortality rate of 10%.

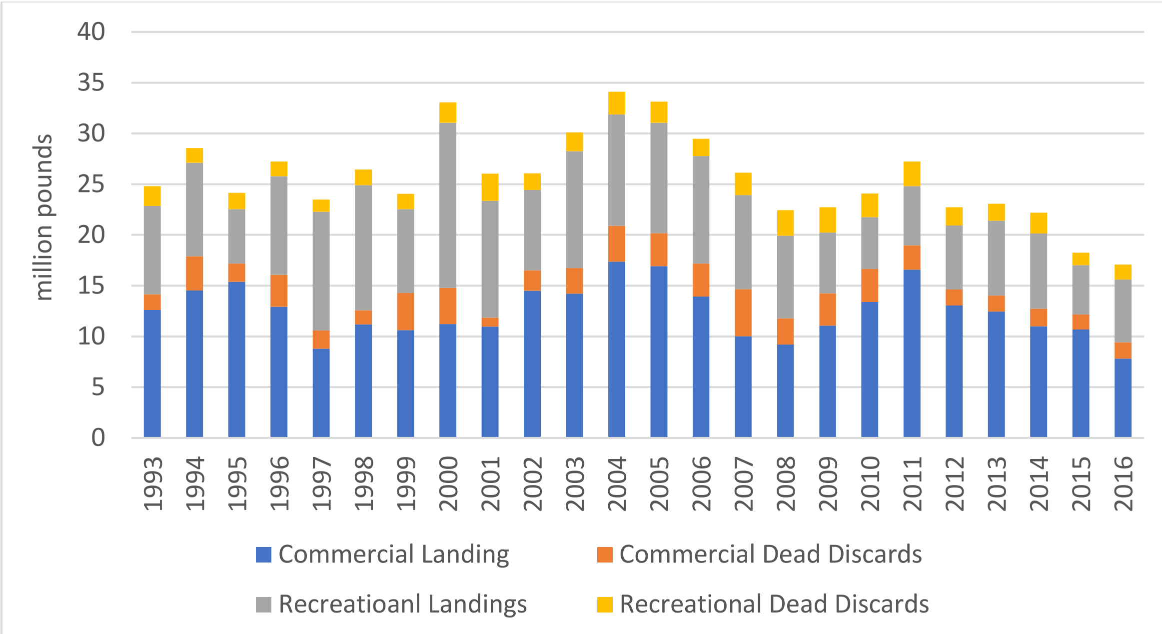


Figure 5: Components of the summer flounder fishery catch from 1993 (implementation of Amendment 2) through 2016. Source: M. Terceiro, pers. comm., July 2016, and Terceiro 2017a.

1.3.2 Commercial Fishery

Summer flounder support an extensive commercial fishery along the Atlantic Coast, principally from Massachusetts through North Carolina. The following sections describe the commercial fishery for summer flounder in terms of trends in landings and discards, spatial characteristics of the fishery, seasonal characteristics of the fishery, and landings by state.

Landings and Discards

Dealer reporting for commercial summer flounder landings has been mandatory only since 1994, thus, landings for years prior have greater uncertainty and may be underestimated. Large scale, offshore commercial exploitation of summer flounder began around 1920. The fishery expanded during the 1920s and 1930s, and by 1940, commercial landings of summer flounder were estimated to have reached about 4,900 mt (10.8 million lb). Annual harvests averaged around 20 million lbs during the 1950s and early 1960s, then steadily declined during the 1960s, falling to 3,000 mt (6.6 million lb) in 1969 (MAFMC 2002; Terceiro 2001). Commercial landings increased in the mid 1970's until 1989, due to increased levels of effort in the southern winter trawl fishery (MAFMC 1993). Since 1993, the first year that a coastwide quota was implemented, commercial landings have fluctuated between a high of about 17.37 million lbs in 2004, to a low of 7.81 million lbs in 2016 (Figure 6).

Commercial summer flounder dead discards over the period 1993-2016 averaged approximately 2.49 million lbs, or about 18% of total commercial catch. Over the same time period, commercial discards also accounted for about 10% of the total catch (recreational + commercial) in weight. In recent years, commercial discards have been below this average (Table 1). A time series (1993-

2015) of landings and dead discards is shown in Figure 23. The current stock assessment for summer flounder assumes a commercial discard mortality of 80%. This discard mortality rate is applied to the live discard estimate regardless of the discard estimation method used.

Table 1: Summer flounder estimated commercial discards and % of total summer flounder catch in weight, 2012-2016. Source: M. Terceiro, pers. comm., and Terceiro 2017a.

	Commercial dead discards, mil lb (mt)	% of total summer flounder catch in weight
2012	1.58 (718)	7%
2013	1.57 (712)	7%
2014	1.73 (785)	8%
2015	1.48 (670)	8%
2016	1.63 (738)	10%

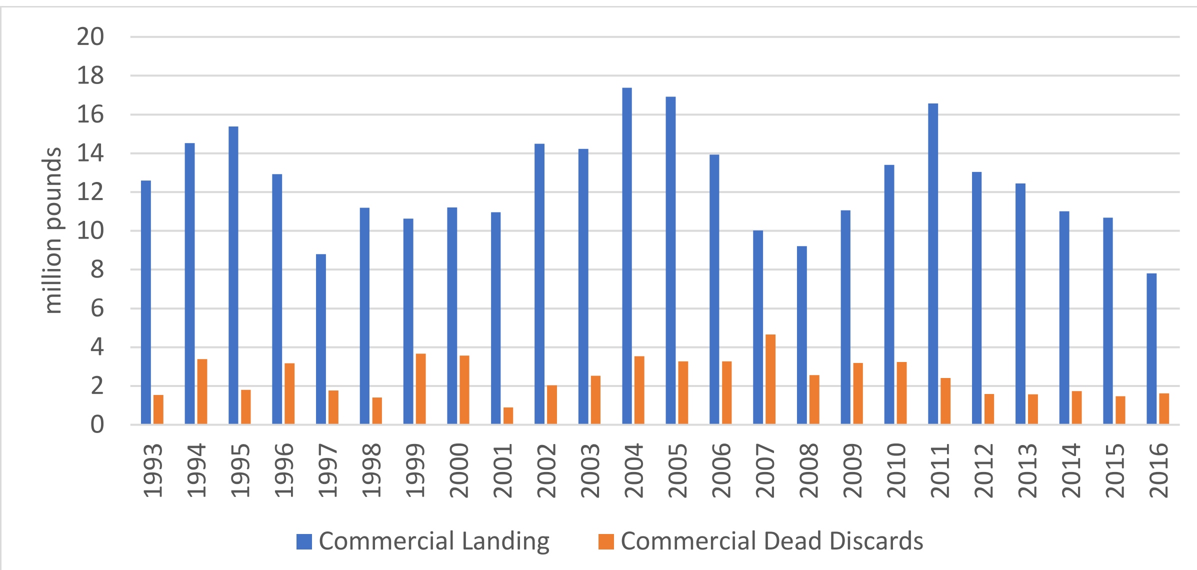


Figure 6: Summer flounder commercial discards and landings, 1993-2016. Source: M. Terceiro, personal communication, July 2016 and Terceiro 2017a.

According to the 2013 benchmark stock assessment, the reasons for discarding summer flounder in the fish trawl and scallop dredge fisheries have been changing over time. For example, during 1989 to 1995, the minimum size regulation was recorded as the reason for discarding summer flounder in over 90% of the observed trawl and scallop dredge tows (NEFSC 2013). During 2012-2016, minimum size regulations were identified as the discard reason in 51% of the observed trawl tows on average, quota or trip limits in 36% of the tows, high grading in 5%, and other reasons 8% (Table 1; M. Terceiro, pers. comm.). The assessment also indicates that as a result of the increasing impact of trip limits, fishery closures, and high grading as reasons for discarding, the age structure of the summer flounder discards has also changed, with a higher proportion of older fish being discarded (NEFSC 2013).

Table 2: Percentage of observed summer flounder discards by recorded discard reason, trawl and scallop gear, 2012-2016.

	% of trawl discards	% of scallop dredge discards
Unknown	0.0%	0.1%
No market	1.6%	66.0%
Market, too small	1.8%	1.6%
Market, too large	0.1%	0.0%
Market, will spoil	1.9%	0.5%
Special sample	0.1%	0.0%
Regs., unknown	1.1%	0.4%
Regs., too small	50.6%	5.5%
Quota filled	36.1%	25.6%
Poor quality	1.6%	0.3%
High Graded	5.3%	0.2%

Spatial Characteristics of the Commercial Fishery

Figure 7 highlights the NMFS statistical areas accounting for more than 1 percent of the summer flounder commercial catch over 2015-2016, based on federal VTR data. Statistical area 616 is typically responsible for the highest percentage of the catch and landings. Statistical area 539 accounted for the highest number of trips that caught summer flounder (at least 5,861 trips by federally permitted vessels over these two years).

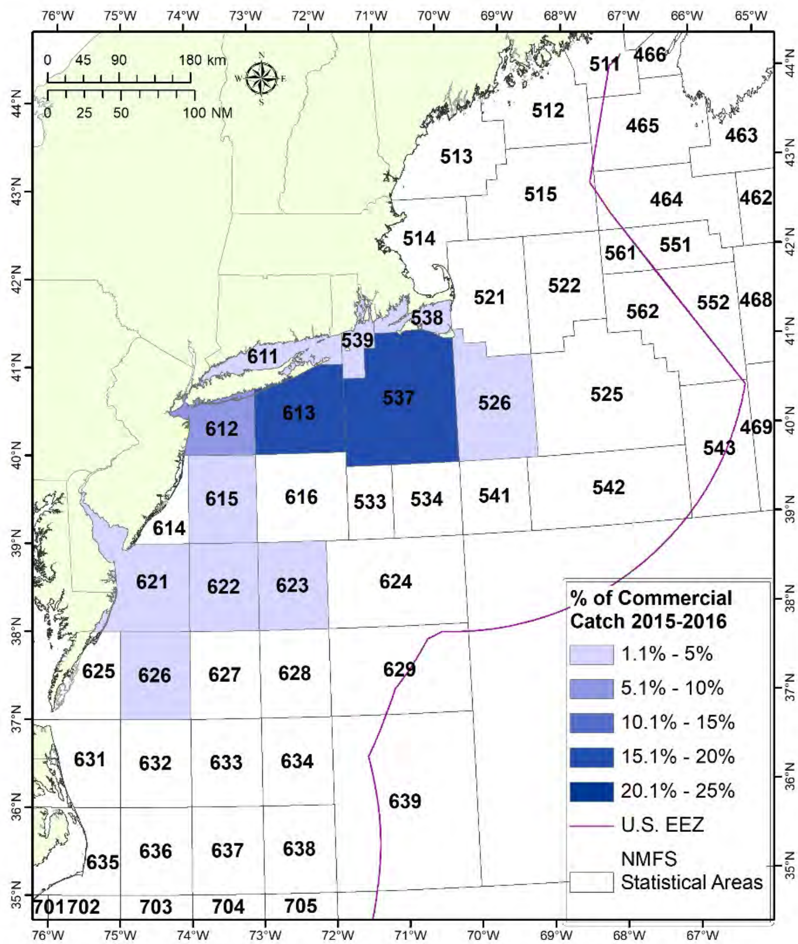


Figure 7: NMFS Statistical Areas, highlighting those that each accounted for more than 1% of VTR-reported commercial summer flounder catch, 2015-2016.

Reported fishing locations by statistical area can provide only a general location of catch. To look at landings and fishery revenues at a finer spatial scale, the NEFSC Social Sciences Branch developed a VTR-based revenue mapping model that incorporates NEFOP observer data with known fishing locations. DePiper (2014) describes this model and its application, and a summary is provided below.

Federally-permitted vessels are required to submit a VTR for each trip, the requirements of which include indicating a general fishing location as a set of geographic coordinates. These self-reported coordinates do not precisely indicate the location of fishing effort, given that only one point is provided regardless of trip length or distance covered during the trip. In the absence of spatially explicit fishery effort data for many fisheries, the VTR mapping model allows for more robust analysis using VTR data by taking into account some of the uncertainties around each reported point. Using observer data, for which precise locations are available, the model was developed to derive probability distributions for actual fishing locations, around a provided VTR point. Other variables likely to impact the precision of a given VTR point, such as trip length, vessel size, and fishery, were also incorporated into the model. This model allows for generation of maps that predict the spatial footprint of fishing. Price information from dealer reports was used to transform VTR catches into revenues. Trip information was used to incorporate information about revenue generated from each trip, resulting in a model that can produce maps of revenue generated for a given set of specified parameters such as gear type, species, or port of landing. The revenue-mapping model can be used to identify areas important to specific fishing communities, species, gears, and seasons to establish a baseline of commercial fishing effort. The probability distributions generated from each reported VTR point create a likelihood of actual fishing locations in all directions from a given point, and do not take into account any specific directionality that may be associated with specific fishing methods or specific locations. For example, the model does not take into account fishing behavior along depth contours or other specific habitat features.

Figure 8 shows these revenue maps for commercial summer flounder landings from 2010-2015 (in 2014 dollars). Revenues are closely correlated with the total amount of landings (similar maps for summer flounder landings show a distribution very close to the revenue maps; see: https://www.nefsc.noaa.gov/read/socialsci/fishing-footprints.php). In general, the bulk of commercial landings and revenue for summer flounder are taken either from nearshore areas off of Rhode Island/Connecticut/eastern Long Island and New Jersey/southern Long Island, or from offshore on the continental shelf between the Delmarva Peninsula and offshore areas south of Cape Cod (Figure 9).

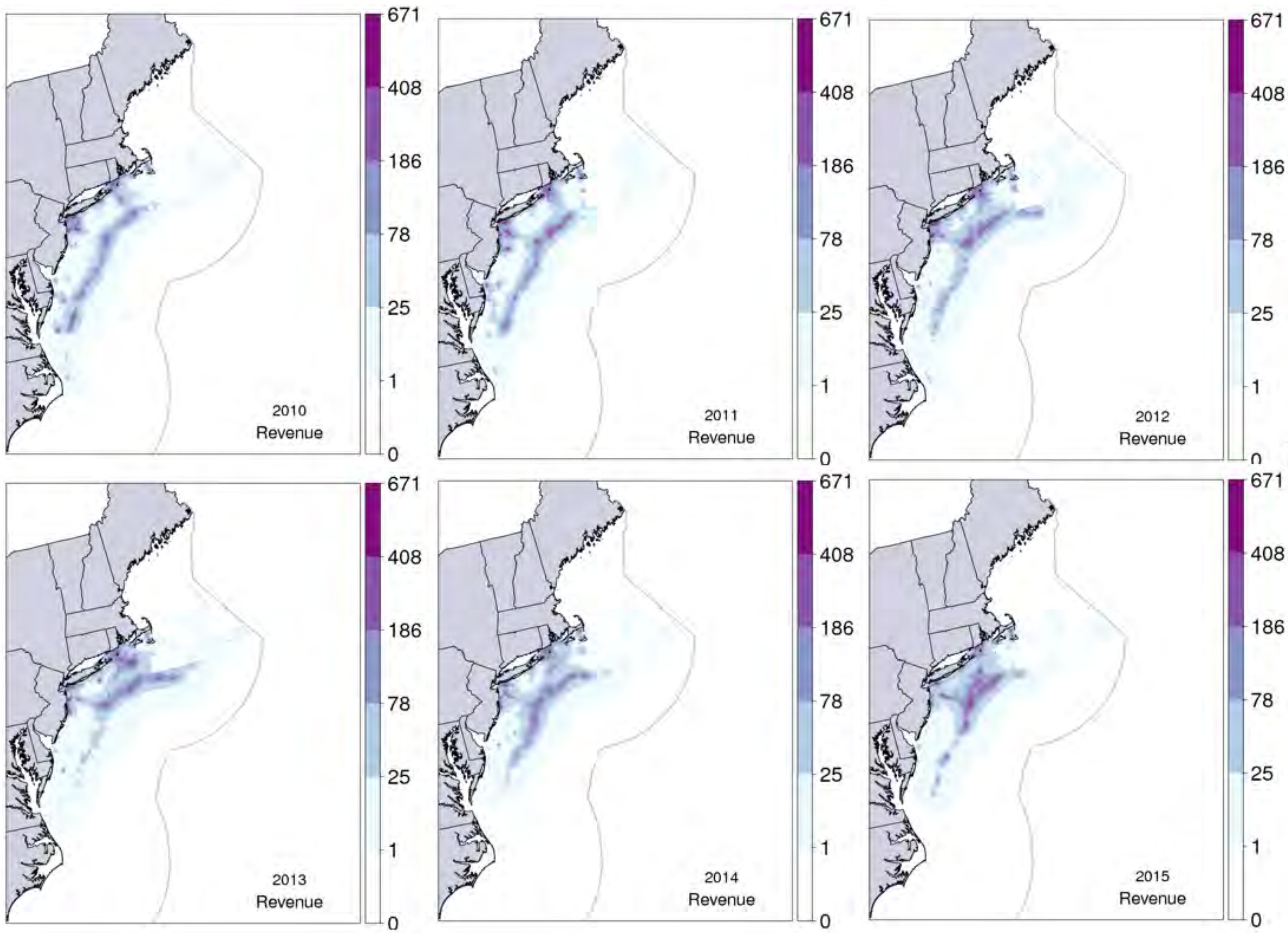


Figure 8: Commercial summer flounder revenue by catch location, 2010-2015, in 2014 real US dollars. Source: NEFSC Social Sciences Branch Fishing Footprints, based on DePiper (2014). Available at: https://www.nefsc.noaa.gov/read/socialsci/fishing-footprints.php.

The 2013 stock assessment examined spatial trends in commercial catch over time, with comparisons to the survey distribution over the same time frames, beginning in 1994 to coincide with the first year of mandatory vessel trip reporting. Figures 9-12 show the results of this exercise from the assessment, with data through 2012.

The 2013 assessment report notes that "the heaviest commercial fishery catches (and by inference, effort) in the 1990s were reported just off of Cape Hatteras, concentrated around the entrances to Hudson Canyon and Narragansett Bay, and offshore along the shelf edge from the Chesapeake Bay entrance through SNE. Large catches of summer flounder continued along the shelf during the early 2000s with concentrations slightly farther north off the Delaware-Maryland-Virginia coast. This northerly trend of offshore commercial catches continued through the present decade with the largest catches now south of Rhode Island. Commercial catches of summer flounder at its southern extent are reduced after 2005. Fishery observer data show a much larger presence of large summer flounder catches on Georges Bank after 2005. The earliest years (1968-1990) of NEFSC fish trawl surveys showed the largest catches of summer flounder in inshore waters from Long Island to Cape Hatteras, with intermittent catches of summer flounder in the Georges Bank-Great South Channel strata or in the Gulf of Maine. The lowest catches occurred during the early 1990s, before increasing slowly in the late 1990s. During the rebuilding period of the 2000s, larger catches of summer flounder began appearing in northern areas, particularly south of Rhode Island and Massachusetts." As described in section 1.2.7, a general pattern increasing latitude in the summer flounder center of biomass from the trawl surveys can be observed since 1994 in the figures below.

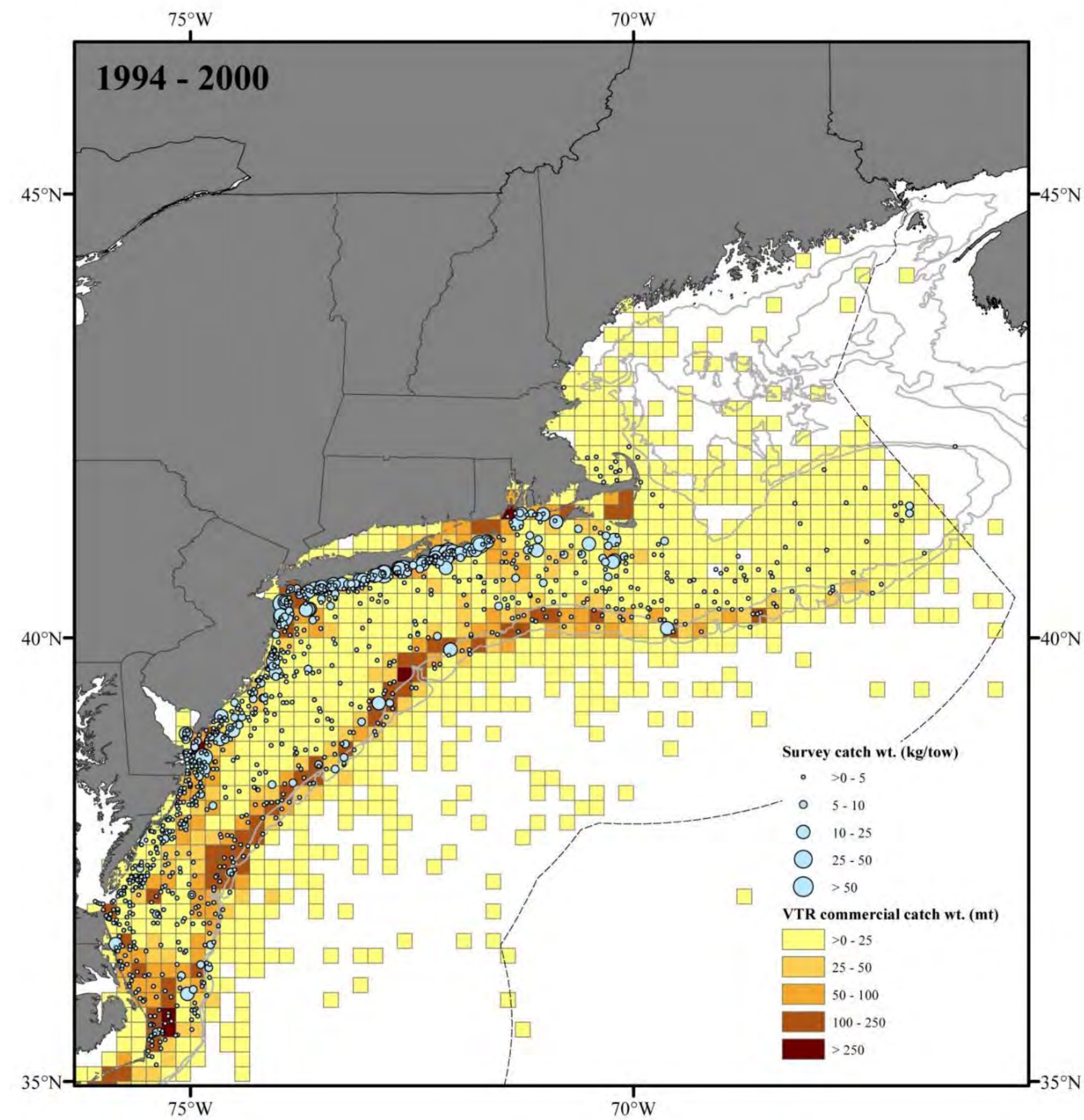


Figure 9: Spatial overlap of NEFSC trawl survey (spring and fall combined) catches (kg/tow) and commercial VTR-reported catch weight (landings and discards) binned to ten minute squares from, 1994-2000. Source: NEFSC 2013.

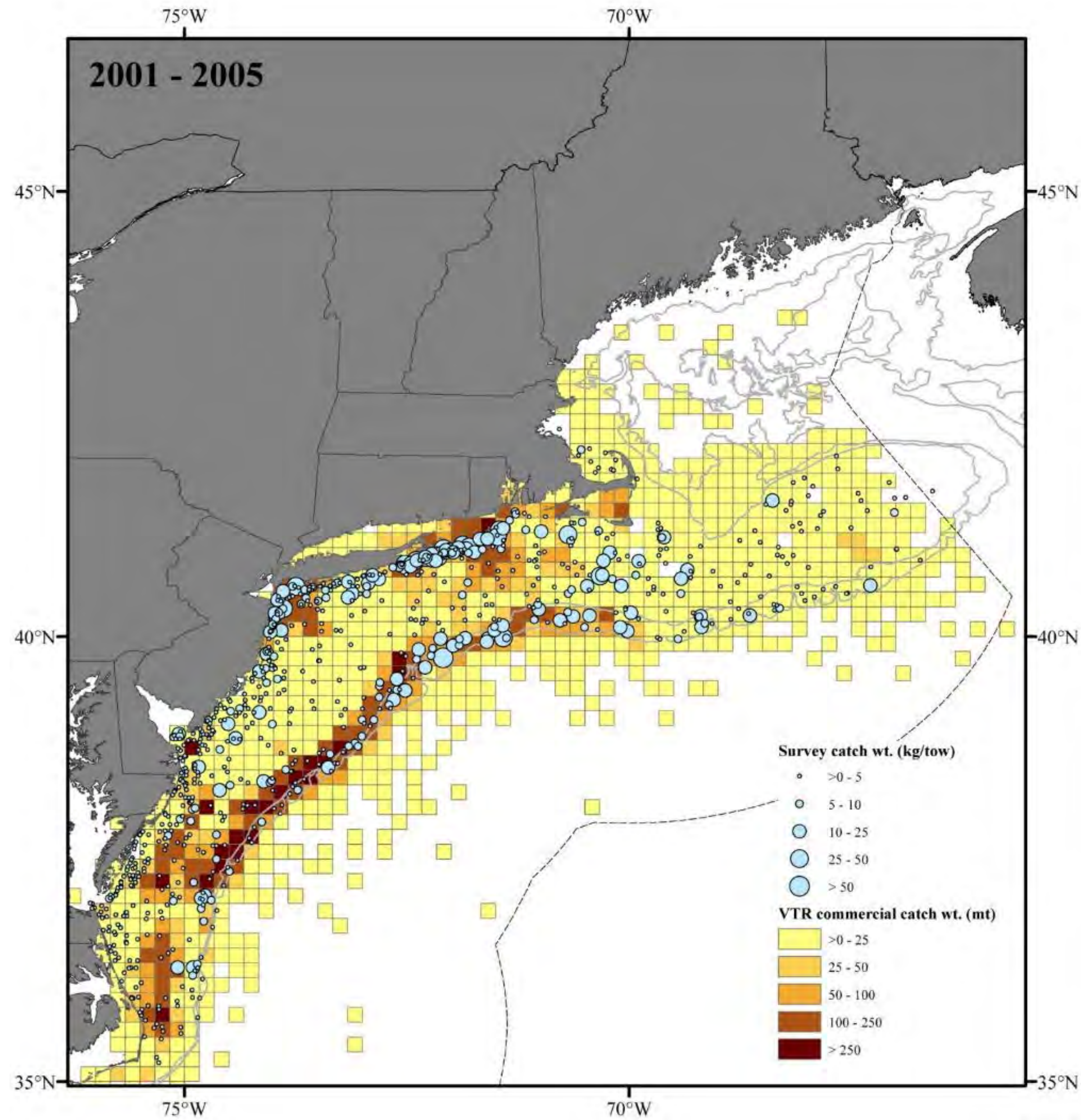


Figure 10: Spatial overlap of NEFSC trawl survey (spring and fall combined) catches (kg/tow) and commercial VTR-reported catch weight (landings and discards) binned to ten minute squares from, 2001-2005. Source: NEFSC 2013.

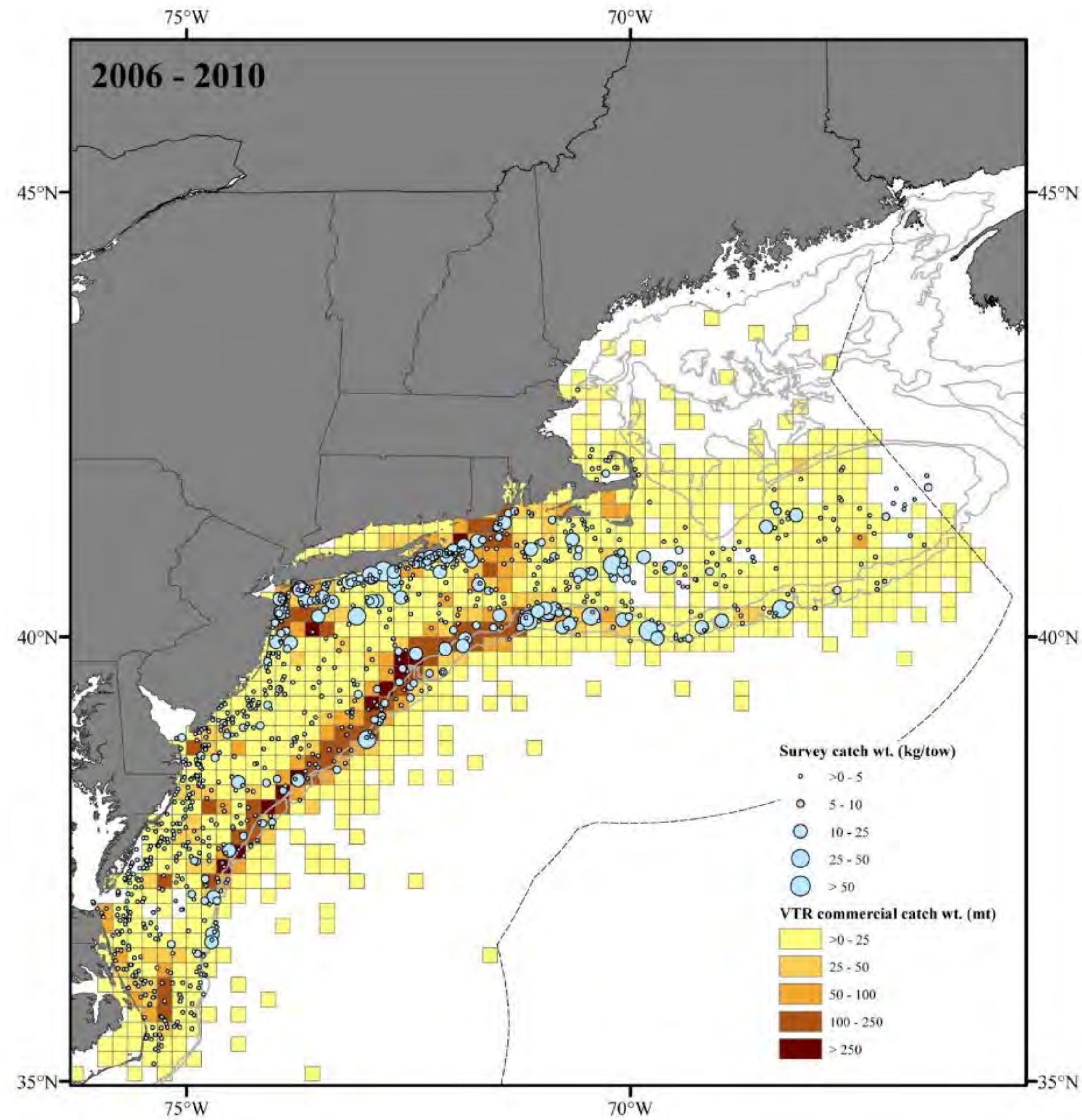


Figure 11: Spatial overlap of NEFSC trawl survey (spring and fall combined) catches (kg/tow) and commercial VTR-reported catch weight (landings and discards) binned to ten minute squares from, 2006-2010. Source: NEFSC 2013.

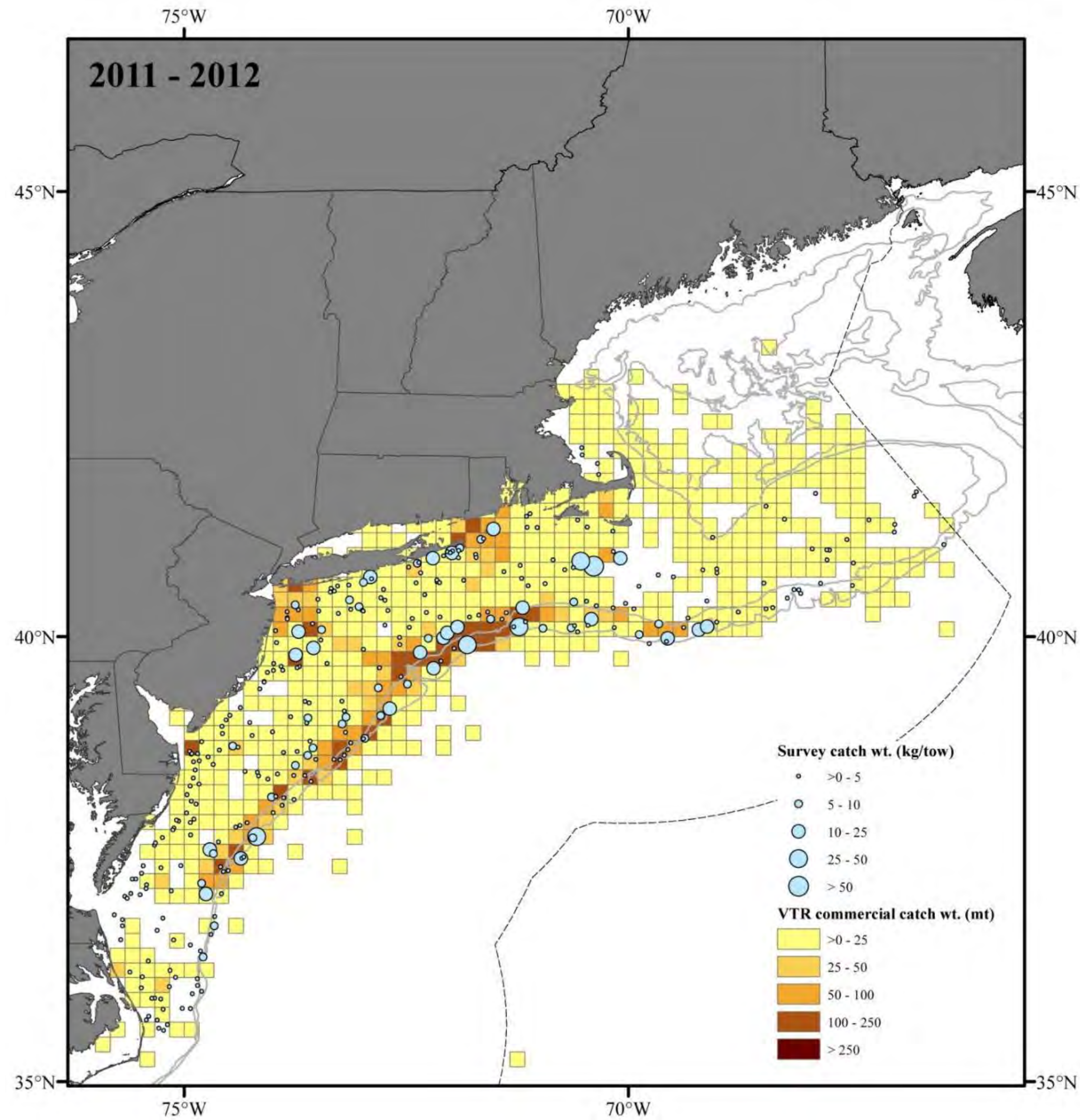


Figure 12: Spatial overlap of NEFSC trawl survey (spring and fall combined) catches (kg/tow) and commercial VTR-reported catch weight (landings and discards) binned to ten minute squares from, 2011-2012. Source: NEFSC 2013.

Seasonal Characteristics of the Commercial Fishery

As a percentage of coastwide harvest, more summer flounder is landed commercially in the winter months, particularly January through March (Figure 13). This corresponds with summer flounder being distributed offshore, where they are targeted by larger trawl vessels.

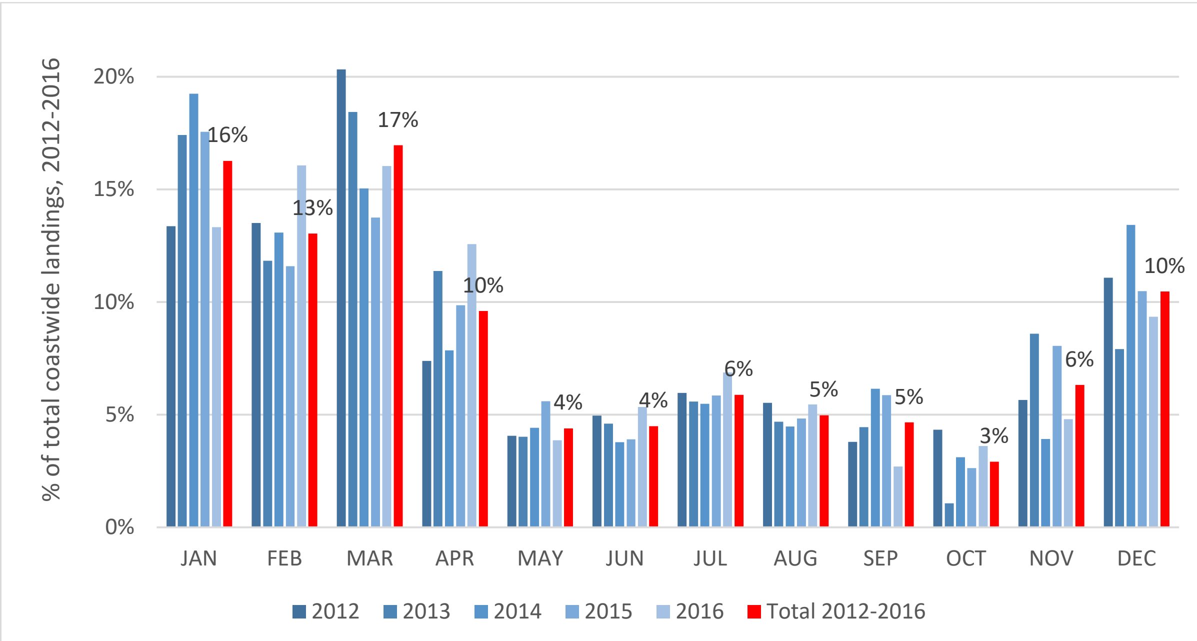


Figure 13: Commercial summer flounder landings by month as a percentage of coastwide harvest, 2012-2016, MA-NC. Total percentages for 2012-2016 are labeled (red bars). Source: NMFS AA tables.

Figure 14 shows that the months of November-April, over 75% of the landings originate from federal waters, as reported on federal VTRs. May, September, and October see a more balanced mix of federal and state waters harvest, while June-August harvest occurs mostly in state waters (Figure 14). There is some seasonal variation in landings by gear type. In the summer, more of the fishery is prosecuted in state waters with smaller vessels using a wider variety of gear types. While bottom trawls are still the dominant gear type in the summer, other gear types, such as hand lines, gill nets, and other gear types are more commonly used compared to the winter fishery (Figure 15). Larger vessels (classified as vessels 51 tons or larger) are dominant in the winter, offshore fishery, while during the spring and early fall, more of a mix of small and larger vessels participate (Figure 16).

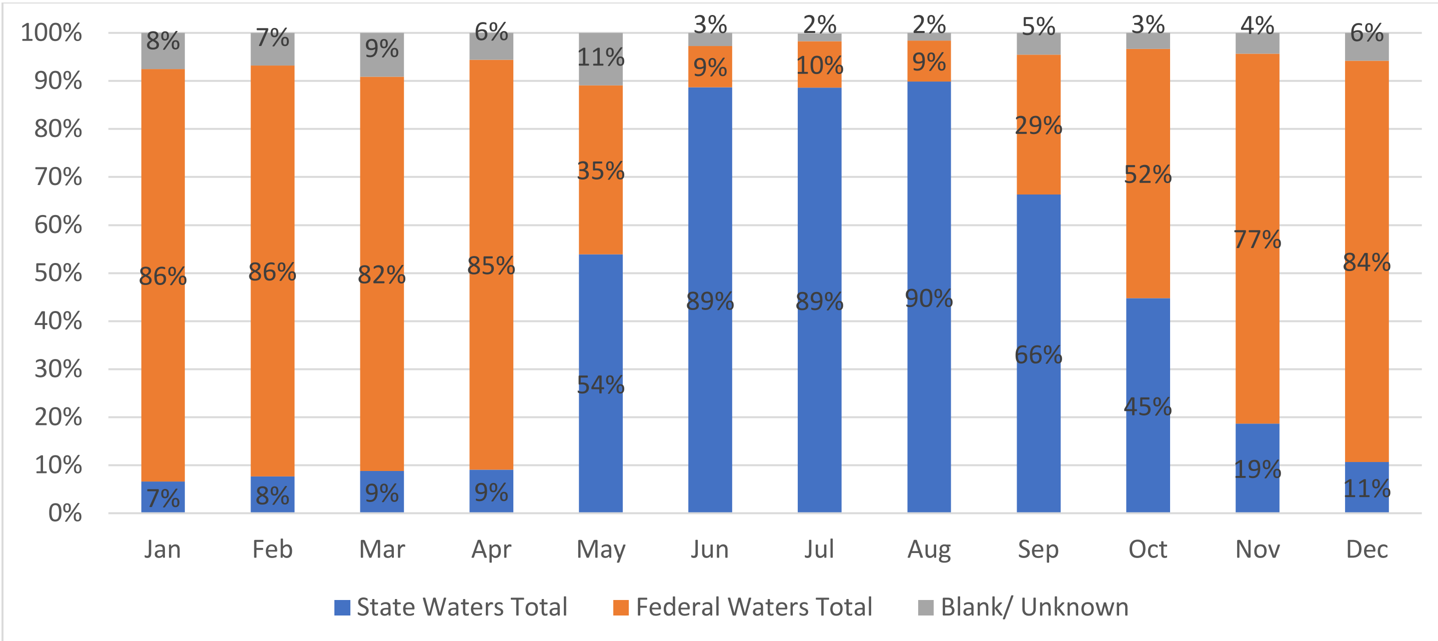
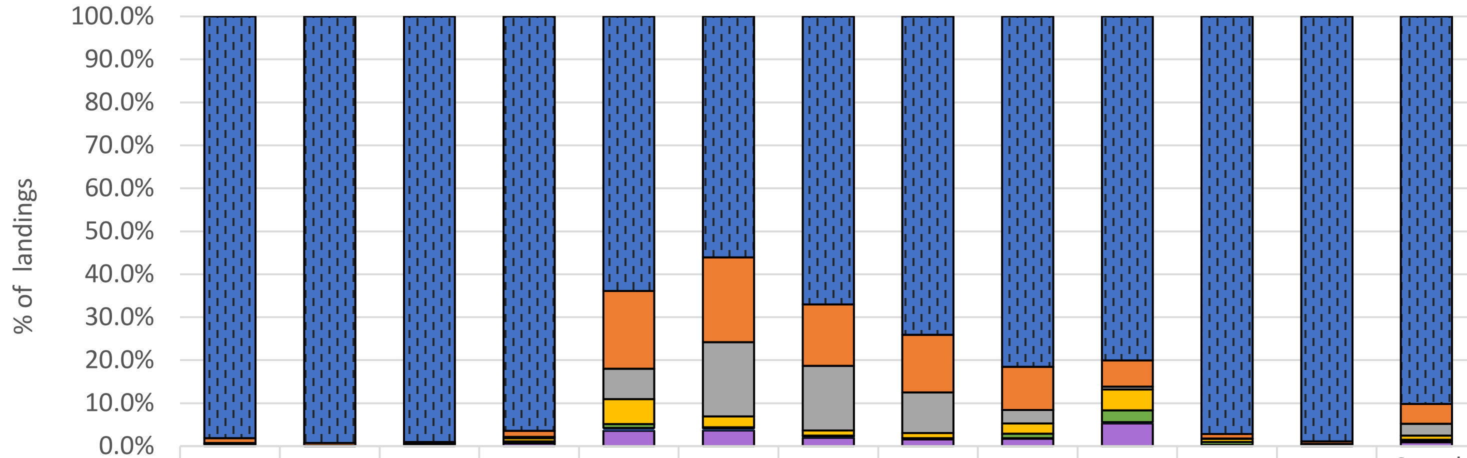
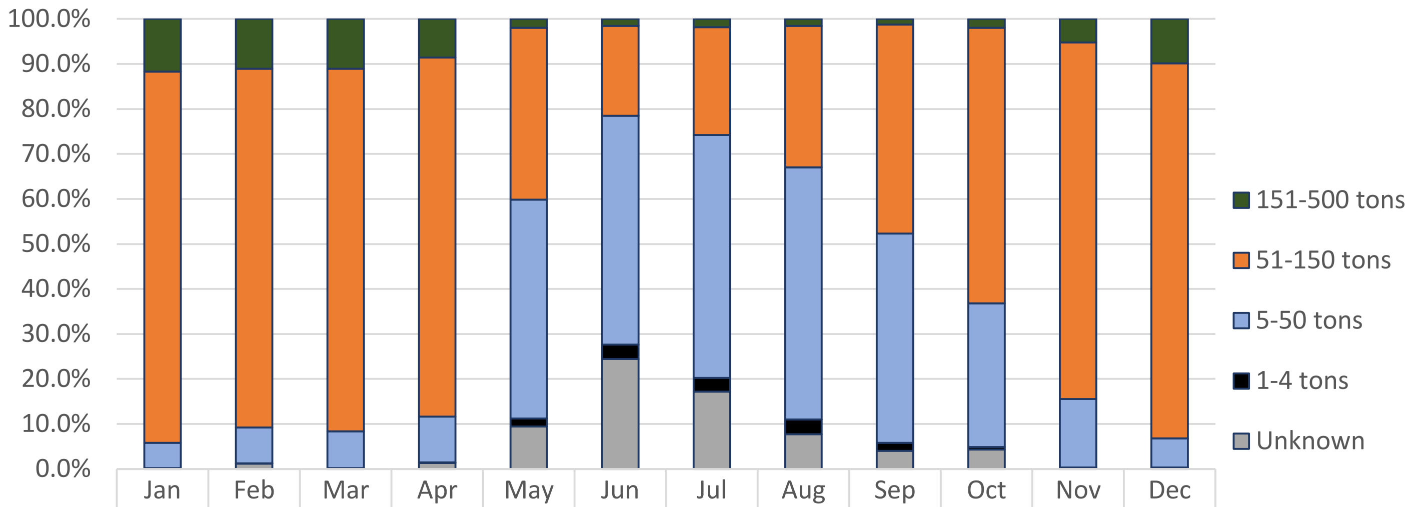


Figure 14: Commercial summer flounder landings by distance from shore by month, as reported on VTRs, 2015-2016, ME-NC. Source: NMFS VTR data as of May 2017.



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Grand Total
BOTTOM TRAWL	98.2%	99.2%	99.0%	96.4%	63.9%	56.1%	67.0%	74.1%	81.5%	80.0%	97.2%	98.8%	90.1%
UNKNOWN	1.1%	0.6%	0.4%	1.4%	18.1%	19.7%	14.3%	13.4%	10.0%	6.1%	1.0%	0.7%	4.6%
HANDLINE	0.0%	0.0%	0.0%	0.3%	7.1%	17.2%	15.0%	9.4%	3.1%	0.6%	0.1%	0.0%	2.8%
GILLNET	0.2%	0.0%	0.1%	0.8%	5.8%	2.6%	1.2%	1.2%	2.4%	4.8%	0.7%	0.3%	1.0%
SCALLOP DRED	0.2%	0.1%	0.3%	0.4%	0.9%	0.2%	0.3%	0.0%	1.0%	2.7%	0.7%	0.2%	0.4%
POT AND TRAP	0.1%	0.0%	0.0%	0.1%	0.6%	0.5%	0.3%	0.2%	0.2%	0.3%	0.0%	0.0%	0.1%
OTHER	0.2%	0.0%	0.2%	0.6%	3.6%	3.7%	1.9%	1.6%	1.7%	5.3%	0.2%	0.0%	0.9%

Figure 15: Percentage of commercial summer flounder landings in each month by gear type, Massachusetts through North Carolina, 2012-2016. Source: NMFS dealer data (AA tables) as of February 2018.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
151-500 tons	11.7%	11.1%	11.0%	8.6%	2.0%	1.5%	1.8%	1.5%	1.2%	1.9%	5.2%	9.8%
51-150 tons	82.5%	79.7%	80.6%	79.8%	38.2%	20.0%	23.9%	31.4%	46.5%	61.3%	79.2%	83.3%
5-50 tons	5.7%	7.9%	8.1%	10.2%	48.6%	50.9%	54.0%	56.1%	46.5%	31.9%	15.2%	6.5%
1-4 tons	0.1%	0.1%	0.1%	0.1%	1.8%	3.2%	3.1%	3.3%	1.8%	0.6%	0.2%	0.2%
Unknown	0.0%	1.2%	0.1%	1.3%	9.4%	24.4%	17.2%	7.7%	4.0%	4.3%	0.1%	0.2%

Figure 16: Average percent of commercial summer flounder landings by vessel ton class in each month, 2011-2015. Source: NMFS dealer data.

Commercial Landings by State

Table 3 shows commercial landings of summer flounder by state (in millions of lbs) since the implementation of state-specific quotas in 1993.

As a percentage of coastwide landings, landings by state have generally been stable since allocations were implemented in 1993 (Figure 17). Exceptions can occur under special circumstances, such as 2012-2013 when a high amount of North Carolina landings were landed in Virginia by mutual agreement due to shoaling at Oregon Inlet, NC. Since 1993, state-level allocations have remained constant, and utilization rates have generally been high among all states involved in the summer flounder fishery.

Commercial summer flounder landings from Maine, New Hampshire, and Delaware are not shown in Figure 2 since landings are minimal, if they occur at all. No commercial summer flounder landings have been reported in Maine since 2010. New Hampshire has indicated that they do not allow commercial harvest of summer flounder and that their reported landings (less than 100 lbs in total) were probably misidentified. Delaware landings have consistently been 0.1% or less of coastwide landings each year since 1993 and have averaged less than 0.01% in recent years.

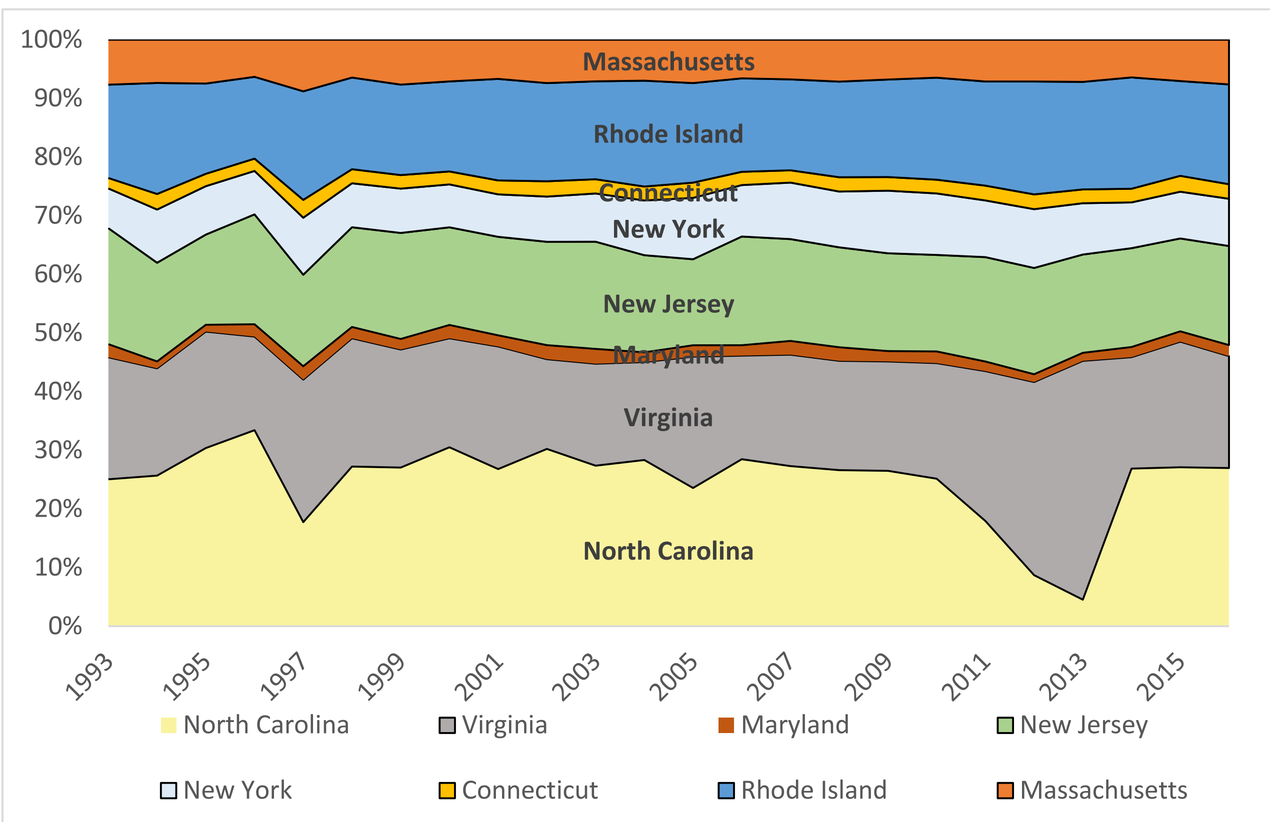


Figure 17: Percentage of coastwide landings by state 1993-2016, Massachusetts through North Carolina (excluding Delaware). Maine, New Hampshire, and Delaware each account for less than 0.1% of landings each year. Maryland and Virginia.

Table 3: Commercial summer flounder landings by state in millions of lbs, 1993-2016. C= confidential. New Hampshire's landings were not provided but are negligible (less than 100 lbs total). The confidentiality status of Delaware's data have not been confirmed. Data source: ACCSP

	ME	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Coast
1993	C	0.954	1.982	0.222	0.844	2.463	C	0.278	2.591	3.121	12.469
1994	C	1.031	2.648	0.371	1.269	2.354	C	0.165	2.559	3.593	13.997
1995	C	1.127	2.320	0.319	1.245	2.319	C	0.175	2.995	4.582	15.092
1996	C	0.800	1.763	0.266	0.936	2.369	C	0.266	2.019	4.227	12.662
1997	C	0.744	1.565	0.257	0.822	1.320	C	0.192	2.055	1.501	8.465
1998	C	0.707	1.712	0.263	0.822	1.863	C	0.211	2.397	2.983	10.973
1999	C	0.812	1.635	0.245	0.801	1.917	C	0.191	2.134	2.869	10.618
2000	C	0.789	1.704	0.245	0.812	1.848	C	0.252	2.063	3.387	11.118
2001	C	0.694	1.799	0.247	0.752	1.745	C	0.197	2.173	2.785	10.422
2002	C	1.009	2.286	0.357	1.053	2.407	C	0.327	2.090	4.129	13.662
2003	-	0.926	2.178	0.317	1.073	2.385	C	0.329	2.269	3.572	13.056
2004	C	1.193	3.085	0.406	1.594	2.831	C	0.284	2.853	4.844	17.098
2005	C	1.274	2.926	0.449	1.804	2.529	C	0.333	3.862	4.064	17.251
2006	C	0.921	2.227	0.317	1.227	2.591	C	0.248	2.469	3.981	13.991
2007	C	0.661	1.516	0.205	0.942	1.698	C	0.229	1.858	2.670	9.787
2008	C	0.646	1.474	0.221	0.860	1.541	C	0.209	1.685	2.407	9.045
2009	C	0.732	1.794	0.251	1.152	1.799	C	0.191	2.012	2.859	10.793
2010	-	0.852	2.289	0.308	1.380	2.166	C	0.261	2.594	3.311	13.163
2011	-	1.132	2.824	0.401	1.537	2.831	C	0.259	4.065	2.854	15.905
2012	-	0.891	2.409	0.315	1.255	2.269	C	0.165	4.123	1.090	12.519
2013	-	0.859	2.193	0.281	1.046	2.004	C	0.164	4.869	0.542	11.959
2014	-	0.696	2.056	0.253	0.846	1.826	C	0.187	2.058	2.912	10.835
2015	-	0.748	1.716	0.287	0.847	1.682	C	0.187	2.275	2.879	10.622
2016	-	0.585	1.306	0.190	0.619	1.297	C	0.144	1.465	2.071	7.680

Table 4 shows the percentages of summer flounder landings by state over a 5-year time period (2012-2016) and a 10-year time period (2007-2016). Maine and New Hampshire have reported no landings of summer flounder in the past five years. Note that the percentages for recent years are of the total harvest, not the total quota, so a percentage that is over or under a state's current allocation does not necessarily mean that state was over or under their allocation on average.

Table 4: Percentage of landings within the management unit from each state Maine-North Carolina, 2012-2016 and 2007-2016, and current state-by-state allocations. Source: ACCSP database. Specific poundage amounts not shown due to confidentiality issues with some states.

State	% of landings by state, 5-YR (2012-2016)	% of landings by state, 10-YR (2007-2016)	Current Allocation (1980-1989)
ME	0.00000%	0.00405%	0.04756%
NH	0.00000%	0.00001%	0.00046%
MA	7.05052%	6.95463%	6.82046%
RI	18.04914%	17.44612%	15.68298%
CT	2.48158%	2.42149%	2.25708%
NY	8.45865%	9.23102%	7.64699%
NJ	16.90554%	17.02198%	16.72499%
DE	0.01332%	0.01765%	0.01779%
MD	1.75850%	1.88532%	2.0391%
VA	27.59778%	24.01402%	21.31676%
NC	17.68497%	21.00370%	27.44584%
Total	**100.00%**	**100.00%**	**100.00%**

Commercial Landings by Month by State

Table 5 shows commercial summer flounder landings by state and month as a percentage of overall coastwide landings, combined over 2012-2016. Table 6 shows commercial summer flounder landings by month as a percentage of each state's annual landings. Combined, these two tables provide insights into the seasonality of summer flounder commercial harvest by state.

Overall, more summer flounder are landed in the winter compared to the summer fishery; about two thirds of annual commercial summer flounder landings typically occur during the months of December through April (Table 5). Virginia and North Carolina vessels, which currently receive nearly 50% of the coastwide allocation, are much more active in the winter months and have low activity in the months of May-September (Table 6). It follows that as a percentage of coastwide annual landings, the largest percentages come from Virginia and North Carolina during the winter months (Table 5). Rhode Island and New Jersey, which have the next highest allocations, tend to spread their fishing effort more evenly throughout the year. Rhode Island is somewhat more active February-April and New Jersey has higher activity in September-November and January. The northern states of New York through Massachusetts are generally more active in the summer months compared to the southern states of New Jersey and south (Table 5; Table 6).

Table 5: Commercial summer flounder landings by state and month as the percentage of the total coastwide landings, 2012-2016. Note: based on state of landing, not accounting for any quota transfers. Color coding indicates highest percentage (dark green) to lowest percentage (dark red). Source: NMFS dealer data.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
MA	0.45%	0.44%	0.29%	0.40%	0.12%	1.27%	1.87%	1.48%	0.37%	0.01%	0.08%	0.00%	6.78%
RI	0.37%	2.71%	3.31%	2.23%	1.42%	1.44%	1.43%	1.25%	0.91%	0.65%	1.03%	0.98%	17.73%
CT	0.28%	0.22%	0.29%	0.29%	0.16%	0.26%	0.25%	0.18%	0.09%	0.05%	0.07%	0.25%	2.40%
NY	0.53%	0.88%	0.53%	0.33%	1.11%	0.76%	0.87%	0.96%	0.76%	0.26%	0.14%	0.27%	7.40%
NJ	4.02%	0.95%	1.19%	0.30%	0.78%	0.65%	1.28%	0.79%	2.39%	1.57%	2.16%	0.68%	16.77%
DE	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
MD	0.04%	0.04%	0.19%	0.24%	0.10%	0.04%	0.05%	0.23%	0.07%	0.14%	0.08%	0.29%	1.49%
VA	4.63%	2.70%	9.32%	4.96%	0.21%	0.05%	0.13%	0.03%	0.03%	0.17%	2.57%	4.90%	29.69%
NC	5.96%	5.10%	1.84%	0.85%	0.49%	0.02%	0.01%	0.04%	0.05%	0.07%	0.21%	3.09%	17.73%
Total	16.27%	13.03%	16.95%	9.60%	4.40%	4.50%	5.89%	4.98%	4.66%	2.92%	6.32%	10.47%	100%

Table 6: Commercial summer flounder landings by state and month as the percentage of each state's total landings, 2012-2016. Note: based on state of landing, not accounting for any quota transfers. Color coding indicates highest percentage (dark green) to lowest percentage (dark red). Source: NMFS dealer data.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
MA	6.59%	6.43%	4.30%	5.94%	1.71%	18.80%	27.60%	21.84%	5.49%	0.11%	1.13%	0.06%	100%
RI	2.06%	15.30%	18.67%	12.59%	8.02%	8.14%	8.07%	7.07%	5.11%	3.65%	5.78%	5.53%	100%
CT	11.69%	9.36%	11.90%	12.05%	6.86%	10.69%	10.52%	7.58%	3.74%	2.08%	3.08%	10.45%	100%
NY	7.15%	11.87%	7.13%	4.46%	15.03%	10.22%	11.71%	13.04%	10.28%	3.57%	1.83%	3.71%	100%
NJ	23.97%	5.65%	7.10%	1.77%	4.66%	3.90%	7.63%	4.71%	14.28%	9.36%	12.90%	4.07%	100%
DE	0.00%	0.00%	2.16%	15.27%	24.51%	7.13%	14.26%	27.88%	8.21%	0.27%	0.14%	0.18%	100%
MD	2.70%	2.40%	12.79%	15.93%	6.60%	2.50%	3.05%	15.60%	4.43%	9.30%	5.16%	19.54%	100%
VA	15.59%	9.10%	31.38%	16.70%	0.71%	0.17%	0.44%	0.11%	0.09%	0.59%	8.64%	16.49%	100%
NC	33.61%	28.76%	10.37%	4.81%	2.79%	0.13%	0.08%	0.24%	0.26%	0.37%	1.17%	17.41%	100%
Coast	**16.27%**	**13.03%**	**16.95%**	**9.60%**	**4.40%**	**4.50%**	**5.89%**	**4.98%**	**4.66%**	**2.92%**	**6.32%**	**10.47%**	100%

Commercial Landings by Area by State

Figure 18 shows summer flounder commercial landings by distance from shore by state (i.e., state vs. federal waters) for 2015-2016, as reported on federal VTRs. This data indicate that some states prosecute their fishery primarily in federal waters/offshore (i.e., Virginia and North Carolina), while other states have substantial landings originating from both state and federal waters. Note that Delaware landings are incidental; Delaware does not have a directed fishery for summer flounder. The percentage of landings actually originating from state waters may be higher than portrayed here, as this dataset does not include state-only permitted vessels fishing only in state waters.

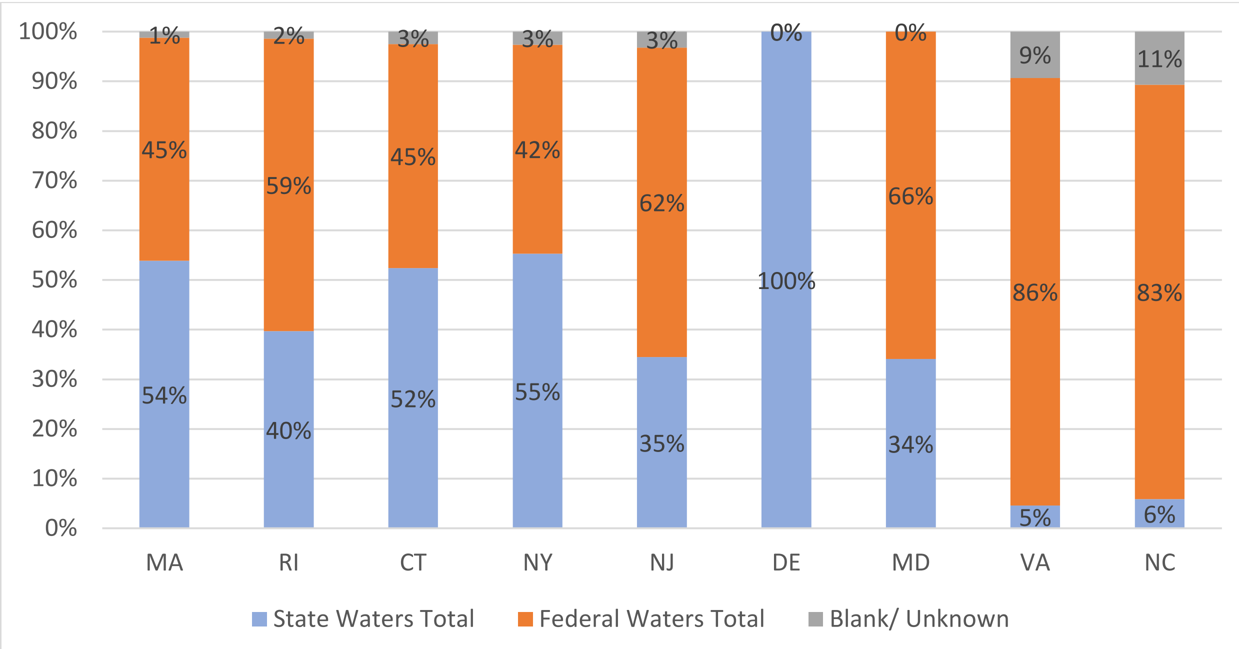
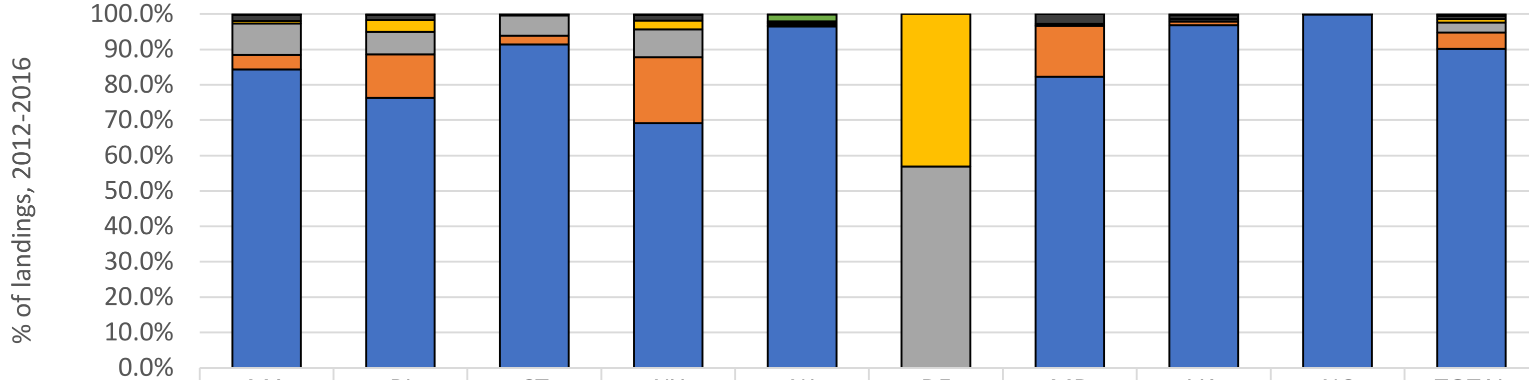


Figure 18: Commercial summer flounder landings by distance from shore by state, as reported on VTRs, 2015-2016. Source: NMFS VTR data as of May 2017. Note: does not include state-level-only VTR data.

Commercial Landings by Gear Type by State

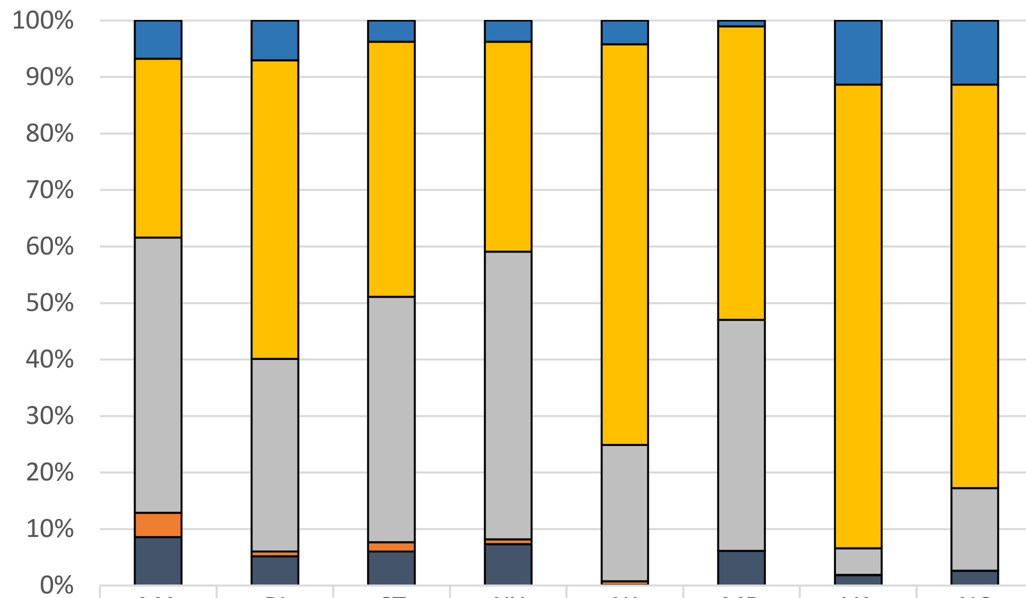
Figure 19 shows recent percentages of landings by gear type in each state according to dealer data merged with VTR information (AA tables), illustrating that landings in most states originate overwhelmingly from bottom trawl gear, especially the states of New Jersey, Virginia, and North Carolina, which are all over 95% trawl gear. Several states have a substantial amount of "unknown" gear type landings in the dealer data, indicating that data quality of the gear type variable in dealer data varies by state and may not be reliable in each state within the management unit. However, completing this analysis with VTR data would not include state-only permitted vessel landings.



	MA	RI	CT	NY	NJ	DE	MD	VA	NC	TOTAL
POT AND TRAP	0.1%	0.3%	0.0%	0.2%	0.2%	0.0%	0.0%	0.1%	0.0%	0.1%
SCALLOP DREDGE	0.2%	0.0%	0.1%	0.0%	1.9%	0.0%	0.0%	0.2%	0.1%	0.4%
OTHER	1.7%	1.4%	0.1%	1.7%	0.3%	0.0%	2.8%	1.1%	0.1%	0.9%
GILLNET	0.7%	3.4%	0.2%	2.4%	0.3%	43.1%	0.6%	0.2%	0.0%	1.0%
HANDLINE	8.9%	6.3%	5.8%	7.9%	0.5%	56.9%	0.0%	0.6%	0.0%	2.8%
UNKNOWN	4.1%	12.3%	2.4%	18.7%	0.3%	0.0%	14.3%	1.0%	0.0%	4.6%
BOTTOM TRAWL	84.3%	76.3%	91.4%	69.1%	96.5%	0.0%	82.3%	96.8%	99.8%	90.1%

Figure 19: Percentage of commercial summer flounder landings in each state by gear type, Massachusetts through North Carolina, 2012-2016. Source: NMFS dealer data (AA tables) as of February 2018.

Commercial Landings by Vessel Size by State
Figure 20 shows recent percentages of landings by vessel tonnage class in each state. The predominant size tonnage class for vessels landing in North Carolina and Virginia, the states with the highest quota allocations is 51-150 tons. Relative to other states, Virginia and North Carolina also have a higher percentage of vessels in the largest tonnage class for summer flounder, 151-500 tons, making up about 11% of each of their fleets. The 51-150 ton class is the most common vessel size class for vessels landing in Rhode Island, Connecticut, New Jersey, and Maryland. The most common vessel size class for vessels landing in Massachusetts and New York is 5-50 tons. Vessels >150 tons and <5 tons represent a relatively small component of landings in all states active in the summer flounder fishery (Figure 20).



	MA	RI	CT	NY	NJ	MD	VA	NC
151-500 tons	6.7%	7.1%	3.8%	3.8%	4.2%	1.0%	11.3%	11.3%
51-150 tons	31.6%	52.8%	45.1%	37.1%	70.9%	51.9%	82.1%	71.4%
5-50 tons	48.7%	34.1%	43.5%	50.9%	24.1%	40.9%	4.7%	14.7%
1-4 tons	4.3%	0.8%	1.7%	0.8%	0.7%	0.0%	0.1%	0.0%
Unknown	8.6%	5.2%	6.0%	7.3%	0.1%	6.1%	1.8%	2.6%

Figure 20: Percent of summer flounder landings by state by vessel tonnage class, 2007-2016.

1.3.3 Commercial Value and Revenue
For the years 1994 through 2016, NMFS dealer data indicate that summer flounder total ex-vessel revenue (adjusted to 2016 dollars to account for inflation) from Maine to North Carolina ranged from a low of $21.30 million in 1996 to a high of $34.80 million in 2004. The adjusted mean price per pound for summer flounder ranged from a low of $1.74 in 2011 ($1.84 in 2011 dollars) to a high of $3.64 in 2016. In 2016, 7.71 million lbs of summer flounder were landed generating $27.35 million in total ex-vessel revenue (an average of $3.64 per pound; Figure 21). Figure 22

shows average ex-vessel price per pound by month for 2012-2016, and Figure 23 shows ex-vessel revenue by state over the same time period.

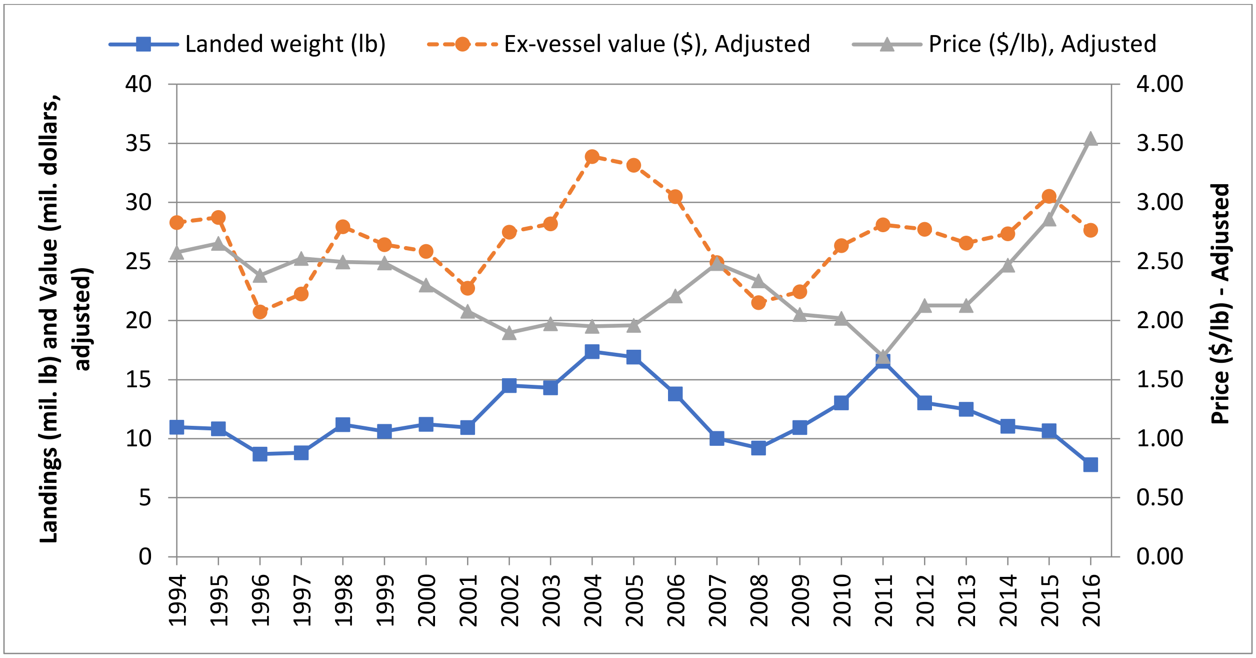


Figure 21: Landings, ex-vessel value, and price per pound for summer flounder, Maine through North Carolina, 1994-2016. Ex-vessel value and price are adjusted to real 2016 dollars.

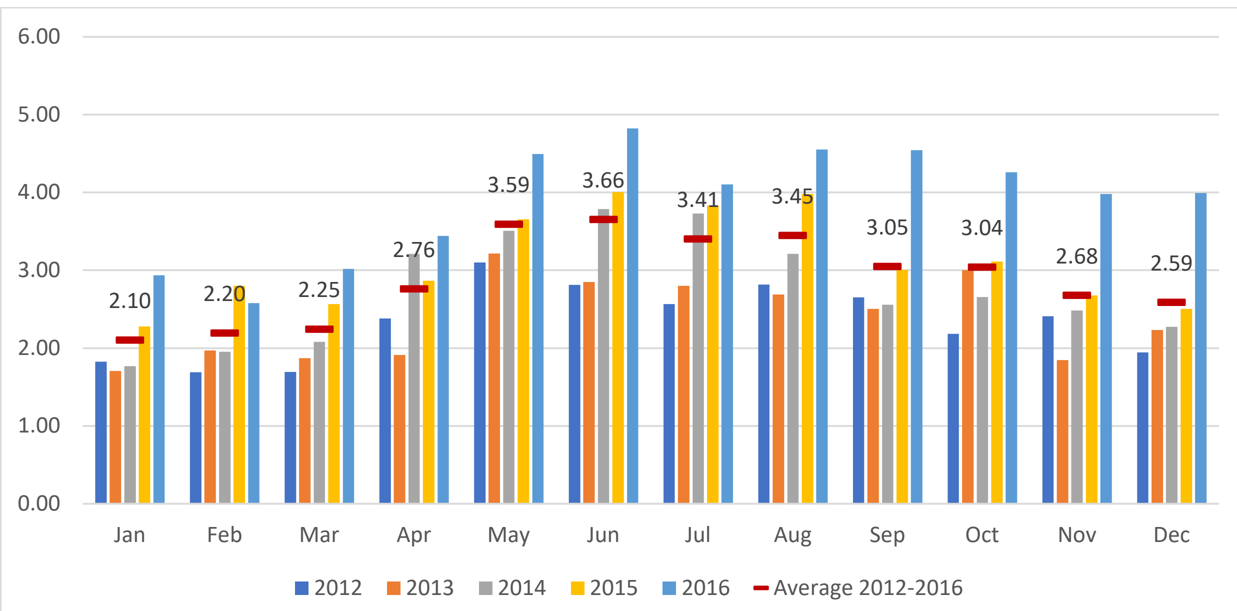


Figure 22: Average ex-vessel price per lbs ($; adjusted to 2016 US dollars) for summer flounder by month, with monthly average (red line), 2012-2016.

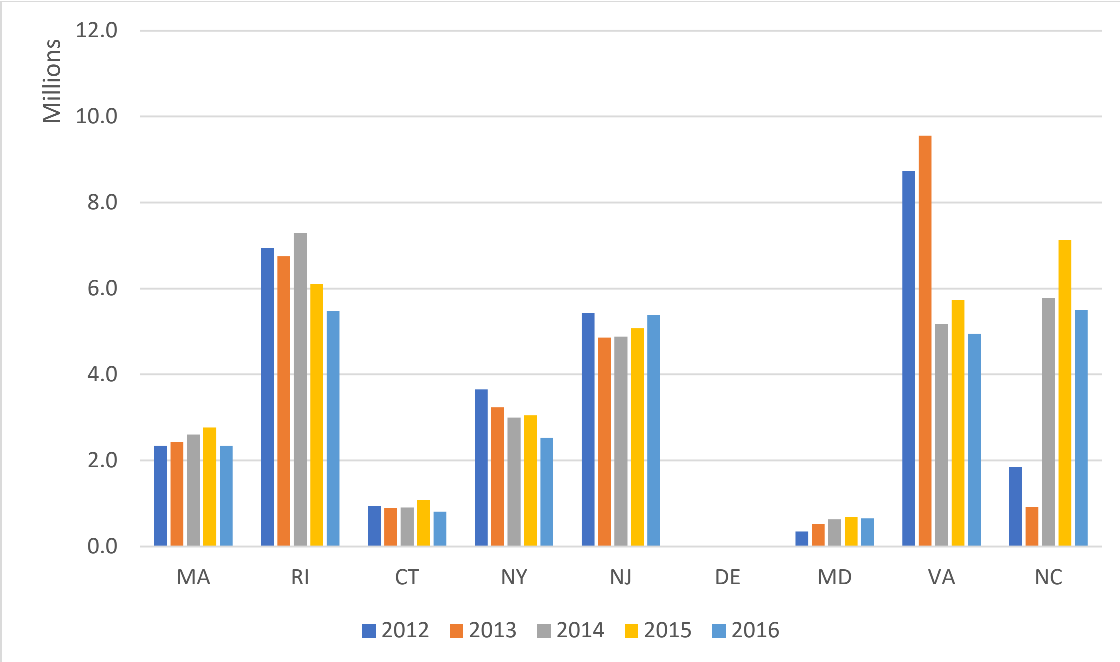


Figure 23: Total ex-vessel revenue (adjusted to 2016 US dollars) for summer flounder landings by state and year, 2012-2016. Source: NMFS dealer data as of May 2017.

Ports and Communities

This amendment will impact communities and ports throughout the coastal northeast and mid-Atlantic. A "fishing community" is defined in the MSA as "a community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community (16 U.S.C. § 1802(17)).

Table 6 describes the top commercial ports for summer flounder landings from 2007-2016, including all ports accounting for at least 1% of the total ex-vessel revenue for summer flounder reported by commercial dealers over this ten-year time period. Together, these 17 ports accounted for over 80% of the summer flounder ex-vessel value during this time period. The top five ports for summer flounder include Point Judith, RI, Hampton, VA, Newport News, VA, Pt. Pleasant, NJ, and Montauk, NY (Table 6).

Table 6: Top ports for commercial summer flounder landings 2007-2016; showing ports landing >1% of total summer flounder ex-vessel revenue 2007-2016. Source: NMFS dealer data as of May 2017.

PORT	Landings (lb), 2007-2016	% of total landings, 2007-2016	Avg. lb per year (2007-2016)	Value ($; unadjusted), 2007-2016	% of total value ($; unadjusted), 2007-2016	Avg. $ per year (2007-2016)
POINT JUDITH, RI	16,542,993	14.40%	1,654,299	48,815,097	17.96%	4,881,510
HAMPTON, VA	11,361,504	9.89%	1,136,150	21,625,623	7.96%	2,162,562
NEWPORT NEWS, VA	11,399,574	9.92%	1,139,957	20,753,942	7.64%	2,075,394
PT. PLEASANT, NJ	8,075,938	7.03%	807,594	19,853,161	7.31%	1,985,316
MONTAUK, NY	4,897,173	4.26%	489,717	16,457,629	6.06%	1,645,763
BEAUFORT, NC	6,476,496	5.64%	647,650	13,858,843	5.10%	1,385,884
WANCHESE, NC	6,954,845	6.05%	695,485	12,387,082	4.56%	1,238,708
BELFORD, NJ	4,119,069	3.59%	411,907	11,773,253	4.33%	1,177,325
CHINCOTEAGUE, VA	5,511,316	4.80%	551,132	9,866,785	3.63%	986,679
CAPE MAY, NJ	4,976,111	4.33%	497,611	9,673,034	3.56%	967,303
NEW BEDFORD, MA	3,644,411	3.17%	364,441	9,624,704	3.54%	962,470
ENGELHARD, NC	3,873,479	3.37%	387,348	7,252,482	2.67%	725,248
STONINGTON, CT	2,029,304	1.77%	202,930	6,251,765	2.30%	625,177
ORIENTAL, NC	3,369,336	2.93%	336,934	6,038,194	2.22%	603,819
HAMPTON BAYS, NY	1,973,522	1.72%	197,352	5,571,142	2.05%	557,114
OCEAN CITY, MD	1,678,651	1.46%	167,865	4,268,405	1.57%	426,841
LONGBEACH/ BARNEGAT LIGHT, NJ	1,415,733	1.23%	141,573	3,825,376	1.41%	382,538
TOP PORTS SUM	**98,299,455**	**85.58%**	**9,829,946**	**227,896,517**	**83.86%**	**22,789,652**

Commercial Dealers

Over 200 federally permitted dealers from Maine through North Carolina bought summer flounder in 2016. More dealers bought summer flounder in New York than in any other state (Table 7). All dealers combined bought approximately $27.65 million worth of summer flounder in 2016. Trends in the number of federal permit dealers purchasing summer flounder from vessels are shown in Figure 24 and 25.

Table 7: Dealers reporting buying summer flounder, by state in 2016. C=Confidential.

State	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC
Number Of Dealers	0	0	32	33	13	48	30	C	7	16	29

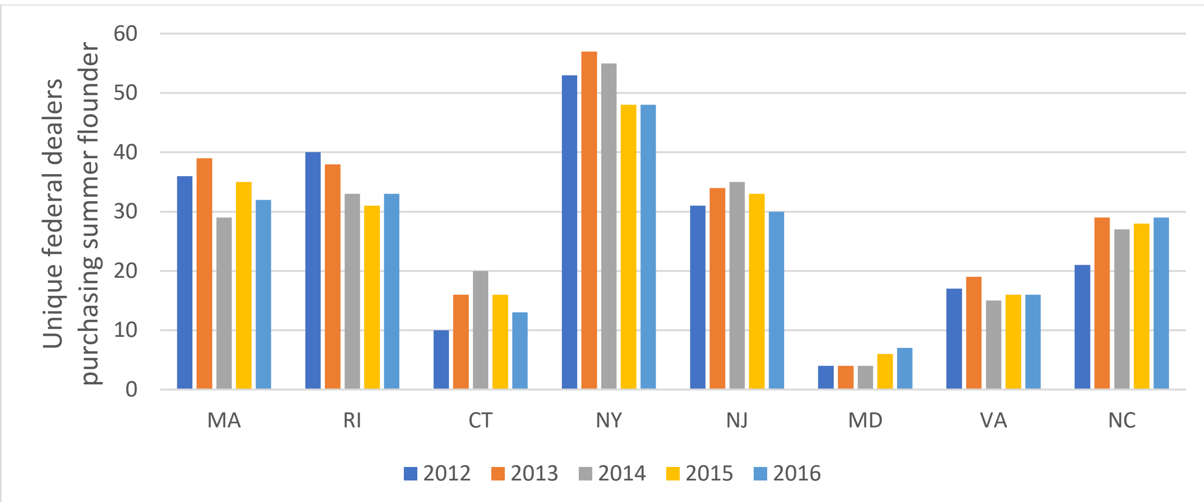


Figure 24: shows trends in the number of unique federally permitted dealers buying summer flounder from vessels in each state between 2012-2016.

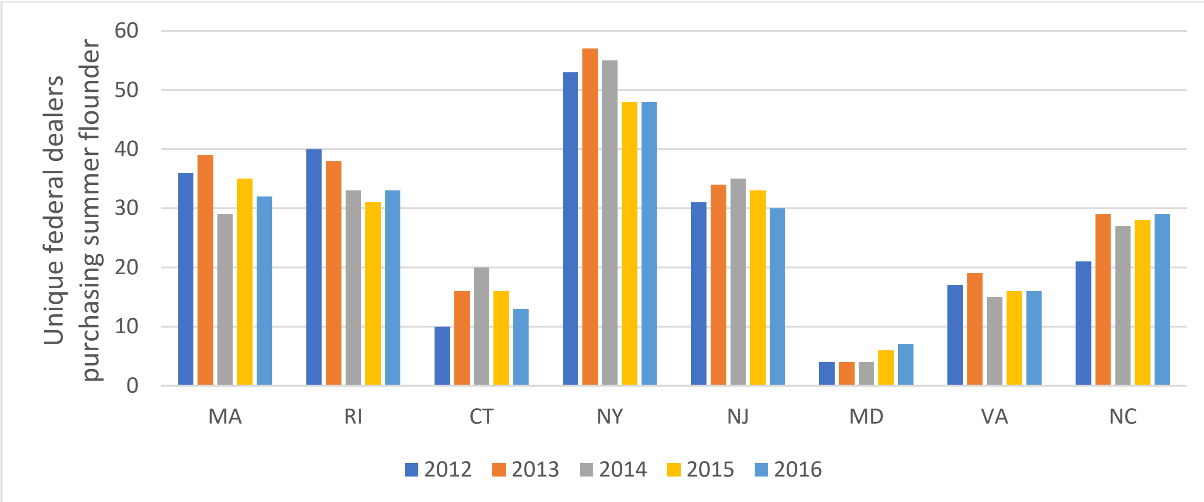


Figure 25: Number of unique federal dealers purchasing summer flounder from commercial vessels, by state and year, 2011-2015. Maine, New Hampshire, and Delaware data are confidential and cannot be displayed. Source: NMFS dealer data as of February 2017.

State Permit Activity

While this Amendment does not impact state level permits, state permits are required in the state of landing for any federally permitted vessels, so a general characterization of the number of active state permits can help provide a sense of the level of participation in the fishery in each state. The precise number of active vessels and/or fishermen in any given state can be difficult to determine.

State permit information for the past five years was compiled by Commission staff and the Atlantic Coastal Cooperative Statistics Program (ACCSP) and is shown in Table 8. States were asked to provide the number of "active" permits over the past five years, meaning there were summer flounder landings associated with that permit over the last five years. The exact method of pulling "active" permits was not necessarily consistent among states. Note that some states permit a vessel, while some states permit an individual. State permit data was provided by state marine fisheries agencies to Commission staff, and is provided along with ACCSP database information for known fishermen with summer flounder landings in each year 2012-2016.

Table 8: ACCSP summer flounder state commercial permit summary; 2012-2016. Delaware and Maine not provided for confidentiality reasons.

	State Provided Permits[a]		Number of Known Fishermen in ACCSP Summer Flounder Landings[e]				
State	Total Count	Active Count[b]	2016	2015	2014	2013	2012
MA	699	274	210	226	203	230	265
RI	1192	546	522	482	486	538	540
CT	N/A	N/A	67	70	68	64	62
NY[c]	491	416	191	199	222	225	234
NJ	177	89	68	61	68	60	51
MD	N/A	N/A	26	27	45	43	47
VA	175	175	114	117	160	47	58
NC[d]	166	138	251	201	222	191	186

[a] "State-provided permits" indicates counts of total and active state commercial summer flounder permits that were provided to Commission staff by individual states. Maryland and Connecticut data had not been provided at time of this report. [b] Provided by individual states; methods may not be consistent. Some states permit a vessel; some states permit individuals. [c] "Active count" in the table above indicates active during the period of 2012-2016, but not necessarily active in each of those years. New York provided an additional breakdown of active permits over each individual year for 2012-2016:

Year	NY Active Count
2012	255
2013	242
2014	251
2015	234
2016	203

[d] Some North Carolina landings by year would have been from non-North Carolina permit holders, leading to the "known fishermen" counts by year being higher than the number of "active" NC permits. [e] "Known fishermen" counts are derived from ACCSP database fisherman ID. "Unknown" fishermen not included. Among identified fishermen (people) in ACCSP Summer Flounder Landings for the period of 2012-2016, approximately 93% had a single fishermen state permit, 6% had two fishermen state permits, and less than 0.5% had three or more fishermen state permits. This includes state permits only, as Federal permits are issued to vessels. Approximately 95% landed in a single state and the remaining 5% landed in two to four states. These percentages are similar in each year throughout the 5-year period.

1.3.5 Recreational Fishery

There is a significant recreational fishery for summer flounder, primarily in state waters when the fish migrate inshore during the warm summer months. Summer flounder have historically been highly sought by sport fishermen, especially in New York and New Jersey waters. Characteristics of the recreational fishery are summarized in the sections below. Because this action does not directly impact the recreational fishery for summer flounder, only a brief summary is provided.

NMFS has conducted recreational fishing surveys since 1979 to obtain estimates of participation, effort, and catch by recreational anglers in marine waters. Recreational data for years 2004 and later are available from the Marine Recreational Information Program (MRIP). For years prior to

2004, recreational data were generated by the Marine Recreational Fishery Statistics Survey (MRFSS). Note that the MRIP program has recently undergone major changes in its collection of effort data,[1] as well as changes to its angler intercept methods for private boat and shore anglers.[2] As such, major changes to the time series of recreational catch and landings were released in July 2018. These changes have not yet been incorporated into the stock assessment or otherwise used for management; therefore, pre-revision data is used in the summary of the recreational fishery below.

Recreational catch and landings for summer flounder peaked in 1983 with 32.11 million fish caught and 21.00 million fish landed. Catch reached a low in 1989 with 2.69 million fish caught, while landings reached a low in 2010 with 1.50 million fish landed (Table 9).

MRIP data indicate that on average, about 85% of recreational summer flounder landings (in number of fish) in the past ten years (2008-2017) were caught by anglers fishing on private or rental boats, about 11% from anglers aboard party or charter boats, and 4% from shore (Figure 26). For-hire vessels carrying passengers in federal waters must obtain a federal party/charter permit. In 2016, there were 763 party and charter vessels that held summer flounder federal for-hire permits. Many of these vessels also hold recreational permits for scup and black sea bass.

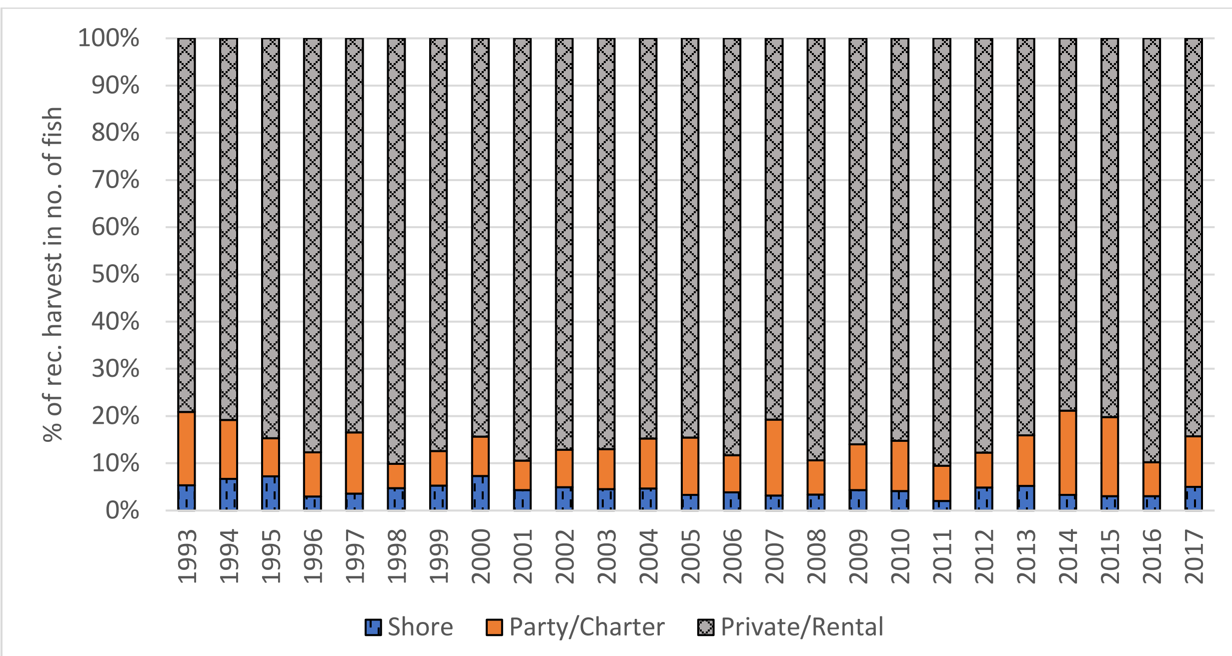


Figure 26: The percent of summer flounder harvested by recreational fishing mode, Maine through North Carolina, 1993-2017.

[1] See https://www.fisheries.noaa.gov/recreational-fishing-data/effort-survey-improvements

[2] See https://www.fisheries.noaa.gov/event/access-point-angler-intercept-survey-calibration-workshop

Table 9: Recreational summer flounder landings, catch, mean weight of landed fish, and percent discarded, from the NMFS recreational statistics databases, Maine through North Carolina, 1981-2017.

Year	Catch (number of fish)	Landings (number of fish)	Landings (lbs)	Mean weight of landed fish (lb)	% Discarded
1981	13,578,784	9,566,574	10,081,009	1.05	30%
1982	23,562,020	15,472,700	18,233,138	1.18	34%
1983	32,062,267	20,996,307	27,969,296	1.33	35%
1984	29,784,927	17,475,171	18,764,678	1.07	41%
1985	13,525,921	11,066,191	12,489,684	1.13	18%
1986	25,292,462	11,620,861	17,861,284	1.54	54%
1987	21,023,452	7,864,762	12,167,243	1.55	63%
1988	17,170,738	9,959,659	14,624,189	1.47	42%
1989	2,676,591	1,716,765	3,158,026	1.84	36%
1990	9,100,825	3,793,585	5,134,330	1.35	58%
1991	16,074,809	6,067,651	7,959,828	1.31	62%
1992	11,909,554	5,002,106	7,147,691	1.43	58%
1993	22,904,142	6,494,041	8,830,916	1.36	72%
1994	17,725,048	6,702,691	9,327,506	1.39	62%
1995	16,307,629	3,325,714	5,421,094	1.63	80%
1996	18,994,405	6,996,985	9,820,336	1.40	63%
1997	20,027,081	7,166,820	11,865,867	1.66	64%
1998	22,085,841	6,979,095	12,476,561	1.79	68%
1999	21,377,718	4,106,995	8,366,202	2.04	81%
2000	25,384,426	7,801,074	16,467,529	2.11	69%
2001	28,187,215	5,293,611	11,636,796	2.20	81%
2002	16,674,286	3,262,159	8,008,107	2.45	80%
2003	20,531,904	4,558,670	11,638,493	2.55	78%
2004	20,336,209	4,316,498	11,021,884	2.55	79%
2005	25,805,581	4,027,466	10,915,335	2.71	84%
2006	21,400,010	3,950,283	10,504,639	2.66	82%
2007	20,731,500	3,107,578	9,336,713	3.00	85%
2008	22,896,846	2,349,873	8,150,661	3.47	90%
2009	24,085,181	1,806,178	6,030,381	3.34	93%
2010	23,721,585	1,501,467	5,108,358	3.40	94%
2011	21,558,699	1,839,876	5,955,714	3.24	91%
2012	16,528,455	2,272,221	6,489,806	2.86	86%
2013	16,105,140	2,521,366	7,355,057	2.92	84%
2014	18,969,451	2,458,003	7,389,014	3.01	87%
2015	12,152,658	1,621,480	4,721,147	2.91	87%
2016	14,170,750	2,027,770	6,182,405	3.05	86%
2017	8,441,805	1,028,483	3,188,669	3.10	88%

Recreational Landings by Area and State

On average, an estimated 86 percent of the landings (in numbers of fish) occurred in state waters over the past ten years (Figure 27). By state, the majority of summer flounder are typically landed in New York and New Jersey (Table 10).

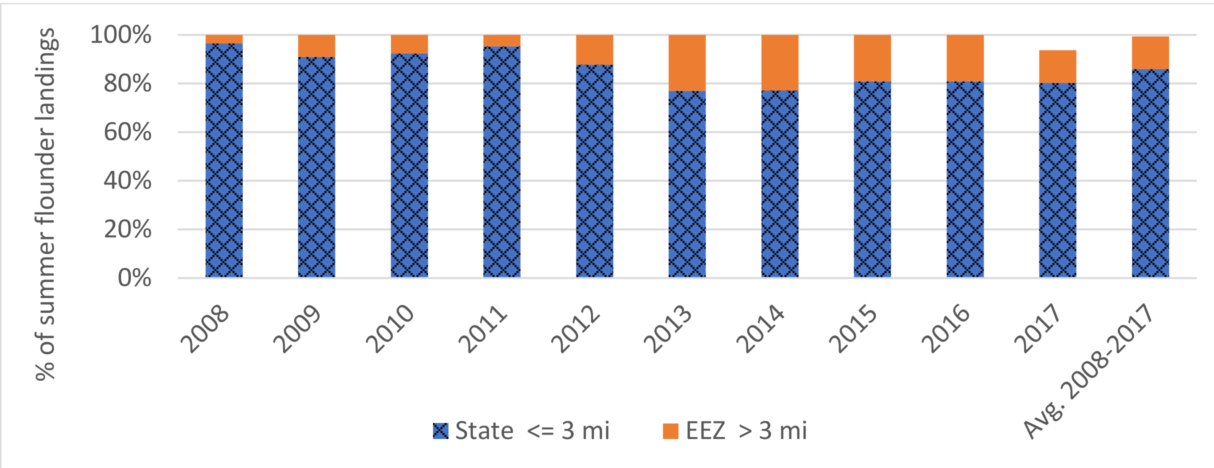


Figure 27: Estimated percentage of summer flounder recreational landings in state vs. federal waters, Maine through North Carolina, 2007-2016.

Table 10: State contribution (as a percentage) to total recreational landings of summer flounder (in numbers of fish), from Maine through North Carolina, 2015-2017.[6]

State	2015	2016	2017	Avg 2015-2017
Maine	0.0%	0.0%	0.0%	0.0%
New Hampshire	0.0%	0.0%	0.0%	0.0%
Massachusetts	4.9%	2.7%	2.6%	3.4%
Rhode Island	10.1%	4.3%	5.9%	6.7%
Connecticut	5.7%	10.7%	8.8%	8.6%
New York	30.3%	35.1%	21.6%	30.5%
New Jersey	30.7%	37.2%	43.6%	36.3%
Delaware	3.2%	4.4%	3.3%	3.8%
Maryland	2.7%	1.1%	2.6%	2.0%
Virginia	9.8%	3.5%	9.0%	6.9%
North Carolina	2.5%	0.9%	2.6%	1.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

1.3.4 Interactions with Other Fisheries

Non-target species are those species caught incidentally while targeting other species, in this case, while targeting summer flounder. Some non-target species are occasionally retained, others are commonly discarded. This section describes the non-target species commonly caught in the commercial summer flounder fishery and summarizes their management status and stock status.

Identification of Major Non-Target Species

For many species, including summer flounder, associated non-target species can be difficult to identify and can change from year to year or over longer time series, based on many factors such as changing regulations, fluctuations in stock conditions, shifting species distributions, and changing economic conditions.

Northeast Fisheries Observer Program (NEFOP) data were used to identify the major species caught incidentally on commercial trawl trips where summer flounder comprised over 50% of the landings (by weight; a proxy for directed summer flounder trips). Those non-target species making up 2% or percentage of total catch weight over that time period include little skate, spiny dogfish, clearnose skate, winter skate, unknown skate, Northern sea robin, barndoor skate, and black sea bass (Figure 28). Scup composed slightly less than 2% of the total catch weight; however, they are included as non-target species in this analysis given their management under the same FMP as summer flounder and black sea bass.

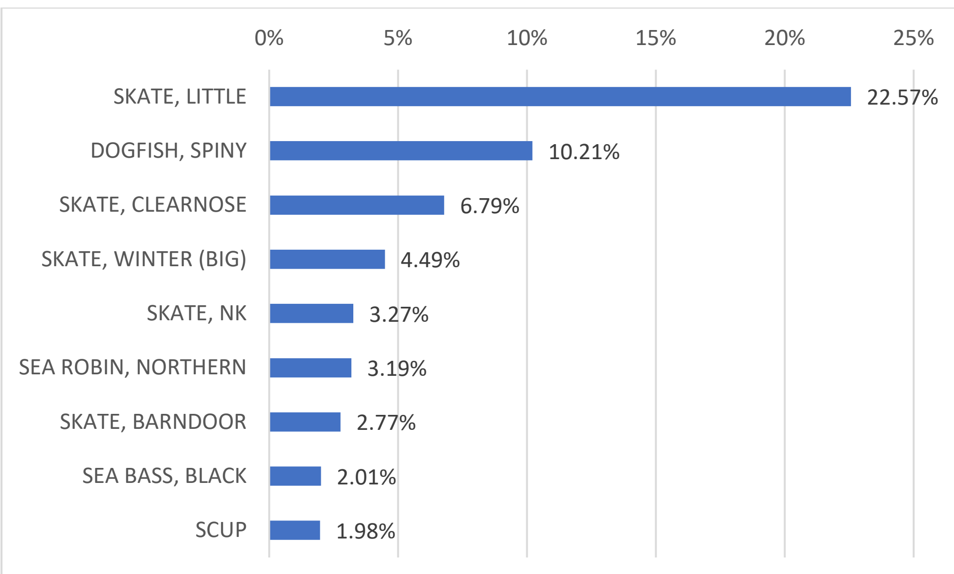


Figure 28: Most commonly caught fish species on observed hauls where summer flounder >50% of catch by weight, 2012-2016. Source: NEFOP data as of July 2016.

Description and Status of Major Non-Target Species

The stock status and management status of the non-target species identified above are briefly described below. Management measures for the Mid-Atlantic and New England Fishery Management Council-managed species (skates, spiny dogfish, black sea bass, and scup) include AMs to address ACL overages through reductions in landings limits in following years. AMs for all these species take discards into account. These measures help to mitigate negative impacts from discards in these recreational fisheries, and other fisheries.

Northeast Skate Complex

The following information is taken from NEFMC 2018. The Northeast skate complex fishery in the Greater Atlantic Region includes seven skate species and operates from Maine to Cape Hatteras, North Carolina, and from inshore to offshore waters on the edge of the continental shelf. Skate is mostly harvested incidentally in trawl and gillnet fisheries targeting groundfish, monkfish, and sometimes scallops. The Northeast skate complex fishery consists of seven species: *Leucoraja ocellata* (winter skate); *Dipturis laevis* (barndoor skate); *Amblyraja radiata* (thorny skate); *Malacoraja senta* (smooth skate); *Leucoraja erinacea* (little skate); *Raja eglanteria* (clearnose skate); and *Leucoraja garmani* (rosette skate). Given that most of these species were identified as non-target catch in the commercial summer flounder fishery, along with "unknown skates," all of these species are briefly summarized here.

Spiny Dogfish

Spiny dogfish (*Squalus acanthias*) is a coastal shark with populations on the continental shelves of northern and southern temperate zones throughout the world. It is the most abundant shark in the western north Atlantic and ranges from Labrador to Florida, but is most abundant from Nova Scotia to Cape Hatteras, North Carolina. Its major migrations on the northwest Atlantic shelf are north and south, but it also migrates inshore and offshore seasonally in response to changes in water temperature. Spiny dogfish are jointly managed by the MAFMC and the NEFMC; the Commission also has a complementary FMP for state waters.

Spiny dogfish have a long life, late maturation, a long gestation period, and relatively low fecundity, making them generally vulnerable to depletion. Fish, squid, and ctenophores dominate the stomach contents of spiny dogfish collected during the NEFSC bottom trawl surveys but they are opportunistic and have been found to consume a wide variety of prey. More detailed life history information can be found in the EFH source document for spiny dogfish at: http://www.nefsc.noaa.gov/publications/tm/tm203/tm203.pdf.

Northern Sea Robin

Northern sea robins *(Prionotus carolinus)* have not been assessed, therefore their overfished and overfishing status is unknown. Sea robins are not managed directly at the federal or state level. Northern sea robins are distributed from Nova Scotia to central Florida, and are most common between Cape Cod, MA and Cape Hatteras, NC. Sea robins typically inhabit coastal waters over open sand or mud from near shore to depths of about 170 meters, and undertake southerly/offshore migrations in the winter (Gilbert and Williams 2002).

Black Sea Bass

Black sea bass are protogynous hermaphrodites, meaning the majority are born females and some individuals later transition to males. Black sea bass are commonly associated with physical structures such as reefs, although they utilize a variety of habitats including open bottom. Both their protogynous life history and structure-orienting behavior have posed challenges for prior analytical assessments of this species. The 2016 benchmark stock assessment working group (NEFSC 2017) spent a great deal of time analyzing and simulating various datasets to gain a better understanding on how these life history characteristics impact the assessment and the black sea bass population.

The most recent benchmark stock assessment for black sea bass was completed in December 2016. This assessment indicated that the black sea bass stock north of Cape Hatteras, NC was not overfished and overfishing was not occurring in 2015. SSB averaged around 6 million lbs from the late 1980's and early 1990's and then steadily increased from 1997 to 2002 when it reached 18.7 million lbs. There was then a decline in SSB until 2007(8.9 million lbs), followed by a steady increase through 2015 with SSB at its highest level estimated. The model-estimated SSB in 2015 was 48.89 million lbs (22,176 mt), 2.3 times SSB at maximum sustainable yield, SSB_{MSY} = 21.31 million lbs (9,667 mt).

Scup

The most recent benchmark stock assessment for scup took place in 2015 as part of the 60th Stock Assessment Work Group and Stock Assessment Review Committee (SAW/SARC 60) and included data through 2014 (NEFSC 2015). A stock assessment update was conducted in 2017 with catch and survey data through 2016. The update assessment found that scup was not overfished and overfishing was not occurring in 2016 relative to the biological reference points from the benchmark assessment (Terceiro 2017b). SSB was very low and averaged around 19.38 million lbs from the early 1980's and late 1990's and then steadily increased from 2000 to a peak in 2011 when it reached 513.80 million lbs. SSB has declined since its peak in 2011 but remains very high and increased slightly in 2016. The model-estimated SSB in 2016 was 396.60 million lbs (179,898 mt), 2.1 times SSB at maximum sustainable yield, SSB_{MSY} = 192.47 million lbs (87,302 mt).

1.4 HABITAT CONSIDERATIONS

1.4.1 Description of Physical Habitat

Summer flounder inhabit the northeast U.S. shelf ecosystem, which includes the area from the Gulf of Maine south to Cape Hatteras, extending seaward from the coast to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream. The northeast shelf ecosystem includes the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, and the continental slope.

The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and strong currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, North Carolina.

The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. It is fairly homogenous, with exceptions at the shelf break, some of the canyons, the Hudson Shelf Valley, and in areas of glacially rafted hard bottom. The continental shelf in this region was shaped largely by sea level fluctuations caused by past ice ages. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet and the subsequent rise in sea level. Currents and waves have since modified this basic structure.

Greene et al. (2010) identified and described Ecological Marine Units (EMUs) in New England and the Mid-Atlantic based on sediment type, seabed form (a combination of slope and relative depth)[2], and benthic organisms.[3] According to this classification scheme, the sediment composition off New England and the Mid-Atlantic is about 68% sand, 26% gravel, and 6% silt/mud. The seafloor is classified as about 52% flat, 26% depression, 19% slope, and 3% steep (Table 11).

Artificial reefs are another significant Mid-Atlantic habitat. These localized areas of hard structure were formed by shipwrecks, lost cargoes, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle and Zetlin 2000). While some of these materials were deposited specifically for use as fish habitat, most have an alternative primary purpose; however, they have all become an integral part of the coastal and shelf ecosystem. In general, reefs are important for attachment sites, shelter, and food for many species, and fish predators such as tunas may be attracted by prey aggregations, or may be behaviorally attracted to the reef structure.

Like all the world's oceans, the western North Atlantic is experiencing changes to the physical environment as a result of global climate change. These changes include warming temperatures; sea level rise; ocean acidification; changes in stream flow, ocean circulation, and sediment deposition; and increased frequency, intensity, and duration of extreme climate events. These changes in physical habitat can impact the metabolic rate and other biological processes of marine species. As such, these changes have implications for the distribution and productivity of many marine species. Several studies demonstrate that the distribution and productivity of several species in the Mid-Atlantic have changed over time, likely because of changes in physical habitat conditions such as temperature (e.g. Weinberg 2005, Lucey and Nye 2010, Nye et al. 2011, Pinsky et al. 2013, Gaichas et al. 2015).

[2] Seabed form contains the categories of depression, mid flat, high flat, low slope, side slope, high slope, and steep slope.
[3] See Greene et al. 2010 for a description of the methodology used to define EMUs.

Table 11: Composition of Ecological Marine Units (EMUs) off New England and the Mid-Atlantic (Greene et al. 2010). EMUs which account for less than 1% of the surface area of these regions are not shown.

Ecological Marine Unit	Percent Coverage
High Flat Sand	13%
Moderate Flat Sand	10%
High Flat Gravel	8%
Side Slope Sand	6%
Somewhat Deep Flat Sand	5%
Low Slope Sand	5%
Moderate Depression Sand	4%
Very Shallow Flat Sand	4%
Side Slope Silt/Mud	4%
Moderate Flat Gravel	4%
Deeper Depression Sand	4%
Shallow Depression Sand	3%
Very Shallow Depression Sand	3%
Deeper Depression Gravel	3%
Shallow Flat Sand	3%
Steep Sand	3%
Side Slope Gravel	3%
High Flat Silt/Mud	2%
Shallow Depression Gravel	2%
Low Slope Gravel	2%
Moderate Depression Gravel	2%
Somewhat Deep Depression Sand	2%
Deeper Flat Sand	1%
Shallow Flat Gravel	1%
Deep Depression Gravel	1%
Deepest Depression Sand	1%
Very Shallow Depression Gravel	1%

1.4.2 Environmental Requirements of Summer Flounder

Summer flounder habitat includes pelagic waters, demersal waters, saltmarsh creeks, seagrass beds, mudflats, and open bay areas from the Gulf of Maine through North Carolina. The center of its abundance lies within the Middle Atlantic Bight from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. Summer flounder exhibit strong seasonal inshore-offshore movements, although their movements are often not as extensive as compared to other highly migratory species. Adult and juvenile summer flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the fall and winter.

Juvenile summer flounder have been shown to make use of several substrate types, including sand, shell, oyster bars, and mud, as well as transition areas between sand to silt/clay. Substrate preferences of juvenile summer flounder may be correlated to presence and types of predators and prey. Juveniles make extensive use of marsh creeks and other estuarine habitats. Other studies have shown that juvenile summer flounder also make use of vegetated habitats such as sea grass beds, as well as aggregations of macroalgae (Packer et al. 1999).

Adult summer flounder generally prefer sandy habitats, including areas of quartz sand, coarse sand, and shell, but can be found in a variety of habitats with both mud and sand substrates including marsh creeks, seagrass beds, and sand flats. As with juvenile summer flounder, adults are also known to utilize vegetation such as seagrass beds, where they are able to ambush prey and avoid predation (Packer et al. 1999).

1.4.3 Identification and Distribution of Essential Habitat

EFH for summer flounder was designated through Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP (MAFMC 1998). EFH designations for each life stage are described below and pictured in Figure 29.

Eggs: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of the all the ranked ten-minute squares for the area where summer flounder eggs are collected in the MARMAP survey. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral, Florida, to depths of 360 ft. In general, summer flounder eggs are found between October and May, being most abundant between Cape Cod and Cape Hatteras, with the heaviest concentrations within 9 miles of shore off New Jersey and New York. Eggs are most commonly collected at depths of 30 to 360 ft.

Larvae: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where summer flounder larvae are collected in the MARMAP survey. 2) South of Cape Hatteras, EFH is the nearshore waters of the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral Florida, in nearshore waters (out to 50 miles from shore). 3) Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database, in the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as greater than 25 ppt) salinity zones. In general, summer flounder larvae are most abundant nearshore (12-50 miles from shore) at depths between 30 to 230 ft. They are most frequently found in the northern part of the Mid-Atlantic Bight from September to February, and in the southern part from November to May.

Juveniles: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37 ^{o}F and salinities from 10 to 30 ppt range.

Adults: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer Continental Shelf at depths of 500 ft in colder months.

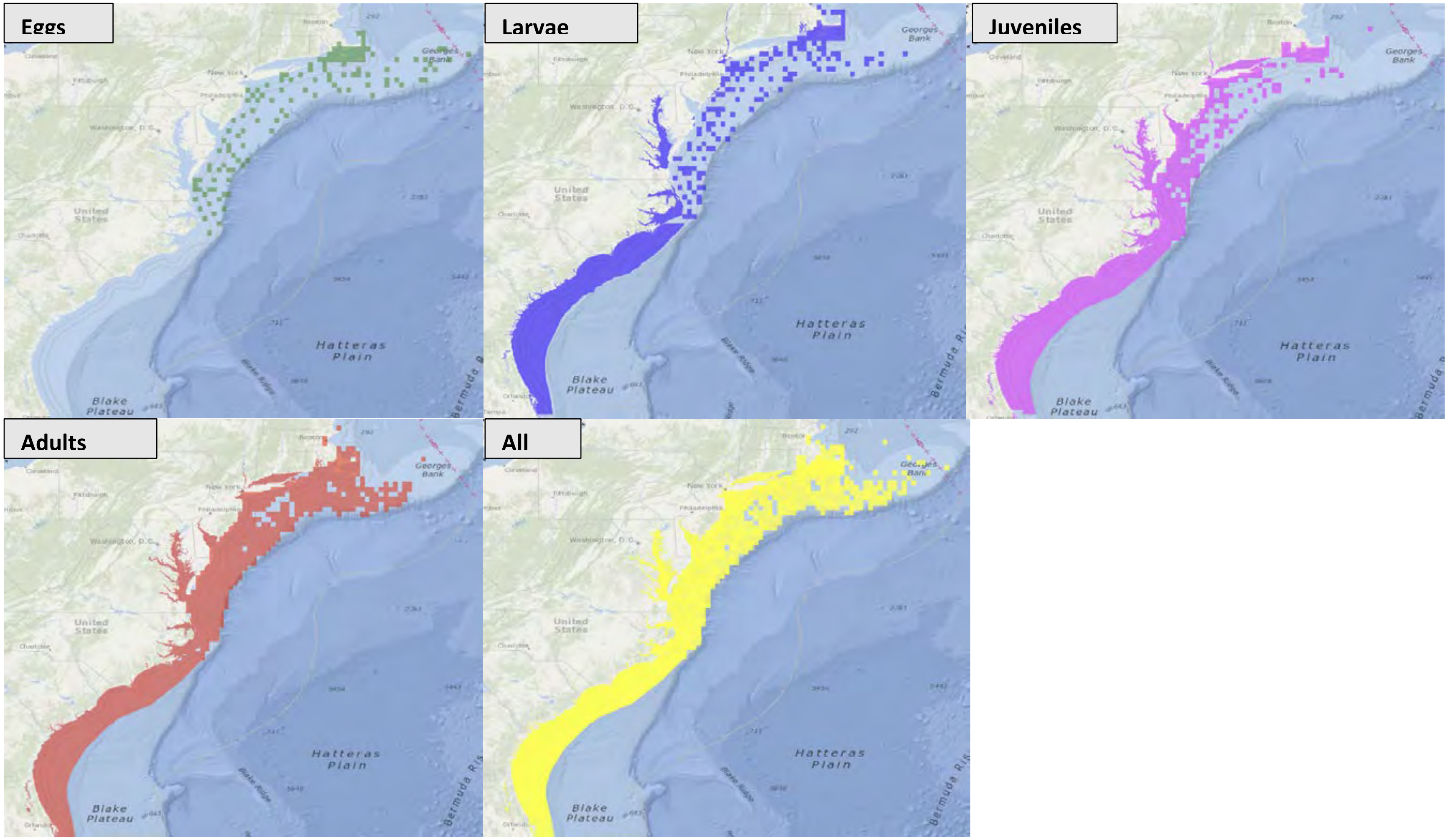


Figure 29: Designated EFH for summer flounder at various life stages. Image source: NOAA Office of Habitat Conservation EFH Mapper.

1.4.4 Anthropogenic Impacts on Summer Flounder and Their Habitat

The principal gear used in commercial fishing for summer flounder is the otter trawl, which historically has accounted for over 90% of the landings.

According to federal Vessel Trip Report data, otter trawls accounted for about 98% of all commercial landings over 2012-2016 (Table 12). Smaller amounts were caught with sink gill nets, scallop trawls, and hand lines (less than 1% each according to VTR data).

A disadvantage of analyzing landings by gear type using federal VTR data is that it does not include state-only permitted vessels submitting only state level VTRs. However, a weakness of the dealer data is the relatively large proportion of missing or unknown "gear type" entries. Thus, there are advantages and disadvantages of both data types and they are shown for comparison in Table 10 for years 2012-2016.

Only those gear types which contact the bottom impact physical habitat. These gears have a variety of impacts on habitat. Stevenson et al. (2004) compiled a detailed summary of several studies of the impacts of a variety of gear types on marine habitats. Conclusions relevant for this action are briefly summarized below with a focus on bottom trawl gear since this is the predominant gear type used to harvest summer flounder.

Otter trawl doors can create furrows in sand, mud, and gravel/rocky substrates. Studies have found furrow depths that range from 2 to 10 cm. Bottom trawl gear can also re-suspend and disperse surface sediments and can smooth topographic features. It can also result in reduced abundance, and in some cases reduced diversity, of benthic species such as nematodes, polychaetes, and bivalves. It can also have short-term positive ecological impacts such as increased food value and increased chlorophyll production in surface sediments. The duration of these impacts varies by sediment type, depth, and frequency of the impact (e.g. a single trawl tow vs. repeated tows). Some studies have documented effects that lasted only a few months. Other studies found effects that lasted up to 18 months. Impacts tend to have shorter durations in dynamic environments with less structured bottom composition compared to less dynamic environments with structured bottom. Shallower water, stronger bottom currents, more wave action, finer-grained sediments, and higher frequencies of natural disturbance are characteristics that make environments more dynamic (Stevenson et al. 2004).

Compared to otter trawls and dredges, Stevenson et al. (2004) summarized fewer studies on other bottom tending gears such as traps. Morgan and Chuenpagdee (2003) found that the impacts of bottom gill nets, traps, and longlines were generally limited to warm or shallow-water environments with rooted aquatic vegetation or "live bottom" environments (e.g. coral reefs). These impacts were of a lesser degree than those from bottom trawls and dredges. Eno et al. (2001) found that traps can bend, smother, and uproot sea pens in soft sediments; however, sea pen communities were largely able to recover within a few days of the impact. Due to the small percentage of non-trawl gear types used in the commercial scup fishery, the impacts of the alternatives in this document (section 7.0) are primarily focused on the bottom trawl fishery rather than on other gear types.

Table 12: Gear type breakdown for summer flounder landings, 2012-2016 combined, from dealer data and VTR data. Source: NMFS dealer data (AA tables) as of February 2017 and NMFS federal VTR data as of January 2018. Gear types accounting for less than 0.5% of landings are not shown.

Gear Type: VTR Data (2012-2016)	% of Summer Flounder Landings
TRAWL, OTTER, BOTTOM, FISH	97.76
BEAM TRAWL, OTHER	1.2%
GILL NET, SINK, OTHER	0.9%
TRAWL, OTTER, BOTTOM, SCALLOP	0.8%
HAND LINE, OTHER	0.7%
Gear Type: Dealer Data (2012-2016)	% of Summer Flounder Landings
TRAWL, OTTER, BOTTOM, FISH	89.8%
UNKNOWN	3.5%
HAND LINE, OTHER	2.4%
GILL NET, SINK, OTHER	0.9%
TRAWL, OTTER, BOTTOM, SCALLOP	0.7%
BEAM TRAWL, OTHER	0.6%

1.4.5 Description of Programs to Protect, Restore, & Preserve Summer Flounder

The Mid-Atlantic Council developed some fishery management actions with the sole intent of protecting marine habitats. For example, in Amendment 9 to the Mackerel, Squids, and Butterfish FMP, the Council determined that bottom trawls used in Atlantic mackerel, longfin and *Illex* squid, and butterfish fisheries have the potential to adversely affect EFH for some federally-managed fisheries (MAFMC 2008). As a result of Amendment 9, closures to squid trawling were developed for portions of Lydonia and Oceanographer Canyons. Subsequent closures were implemented in these and Veatch and Norfolk Canyons to protect tilefish EFH by prohibiting all bottom trawling activity. In addition, amendment 16 to the Mackerel, Squid, and Butterfish FMP prohibits the use of all bottom-tending gear in fifteen discrete zones and one broad zone where deep sea corals are known or highly likely to occur (81 Federal Register 90246, December 14, 2016).

Actions implemented in the Summer Flounder, Scup, and Black Sea Bass FMP that affected species with overlapping EFH were considered Amendment 13 (MAFMC 2002). The analysis in Amendment 13 indicated that no management measures were needed to minimize impacts to EFH because the trawl fisheries for summer flounder, scup, and black sea bass in Federal waters are conducted primarily in high energy mobile sand and bottom habitat where gear impacts are minimal and/or temporary in nature. The principal gears used in the recreational fisheries for scup are rod and reel and handline. These gears have minimal adverse impacts on EFH in the region (Stevenson et al. 2004).

2.0 GOALS AND OBJECTIVES

2.1 HISTORY OF MANAGEMENT

The Council first considered the development of an FMP for summer flounder in late 1977. It was determined that the initial plan would be prepared by the Commission, and New Jersey was designated as the state with lead responsibility for the plan. The state/federal draft was adopted by the Commission at its annual meeting in October 1982. The original management measure recommendations in the Commission's plan included a 14-inch total length minimum fish size or a 5.5" minimum net mesh for mobile fishing gear; seasonal measures were not included.

The original Council Summer Flounder FMP (MAFMC 1988) was based on the Commission's management plan and was approved by NMFS in 1988. At the time of Council adoption of the FMP, most states had not implemented the Commission plan. Massachusetts, Rhode Island, Connecticut, New York, and Delaware had 14-inch minimum size limits. New Jersey had a 13-inch limit, while Maryland and Virginia had 12-inch limits and North Carolina had an 11-inch limit. Minimum mesh regulations were in effect for some or all of the waters and/or gear in New Jersey (4.5"), Maryland (2.5" gill net), Virginia (4.5"), and North Carolina (4.5").

The Council's original FMP adopted for public hearings in October 1987 included a minimum fish size and a minimum otter trawl mesh size. In light of industry opposition and negative comments on the enforceability of minimum net mesh rules by NMFS and the Coast Guard, the mesh provision was dropped by the Council in the final version of the FMP (and taken up later in Amendments 1 and 2, as described below). The final version of the original Council FMP did include a 13-inch minimum size requirement (for both recreational and commercial possession), permit requirements, and a plan to begin annually reviewing fishing mortality estimates and the performance of management measures after the third year of FMP implementation.

Joint Management

The Council and Commission work cooperatively to develop fishery regulations for summer flounder off the east coast of the United States. The Council and Commission work in conjunction with NMFS, which serves as the federal implementation and enforcement entity. This cooperative management endeavor was developed because a significant portion of the catch is taken from both state (0-3 miles offshore) and federal waters (3-200 miles offshore, also known as the Exclusive Economic Zone, or EEZ).

The joint FMP for summer flounder became effective in 1988 and established the management unit for summer flounder as U.S. waters in the western Atlantic Ocean from the southern border of North Carolina northward to the U.S.-Canadian border. The FMP also established measures to ensure effective management of summer flounder fisheries, which currently include catch and landings limits, commercial quotas, recreational harvest limits, minimum fish sizes, gear regulations, permit requirements, and other provisions as prescribed by the FMP.

There are large commercial and recreational fisheries for summer flounder. These fisheries are managed primarily using output controls (catch and landings limits), with 60 percent of the landings being allocated to the commercial fishery as a commercial quota and 40 percent allocated to the recreational fishery as a recreational harvest limit. Management also uses minimum fish sizes, gear regulations, permit requirements, and other provisions as prescribed by the FMP. Summer flounder was under a stock rebuilding strategy beginning in 2000 until it was declared rebuilt in 2011, based on an assessment update with data through 2010. Although the most recent (2016) assessment update included a revised biomass time series indicating that estimated biomass never actually reached the target biomass, current biomass estimates are still above the minimum stock size threshold that would trigger a new rebuilding plan (section 1.2.8).

The ASMFC has primary authority for development of FMPs for state waters under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) of 1993. Recognizing the interjurisdictional nature of fishery resources and the necessity of the states and federal government coordination on regulations, under this act, all Atlantic coast states that are included in a Commission fishery management plan must implement required conservation provisions of the plan or the Secretary of Commerce may impose a moratorium for fishing in the noncompliant state's waters.

The Council, under the MSA, has primary authority for developing federal FMPs for Council managed species. The Commission and the Council meet jointly at least twice a year to approve management measures for the fishery for the upcoming year or years. State fishery departments implement FMP measures under the ACFCMA, while NOAA Fisheries issues rules to implemented approved FMPs prepared by the Councils.

State regulations apply to vessels fishing in state waters; however, vessels with federal summer flounder permits must abide by the federal regulations regardless of where they are fishing. If state and federal measures differ, the vessel must abide by whichever measure is more restrictive. Approved regulations are enforced through cooperative actions of the U.S. Coast Guard, NMFS Law Enforcement, and state authorities.

The Secretary of Commerce has the ultimate responsibility for summer flounder measures. The Council's proposed FMPs and amendments are submitted to the Secretary of Commerce for approval, which in most cases is delegated to NMFS. NMFS typically prepares specifications and implementing federal regulations for the summer flounder fishery based on the recommendations of the Council and Commission, if such recommendations are deemed to be consistent with the MSA and other applicable law. NMFS publishes proposed rules in the *Federal Register* for public comment. As mentioned above, the Secretary of Commerce also has ultimate responsibility for determining whether individual state measures are consistent with the Commission's FMP. If the Commission finds a state out of compliance and is unable to rectify this issue, the Commission may notify the Secretary. Within 30 days of receiving the Commission's notice, the Secretary must decide whether the state is out of compliance, and if so, whether the noncompliance compromises the conservation of the fishery. If it does, the Secretary can impose a moratorium on all summer flounder fishing (commercial and recreational), until the Commission and the Secretary determine that the noncompliance has ceased.

Annual Specifications

Summer flounder catch limits and other management measures established under the FMP are annually reviewed and may be revised through a process known as "specifications." This primarily concerns the setting of annual catch and landings limits, which typically fluctuate from year to year based on biological trends in the stock as well as performance of the fisheries. The Council and Board may also modify certain commercial or recreational management measures during the specifications process, such as minimum size limits, possession limits, seasons, gear requirements and restrictions, and exemption programs.

The Council’s Scientific and Statistical Committee (SSC) recommends annual Acceptable Biological Catch (ABC) levels for summer flounder, which are then approved by the Council and Commission and submitted to NMFS for final approval and implementation. The ABC is divided into commercial and recreational Annual Catch Limits (ACLs), based on the landings allocation prescribed in the FMP and the recent distribution of discards between the commercial and recreational fisheries. Amendment 2 (1992) set the allocation of 60% of the total allowable landings (TAL) to the commercial sector as a commercial quota, with the other 40% of the TAL allocated to the recreational sector as a recreational harvest limit. Projected discards are apportioned between the commercial and recreational sectors based on a three-year moving average of discards by sector, and combined with the landings limits to derive the sector-specific ACLs.

The Council first implemented recreational and commercial ACLs, with a system of overage accountability, in 2012 (MAFMC 2011). Prior to this time, the fishery was managed based on total allowable landings. Both the ABC and the ACLs are catch limits (i.e., include both projected landings and discards), while the commercial quota and the recreational harvest limit are landing limits.

Each year during the specifications process, the SSC meets to review the latest scientific information, including any recent benchmark assessments, assessment updates, or data updates. The SSC either recommendations ABCs for the upcoming fishing year(s), or reviews previously implemented ABCs to ensure they are still appropriate. The Monitoring Committee then meets to recommend any changes to the ACLs, RHL, commercial quota, or commercial management measures (commercial minimum size, mesh size requirements, possession limits triggering the minimum mesh requirements, and exemption programs). The Council and Board typically meet jointly in August to review the SSC recommendations, Monitoring Committee recommendations, and Advisory Panel comments. The Council and Board recommend any necessary new specifications or changes to implemented specifications to NMFS (Table 13).

The recreational measures are considered later in the year (Table 13) because recreational data from the Marine Recreational Information Program (MRIP) becomes available in two-month “waves.” The Council and Board want to consider the most up-to-date recreational data possible when making recommendations for the upcoming year.

Table 13: Typical specifications cycle for summer flounder, with major steps and products throughout the year. Details may change in a given year if necessary.

Group	*Timing*	*Action or Product*
Council staff	May/June	Council staff summarizes recent fishery performance data.
Council and Commission Advisory Panels	June/July	Council and Commission Advisory Panels meet to develop Fishery Performance Reports, summarizing recreational and commercial advisor observations on catch and landings trends, ecological trends, economic trends, and management issues.
NEFSC	June/July	NEFSC finalizes any assessment reports, possibly including: benchmark assessments (major changes and peer review), assessment updates (existing model updated with new data), or data updates (recent catch, landings, and fishery independent survey indices).
Council staff	June/July	Assessment information and the Council's risk policy is used to develop recommendations on catch limits and commercial management measures for the upcoming year(s) (up to 3 years at a time).
Council's SSC	July	SSC recommends or reviews the Annual Biological Catch (ABC) limits, or recommend new limits for the upcoming year(s), based on any assessment information and the Council's risk policy.
Council and Commission joint Monitoring Committee	July	Monitoring Committee reviews fishery performance and recommends sector-specific Annual Catch Limits (ACLs) and Annual Catch Targets (ACTs), as well as any changes to commercial management measures including minimum fish size, minimum mesh size, other gear requirements and restrictions, commercial possession limits, and exemption programs.
Council and Commission Advisory Panels	Late July/ early August	Advisory Panels review recent assessment information (if not available at previous meeting), and to comment on the recommendations of the SSC and Monitoring Committee.
Council and Board	August	Council and Board review information and recommendations from prior meetings and may recommend new specifications or changes to previously implemented specifications.
Council staff	Fall	Council staff develops supporting documents for submission to NMFS. NMFS goes through the rulemaking process to implement the catch limits, including a public comment process.
Council staff	November	Staff develops recreational information and recommendations for management strategies/specific measures (bag limit, size limit, and season) for upcoming fishing year.
Monitoring Committee	Mid-November	Monitoring Committee meets to recommend recreational management measures (bag limit, size limit, and season) and recreational management strategies for the upcoming fishing year.
Council and Commission Advisory Panels	November/ December	The Advisory Panels meet to discuss recreational fishery performance and make recommendations regarding recreational management measures.
Council and Commission's Summer Flounder Board	Mid-December	The Council and Board approve either conservation equivalency or specific coastwide measures for the upcoming year. The Board may also approve or discuss general management strategies affecting state waters measures.
Commission's Technical Committee and Board	January-April	If applicable, TC develops state-specific proposals for recreational measures that are considered and approved by the Board. Commission staff then submits letter to NMFS certifying that combination of state measures is conservationally equivalent to coastwide measures and will achieve the next year's RHL.
Council staff	Late winter/ early Spring	Council staff develops documents supporting the decisions on federal recreational measures, for submission to NMFS. NMFS rulemaking occurs.

Amendments and Other FMP Modifications
The following outlines Amendments and other modifications to the FMP to present specific to management of the commercial fishery.

Amendment 1 to the FMP (1990) added an overfishing definition to the FMP and proposed a minimum net mesh size to protect the 1989 and 1990 year classes. NMFS approved the overfishing definition, but disapproved the minimum net mesh provision because the mesh size along with the existing minimum fish size would not allow the overfished resource to rebuild.

Amendment 2 (1993) was a comprehensive amendment designed to rebuild a severely depleted summer flounder stock. Amendment 2 was approved by NMFS on 6 August 1992. It contained a number of management measures to regulate the commercial and recreational fisheries for summer flounder, including a rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions including minimum mesh sizes, and permit and reporting requirements. Amendment 2 established a mesh size exemption for the flynet fishery, as well as the small mesh exemption area, an offshore area where fishermen participating in the winter trawl fishery may obtain an authorized exemption from the minimum mesh size regulations. Amendment 2 also established the Summer Flounder Monitoring Committee, which meets annually to review the best available biological and fisheries data and make recommendations regarding the commercial quota and other management measures.

Amendment 3 (1993) modified the demarcation line for the small mesh exempted fishery area, and increased the large mesh net possession threshold (established in Amendment 2) to 200 lbs during the winter fishery (November 1-April 30). Amendment 3 also stipulated that otter trawl vessels fishing from 1 May through 31 October could only retain up to 100 lbs of summer flounder before using the large mesh net.

Amendment 4 (1993) adjusted Connecticut's commercial landings of summer flounder and revised the state-specific shares of the coastwide commercial summer flounder quota as requested by the Commission. **Amendment 5** (1993) allowed states to transfer or combine portions of their commercial quota. **Amendment 6** (1994) allowed multiple nets on board if they were properly stowed and changed the deadline for publishing the overall catch limits and commercial management measures to 15 October and the recreational management measures to 15 February. **Amendment 7** (1995) revised the fishing mortality rate reduction schedule for summer flounder.

In 1996, NMFS requested that the black sea bass and scup regulations be incorporated into another FMP to reduce the number of separate fisheries regulations issued by the federal government. As a result, the Scup FMP and the Black Sea Bass FMP were incorporated into the summer flounder regulations as **Amendments 8 and 9** (1996) to the Council's Summer Flounder FMP, respectively. There are no Amendments 8 or 9 in the Commission's FMP; the Board opted at the time to manage Scup and Black Sea Bass under separate FMPs. The Council's Amendments 8 and 9 were major amendments that implemented a number of management measures for scup and black sea bass including commercial quotas, commercial gear requirements, minimum size limits, recreational harvest limits, and permit and reporting requirements.

Amendment 10 (1997) made several changes to the summer flounder regulations implemented by Amendment 2 and later amendments to the Summer Flounder, Scup and Black Sea Bass FMP. Specifically, this amendment modified the commercial minimum mesh regulations, continued the moratorium on entry of additional commercial vessels, removed provisions pertaining to the expiration of the moratorium permit, prohibited the transfer of summer flounder at sea, and established a special permit for party/charter vessels to allow the possession of summer flounder parts smaller than the minimum size.

Amendment 11 (1999) was implemented to achieve consistency among Mid-Atlantic and New England FMPs regarding vessel replacement and upgrade provisions, permit history transfer, splitting, and renewal regulations for fishing vessels issued Northeast Limited Access federal fishery permits.

Amendment 12 (1999) brought the FMP into compliance with the new and revised National Standards and other required provisions of SFA. Specifically, the amendment revised the overfishing definitions (National Standard 1) for summer flounder, scup, and black sea bass and addressed the new and revised National Standards (National Standard 8 - consider effects on fishing communities; National Standard 9 - reduce bycatch; and National Standard 10 - promote safety at sea) relative to the existing management measures. The amendment also identified essential habitat for summer flounder, scup and black sea bass. In addition, Amendment 12 added a framework adjustment procedure that allows the Council to add or modify management measures through a streamlined public review process. Amendment 12 was partially approved on 28 April 1999.

Amendment 13 (2003) addressed the disapproved sections of Amendment 12, revised the black sea bass commercial quota system, and addressed other black sea bass management measures. Although there were some alternatives included in public hearing drafts of the document that could have resulted in changes to summer flounder or scup management measures, none were preferred alternatives or approved for implementation. As a result, Amendment 13 has no impact on summer flounder or scup.

Amendment 14 (2007) established a rebuilding schedule for scup and made the Scup Gear Restricted Areas (GRAs) modifiable through the framework adjustment process. **Amendment 16** (2007) implemented Standardized Bycatch Reporting Methodology (SBRM). **Amendment 15** (2011) Established Annual Catch Limits (ACLs) and Accountability Measures (AMs), as required by the 2007 reauthorization of the MSA. **Amendment 19** (2013) modified the AMs for the Council's recreational fisheries. **Amendment 17** (2015) implemented a revised version of the Standardized Bycatch Reporting Methodology (SBRM). **Amendment 18** (2015) eliminated the requirement for vessel owners to submit "did not fish" reports for the months or weeks when their vessel was not fishing, and removed some of the restrictions for upgrading vessels listed on Federal fishing permits.

2.3 MANAGEMENT UNIT

Summer flounder, scup, and black sea bass fisheries are managed cooperatively by the Commission in state waters (0-3 miles), and by the Council and NOAA Fisheries in Federal waters (3-200 miles). The management unit for summer flounder, scup, and black sea bass in US waters is the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border.

2.4 PURPOSE AND NEED FOR ACTION

Table 14 summarizes the needs for action and the corresponding purposes. The "Need for Action" describes "Why is the Board and Council taking a given action?" For each "Need for Action" there is a "Corresponding Purpose," which is how the Board and Council proposes to address the Need for Action. Additional details on the needs and purposes are provided after the table. The alternatives described in this document provide a reasonable range of specific tools to address each purpose, i.e. solve the problem.

Table 14: Summary of purposes and needs for this action.

Need for Action	Corresponding Purpose	Alternatives That Address This Purpose
Issue 1. Federal permit qualification criteria have not changed since establishment in 1993. Stakeholders believe lenient original qualifications criteria resulted in more permits than the fishery could profitably support in the long term. Recent lower quotas and concerns about inactive vessels reentering the fishery led to a perceived need to adjust fleet size to more closely reflect current stock and fishery conditions.	Consider reducing federal permit capacity	• 1A (Status Quo) • 1B-1 • 1B-2 • 1B-3 • 1B-4 • 1B-5 • 1B-6 • 1B-7
Issue 2. Current commercial allocation was last modified in 1993. Summer flounder distribution, biomass, and fishing effort has changed since then, and some believe initial allocations may not have been equitable or were based on flawed data; therefore, stakeholders requested evaluation of alternative allocation systems.	Consider modifications to commercial quota allocation (revised basis for state-by-state allocations or other modified allocation system)	• 2A (Status Quo) • 2B-1 • 2B-2 • 2C-1 • 2C-2 • 2D-1 • 2D-2
Issue 3. Council and Board members would like the ability to address landings flexibility through a simpler and more efficient action in the future if necessary (i.e., if this issue is not addressed by the states or through the Commission process).	Consider adding landings flexibility as a frameworkable issue in the Council's FMP	• 3A(Status Quo) • 3B

Issue 1: Consider Reducing Federal Permit Capacity

Qualifying criteria for federal commercial moratorium permits for summer flounder were determined in Amendment 2 to the Summer Flounder, Scup, and Black Sea Bass FMP (1993), and have not been modified since that time. Stakeholders have raised concerns that the qualifying criteria chosen at that time (landed any summer flounder between January 26, 1985 and January 26, 1990) may have been too lenient, resulting in more federal permits than the fishery could profitably support long-term. Many stakeholders believe that the current qualification criteria are thus outdated and should be re-evaluated based on more recent participation data and more comprehensive and accurate ladings data that have been collected in recent decades.

In addition, as both the understanding of summer flounder stock status and the Council's approaches to quota setting have changed, overall quotas have been reduced from historic levels on average. There is some concern that the current number of federal permits is too high relative to recent stock size estimates and resulting quotas. Given restrictions and trends in other fisheries, there is concern about a potential increase in inactive permits re-entering the fishery for summer flounder, putting further economic strain on participating vessels under recent lower quota levels. Some stakeholder have requested that the Council and Board consider reductions in fleet capacity to ensure access to the resource for those who have actively participated in the fishery either in recent years or consistently over the many years since implementation of Amendment 2. Thus, the purpose associated with alternative set 1 is to consider whether a reduction in federal permit fleet capacity (i.e., the number of commercial moratorium permits for summer flounder) is appropriate, and if so, how qualifying criteria should be revised.

Issue 2: Consider Modifications to Current Commercial Quota Allocation
The current commercial allocation is perceived as outdated given that it was last modified in 1993 and is based on landings data from 1980-1989. Evidence suggests that summer flounder distribution, center of biomass, and location of fishing effort has changed over time, likely due to a combination of stock rebuilding and climate related impacts. As changing environmental conditions have resulted in an apparent shift in the average distribution of biomass for summer flounder, there have been requests to incorporate current distribution information to quota allocations. The intention of incorporating this information is to improve efficiency in the fisheries by providing more access to the resource for states with higher concentrations of summer flounder off their coast.

In addition, many stakeholders believe the initial allocations were not equitable or were developed based on flawed data, for example asserting that historical data for some states is incomplete or inaccurate, in part because data collection methods and requirements during 1980-1989 were not necessarily consistent among states. Some support eliminating state-specific quotas for the winter fishery to increase flexibility in landing location for the commercial fishery. Stakeholders have requested evaluation of alternative systems of allocation that may take these factors into account.

Given the need described above, the purpose associated with alternative set 2 is to consider whether modifications to the commercial quota allocation are appropriate, and if so, how the quota should be re-allocated.

Issue 3: Consider Adding Landings Flexibility as an FMP Framework Provision

The Council and Board are interested in exploring added flexibility in the commercial fishery in the form of landings flexibility policies, which would give commercial vessels greater freedom to land or possess summer flounder in the state(s) of their choice. The groups determined that such policies may be more effectively developed by state level agreements, which may involve fewer enforcement questions than implementing a coastwide landings flexibility policy. The Council and Board thus moved to send a letter to the states requesting the development of partnerships between states toward increased flexibility in state of landing, including policies that may allow vessels to have multiple state possession limits on board for offloading in multiple states. Because it was uncertain how much progress would be made on these state level policies, the Council and Board are also considering, through this action, adding landings flexibility policies as a frameworkable item in the Council's FMP, which would allow a future landings flexibility action to be completed more efficiently. The Board already has the ability to implement these policies via an addendum to the Commission's FMP. The purpose associated with alternative set 3 is to consider adding landings flexibility policies to the list of management measures in the Council's FMP that could be modified via framework action.

2.5 GOALS AND OBJECTIVES

The original FMP objectives were adopted via Amendment 2 to the Summer Flounder FMP in 1993 and have remained unchanged since that time. This amendment proposes options to modify the current objectives of the FMP. The current FMP objectives are:

1. Reduce fishing mortality in the summer flounder, scup and black sea bass fishery to assure that overfishing does not occur.
2. Reduce fishing mortality on immature summer flounder, scup and black sea bass to increase spawning stock biomass.
3. Improve the yield from these fisheries.
4. Promote compatible management regulations between state and federal jurisdictions.
5. Promote uniform and effective enforcement of regulations.
6. Minimize regulations to achieve the management objectives stated above.
7.

2.5.1 Proposed Revisions to FMP Objectives

The Council and Board identified revising the current FMP objectives for summer as a priority for this amendment. The existing FMP objectives have remained unchanged since 1993 (Amendment 2). While the current FMP contains only management *objectives*, the proposed revisions contain both broader *goals* as well as objectives. During development, the Council and Board referenced the following general characterization of goals vs. objectives vs. strategies:

- Goals are broad, big picture, and aspirational. They can help communicate high-level values and priorities for summer flounder management.
- Objectives are more specific and actionable. They can help describe important steps toward accomplishing goals.
- Strategies refer to specific processes, decision points, and actions the Council and Board may take to achieve objectives and support goals. The current and proposed revisions to

FMP objectives do not address specific management strategies, as these are laid out through specific management measures within the FMP.

In the fall of 2015, the Council contracted the Fisheries Leadership & Sustainability Forum (Fisheries Forum)[4] to solicit feedback from the Council's Demersal Committee, the Commission's Summer Flounder, Scup, and Black Sea Bass Board, and members of both bodies' Advisory Panels on the structure, content, and use of FMP goals and objectives. Fisheries Forum staff also reviewed feedback on goals and objectives obtained from the amendment scoping process and the Council's 2012 Visioning and Strategic Planning Project Stakeholder Input Report. Fisheries Forum distilled this feedback into a synthesis of ideas, perspectives, and themes of discussion, integrated with subsequent recommendations from the Summer Flounder Amendment Fishery Management Action Team (FMAT).[5]

In December 2015, the Council and Board held a workshop on summer flounder FMP goals and objectives, where the groups reviewed the Fisheries Forum synthesis of input on goals and objectives and provided additional feedback and direction for revisions. The feedback from this workshop was incorporated into revised draft goals and objectives that were reviewed by the Demersal Committee in November 2017 and, after slight modifications, approved for public hearings by the Council and Board in December 2017.

The proposed revised FMP Goals and Objectives for summer flounder include three goal statements, each with one or more associated management objectives. **The proposed revisions are as follows:**

Goal 1: Ensure the biological sustainability of the summer flounder resource in order to maintain a sustainable summer flounder fishery.

> **Objective 1.1:** Prevent overfishing, and achieve and maintain sustainable spawning stock biomass levels that promote optimum yield in the fishery.

Goal 2: Support and enhance the development and implementation of effective management measures.

> **Objective 2.1:** Maintain and enhance effective partnership and coordination among the Council, Commission, Federal partners, and member states.
>
> **Objective 2.2:** Promote understanding, compliance, and the effective enforcement of regulations.
>
> **Objective 2.3:** Promote monitoring, data collection, and the development of ecosystem-based science that support and enhance effective management of the summer flounder resource.

[4] http://www.fisheriesforum.org/

[5] This synthesis document is available at: http://www.mafmc.org/s/Tab10_SF-goals-and-objectives.pdf.

Goal 3 (combined previous Goals 3 and 4): Optimize economic and social benefits from the utilization of the summer flounder resource, balancing the needs and priorities of different user groups to achieve the greatest overall benefit to the nation.

> **Objective 3.1:** Provide reasonable access to the fishery throughout the management unit. Fishery allocations and other management measures should balance responsiveness to changing social, economic, and ecological conditions with historic and current importance to various user groups and communities.

While these revisions are not included as an explicit alternative set within this amendment, **the proposed revisions above would not be final until approved by the Council and Board through final action within this amendment. The Council and Board are seeking feedback from the public on the proposed revisions during the public hearing process.**

3.0 MONITORING PROGRAM SPECIFICATION

3.1 COMMERCIAL CATCH AND LANDINGS PROGRAM

The reporting requirements for the Summer flounder commercial fishery are specified by the two general permit types: 1) state issued commercial permits and 2) federal moratorium permit. State commercial permits are issued to individuals, with qualification and reporting requirements varying by state. Weekly landings information including species landed by gear and state are submitted by the Atlantic coastal states are submitted by through the Standard Atlantic Fisheries Information System (SAFIS). Landings information assembled in the SAFIS database include both state and federal landings data. **Please note that this Amendment does not propose options to change the current state issued commercial permit qualification or reporting requirements.** The following sub-section provides background the federal moratorium permit system. Options in section 4.2 Commercial Management propose modifications to the requirements to qualify for federal moratorium permits as well as total number of permits.

3.1.1 Federal Moratorium Permit System

There is a single limited access federal permit category for the summer flounder commercial fishery: summer flounder moratorium permits. There is no commercial open access permit category for summer flounder nor are there separate permits for incidental catch. In federal waters, a moratorium permit is required to fish commercially for summer flounder, meaning this permit is required to sell any amount of summer flounder to a federally permitted dealer.

Moratorium permits were established via Amendment 2 to the FMP (1993) and were issued to the owner or operator of a vessel that landed and sold summer flounder in the management unit between January 26, 1985 and January 26, 1990, OR the vessel was under construction for, or was being re-rigged for, use in the directed fishery for summer flounder on January 26, 1990 (provided the vessel had landed summer flounder for sale prior to implementation of Amendment 2).

All moratorium permits must be reissued on an annual basis by the last day of the fishing year for which the permit is required, unless a Confirmation of Permit History (CPH) has been issued (as described below). To be eligible for a moratorium permit, a vessel must have been issued a moratorium permit in the previous year or be replacing a vessel that was issued a moratorium permit after the owner retires the vessel from the fishery.

The fishing and permit history of a vessel is presumed to transfer with the vessel whenever it is bought, sold, or otherwise transferred, unless there is a written agreement verifying that the transferor/seller is retaining the vessel's fishing and permit history for purposes of replacing the vessel. A limited access permit cannot be "split" from another limited access permit; generally, this means if two or more different limited access permits are on one boat they may not be divided and put on two or more boats.

3.1.2 Confirmation of Permit History

A CPH may be issued when a vessel that has been issued a limited access permit has sunk, been destroyed, or has been sold to another person without its permit history. Possession of a CPH will allow the permit holder to maintain landings history of the permit without owning a vessel. A CPH preserves the eligibility of an individual to apply for a limited access permit for a replacement vessel based on the previous qualifying vessel's fishing and permit history at a subsequent time, subject to the replacement provisions specified in the federal regulations at §648.4. The CPH remains valid until the fishing and permit history preserved by the CPH is used to qualify a replacement vessel for a limited access permit.

3.1.3 Vessel Replacements and Upgrades

A permit holder can submit documentation of a replacement of one vessel or CPH with another vessel and the transfer of fishing histories and limited access permit eligibility from the old vessel or CPH to the new vessel. The qualifying vessel or CPH must be under the identical ownership as the replacement vessel. The vessel length and engine horsepower may be increased either through an upgrade or a replacement. A 10% increase in length overall and a 20% increase in engine horsepower are allowed.

3.1.4 Moratorium Right IDs

A moratorium right ID (MRI) is a unique number associated with a specific fishing right for summer flounder, used by NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO) to track where a particular permit history has been transferred in a vessel replacement and over time. This number is created through the original qualification process for a moratorium program.

A single vessel, regardless of its unique vessel permit number, may have multiple different MRIs (e.g., one MRI for its summer flounder permit, one for its scup permit, one for its scallop permit). If permit history has been transferred from Vessel A to Vessel B (i.e., the vessels via a vessel replacement move their fishing permits from one vessel to the other), the MRIs associated with those three permits of Vessel A would be transferred to Vessel B, even though the vessel permit numbers would stay the same for each vessel and would not transfer. For this reason, a single vessel (identified through its permit number) may be associated with multiple MRIs for summer flounder over time. The fishing permit history and associated landings would be captured through a review at the MRI level, rather than the vessel permit.

3.2 RECREATIONAL FISHERY CATCH REPORTING PROCESS

The Marine Recreational Information Program (MRIP) contains estimated summer flounder catches from 1981-2016. Recreational harvest of summer flounder was previously collected through the Marine Recreational Fisheries Statistics Survey (MRFSS), which was a recreational data collection program used from 1981-2003. The MRFSS program was replaced by MRIP in 2004 and was designed to provide more accurate and timely reporting as well as greater spatial coverage. The MRFSS and MRIP programs were simultaneously conducted in 2004-2006 and this information was used to calibrate past MRFSS recreational harvest estimates against MRIP recreational harvest estimates. Recreational catches of summer flounder were downloaded from http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html using the query option.
An online description of MRIP survey methods can be found here:
http://www.st.nmfs.noaa.gov/recreational-fisheries/index#meth

3.3 SOCIAL AND ECONOMIC COLLECTION PROGRAMS

Data on a number of variables relevant to social and economic dimensions of summer flounder fisheries are collected through existing ACCSP data collection programs and MRIP; however, no explicit mandates to collect socioeconomic data for summer flounder currently exist. In addition to landed quantities, commercial summer flounder harvesters and dealers may report ex-vessel prices or value, fishing and landing locations, landing disposition, and a variety of measures capturing fishing effort. MRIP regularly collects information on recreational fishing effort and landings, and occasionally gathers socioeconomic data on angler motivations and expenditures.

3.4 BIOLOGICAL DATA COLLECTION PROGRAMS

3.4.1 Fishery-Dependent Data Collection

Several states and NMFS collect information from commercial and recreational fisheries. The Commonwealth of Massachusetts monitors the commercial fishery through the observation of six directed trawl fishery trips, as well as through dealer Integrated Voice Response (IVR) systems and mandatory fishermen's logbook. Rhode Island monitors the commercial quota for summer flounder using an automated IVR system and dealers are required to provide weekly reports through the IVR of summer flounder landings. Connecticut commercial summer flounder landings are monitored through monthly commercial fishermen logbooks, and weekly and monthly dealer reports. These reports contain daily records of fishing and dealer purchase activity. New York conducts a survey of recreational anglers on open boats throughout the marine district to collect additional data on size composition of kept and discarded fish and also conducts a small mesh otter trawl survey in the Peconic Bays that samples summer flounder. New York requires trip level reporting from all of its commercial fishermen and monitors quota through a combination of trip reports and dealer reports. New Jersey collects data from the commercial trawl fishery and conducts an ocean trawl survey from which data on summer flounder are collected and catch-per-unit-of-effort and distribution information are generated for juveniles and adults. Delaware's commercial landings are monitored through a mandatory monthly harvest report from all state-licensed fishermen. Maryland constructs a juvenile index from trawl data collected in the ocean side bays and is also compiling data on population age, sex, and size from summer flounder taken in pound nets. A statewide voluntary angler survey is conducted that records location, time spent fishing, number of fish caught, number kept, and lengths of the first 20 fish caught. Virginia prepares a young-of-the-year index from data collected from beach seine and trawl surveys. North Carolina conducts two otter trawl surveys for juvenile fluke and collects information on age and growth and catch-per-unit-of-effort for the winter trawl fishery, estuarine gill net fishery, pound net fishery, the ocean gill net fishery, commercial gig, and the long haul seine fishery.

3.4.1.1 Observer Program

As a condition of state and/or federal permitting, many vessels are required to carry at-sea observers when requested. A minimum set of standard data elements are to be collected through the ACCSP at-sea observer program (refer to the ACCSP Program Design document for details). Specific fisheries priorities will be determined by the Discard/Release Prioritization Committee of ACCSP.

3.4.2 Fishery-Independent Data Collection

Assessment of the summer flounder stock requires information from a variety of fishery-independent surveys along the coast. As a part of the 2013 Benchmark Stock Assessment and the 2015 and 2016 Stock Assessment Updates, thirteen fishery-independent surveys (many that include both seasonal fall and spring indices) were used to create both Juvenile or Young of Year (YOY) and adult indices of abundance. For many of the surveys used, the primary objective is to measure the abundance of multiple species including summer flounder. State and federal agencies and academic institutions conducting these surveys are encouraged to continue them into the future to allow for the best possible assessment of the Summer flounder population.

4.0 MANAGEMENT PROGRAM

4.1 COMMERCIAL MANAGEMENT

The coastwide annual commercial quota (60% of the TAL for the overall fishery as described above) is currently allocated on a percentage basis to each of the states in the management unit (Maine-North Carolina) based on historical landings from the period 1980-1989.[6] State-by-state allocations were developed to allow each state to develop specific management programs that were designed for the commercial fishery in their state.

[6] Estimated landings by state and year for 1980-1989, as of the time of Amendment 2 development, can be found in Table 2 (pounds) and Table 72 (percentage) of the Amendment 2 document, available at: http://www.mafmc.org/s/SFSCBSB_Amend_2.pdf.

The commercial quota is divided among the states based on the allocation percentages given in Table 15 and each state sets measures to achieve their state-specific commercial quotas. These allocations are included in both the Council and the Commission FMPs. When a state's quota has been landed, fishing for and/or landing summer flounder is prohibited in that state. Any quota overages by a state during the year are subtracted from the state's quota the following year.

Table 15: State-by-state percent share of commercial summer flounder allocation.

State	Allocation (%)
ME	0.04756
NH	0.00046
MA	6.82046
RI	15.68298
CT	2.25708
NY	7.64699
NJ	16.72499
DE	0.01779
MD	2.03910
VA	21.31676
NC	27.44584
Total	100

These state-by-state shares reflect a revision made later in 1993, after the state of Connecticut argued that during the early and mid-1980s, the state did not have the authority to collect landings data from offshore fishermen, nor did NMFS provide a port agent to the state. Thus, the state contended that their commercial landings during the allocation base years were underreported and that its quota share was too small. Amendment 4 (1993) increased Connecticut's quota share from 0.95% to 2.26%.[7]

States are required to adopt appropriate measures to manage their quota shares, and employ a variety of quota periods, trip limits, and other such measures to do so. Quota periods and other quota management measures vary from state to state (Table 16).

[7] Revised 1980-1989 landings by state and year, and the resulting quota shares from Amendment 4 can be found in Table 1 of that document, at: http://www.mafmc.org/s/SFSCBSB_Amend_4.pdf.

Table 16: State-specific commercial quota management summary as of April 2017. States may manage their quota as they see fit each year and some states revise their management strategy frequently.

State	Commercial Quota Management Summary
Massachusetts	Two quota periods (30% allocated to January 1-April 22; 70% to April 23-December 31). Landings or possession of fluke by commercial fishermen allowed from 6 AM to 8 PM daily only. Gear-specific season, open days and possession limits.
Rhode Island	Three quota periods (54% of quota allocated to January 1-April 30; 35% to May 1-October 31; 11% from November 1-December 31). Possession limits vary by period.
Connecticut	The harvest strategy is reassessed each year and modified based on annual quota and industry input. Currently, there are four quota periods: Winter I (January 1-March 31), April, Summer (May 1-October 31), Winter II (November 1-December 31). Quota period year-to-date targets include 25% through Winter I; 95% through April and Summer, and 100% through Winter II. Possession limits vary by period and may be adjusted if period target quota is projected to be landed.
New York	Seven quota periods: January-March (25%); April (10%; May (14%); June-July (27%); August-September (14%); October (5%); December (5%). Initial daily trip limit is 70 lb in period 1 and 50 lb in all other periods. Over/under harvest from period 1 rolls into period 7; over/under harvest from period 2 into period 6; over/under harvest from periods 3 through 5 are rolled into the next period.
New Jersey	Six landings periods with differing daily and/or weekly possession limits: January-February; March-April; May-June; July-August; September-October; November-December. Over/under harvest from any of the first five periods is added or deducted from the following period. 10%, but no more than 200,00 lbs, is allocated to bycatch landings when the directed fishery in a given period is closed. The bycatch allocation is divided between the six seasons at the same percentage as for the directed fishery.
Delaware	Delaware qualifies for *de minimis* status for the commercial summer flounder fishery; the fishery operates under a 200 pound trip limit year round.
Maryland	Managed under an IFQ system, where permit holders may land their allocation year-round with no possession limits. Non-permitted harvesters are subject to the relevant daily possession limits (100 lb per day from the Atlantic Ocean and 50 lb per day from the Chesapeake Bay and tributaries).
Virginia	Two landings periods and a separate allocation for tidal waters. Summer flounder harvest from Virginia tidal waters is limited to 300,000 lbs, 142,114 lbs of which is set aside for the Chesapeake Bay. Period 1 includes the first Monday in January-October 31 (70.7% of the quota after deducting tidal allocation). The second period (November 1-December 31) is allocated 29.3% of the quota, after the tidal allocation. Over/under harvest from the first period may be deducted or added to the second. Possession limits vary by period.
North Carolina	The North Carolina season for landing ocean-caught flounder opens January 1 each year. If 80 percent of the quota is projected to be taken, North Carolina ports are closed to landing of flounder taken from the ocean. The season reopens November 1 if there is remaining quota. If after reopening, if 100 percent of the quota is projected to be taken prior to the end of the year, the fishery is closed.

Amendment 5 (1993) allowed two or more states, with the consent of NMFS, to transfer or combine their summer flounder commercial quota under mutual agreement and with the approval of the NMFS Regional Administrator. These transfers do not permanently affect the state specific share of the coastwide quota that each state receives each year. The ability to transfer or combine quota allows states the flexibility to respond to variations in the resource, short term emergency situations, often called “safe harbor” requests (e.g., when it is unsafe for a vessel to return to its intended port because of weather, mechanical breakdown of vessel, injured crew member, etc.), or other factors affecting the distribution of catch.

A quota transfer may take place after the Regional Administrator receives a request from two or more states, considers the requirements of the quota transfer regulations, and makes a determination to transfer the quota. Approved quota transfers are published in the Federal Register. To allow for these in-season adjustments, commercial state landings for summer flounder are monitored by the states and NOAA via the Dealer Electronic Reporting to the Standard Atlantic Fisheries Information System (SAFIS), as well as state agencies.

Currently, both the Council and Commission's FMPs require a 14-inch total length minimum fish size in the commercial fishery. Trawl nets are required to have 5.5-inch diamond or 6-inch square minimum mesh in the entire net for vessels possessing more than the threshold amount of summer flounder (i.e., 200 lb from November 1-April 30 and 100 lb from May 1-October 31). These requirements are in place in the federal regulations for federal waters and federal permit holders, and each state within the management unit is required to implement these measures as a condition of compliance with the Commission's FMP.

A thorough review of summer flounder commercial management measures that can be modified through specifications was conducted in the fall of 2015. The report on those measures can be found at: http://www.mafmc.org/s/Tab11_SF-S-BSB-Commercial-Measures.pdf.

Commercial landings relative to the commercial quotas has varied over the years since quotas were implemented. Reporting and in-season monitoring have improved, meaning that generally the commercial fishery is able to achieve landings very close to the commercial quota in any given year (Figure 30).

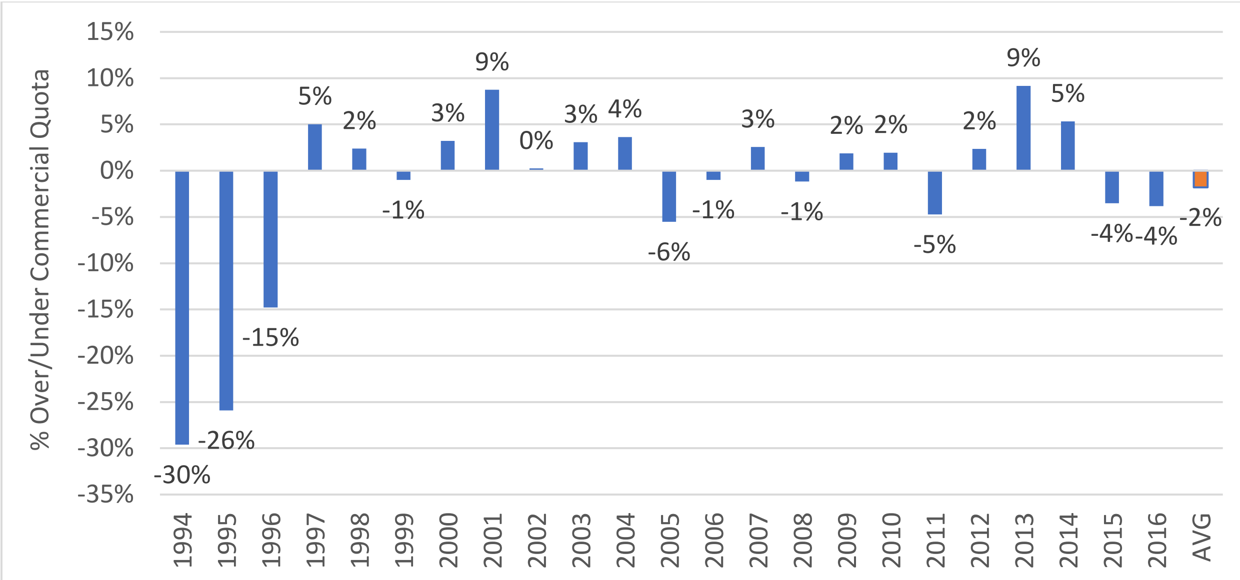


Figure 30: Percent overage/underage relative to summer flounder commercial quota since 1994. Data source: NMFS dealer data as of May 2017.

4.2 PROPOSED COMMERCIAL MANAGEMENT PROGRAM

4.2.1 Federal Moratorium Permit Requalification (Issue 1)

This alternative set contains options for requalification criteria for federal commercial moratorium permits for summer flounder, in the form of combinations of various landings thresholds and time periods over which those landings thresholds must have been achieved.
The permit requalification alternatives (sub-alternatives under alternative 1B) would evaluate requalification only from the existing pool of moratorium permit holders and would not allow new entrants to obtain a permit based on the qualifying criteria.

Alternative 1A: No Action/Status Quo

This alternative would maintain the current single-tier, commercial moratorium permit system for the summer flounder fishery, with no requalification. See section 3.1 for more details on current federal permit system)

Alternative 1B: Requalification of existing single-tier federal moratorium permits

This alternative would impose requalification criteria on current summer flounder moratorium permits under the existing single-tier federal permit system. Permits not meeting the requalification criteria would be permanently cancelled/relinquished. Permits in CPH could requalify if they meet the requalifying criteria. This alternative would **not** allow new entrants to qualify for a moratorium permit.

Alternative 1B has seven sub-alternatives with various combinations of qualification time periods and landings thresholds. Each of the sub-alternatives uses the revised control date for the commercial summer flounder fishery of August 1, 2014, which was published on that date by NMFS at the request of the Council (79 FR 44737). The establishment of the control date notified the public that the Council and Board was considering future limitations on the number of federally permitted participants in the fishery. The control date was intended to help the Council and Board to identify latent effort in the summer flounder fishery. All time frame criteria within all seven sub-alternatives below use requalifying time periods for summer flounder landings *prior to* August 1, 2014.

As described above, eligibility for moratorium permits is tracked by NMFS using a unique moratorium right ID (MRI) number associated with a specific fishing right. This allows permit history tracking where permit history has been transferred in a vessel replacement and over time. Permit history can transfer between vessels through a vessel replacement, and the MRIs associated with those permits transfer as well, even though the vessel permit numbers remain the same for each vessel. For this reason, a single vessel permit number may be associated with multiple MRIs for summer flounder over time. **In this action, any requalification would be done on the basis of landings associated with the MRI, and not the vessel permit number**, since a single MRI could be associated with multiple vessels over time.

If the Council and Board select alternative 1B, one of the sub-options below in Table 17 would need to be selected. The time periods listed below are inclusive of the start and end dates (e.g., option 1B-1 would include qualifying landings dated August 1, 2009 through July 31, 2014). The data used for re-qualification would include commercial summer flounder landings as maintained in NMFS dealer records.

Table 17: Sub-alternatives under Alternative 1B, with comparison to Alternative 1A (*status quo*) and associated number of moratorium rights retained and eliminated. Landings thresholds refer to commercial landings of summer flounder associated with each MRI.

Comparison to *Status Quo*	**Time Period**	**Landings Threshold**	**# Current MRIs**	**% MRIs Requalifying**	**# MRIs Eliminated**	**% MRIs Eliminated**
Alternative 1A (No Action)	*January 26, 1985 - January 26, 1990 (5 yrs)*	*At least 1 pound in any year over this time period*	*941*	*100%*	*N/A*	*N/A*
Sub-alternative under 1B	**Time Period**	**Landings Threshold**	**# MRIs Requalifying**	**% MRIs Requalifying**	**# MRIs Eliminated**	**% MRIs Eliminated**
Alternative 1B-1	August 1, 2009-July 31, 2014 (5 yrs)	≥1,000 lbs cumulative over this time period	425	45%	516	55%
Alternative 1B-2	August 1, 2009-July 31, 2014 (5 yrs)	At least 1 pound in any year over this time period	493	52%	448	48%
Alternative 1B-3	August 1, 2004-July 31, 2014 (10 yrs)	≥1,000 lbs cumulative over this time period	552	59%	389	41%
Alternative 1B-4	August 1, 2004-July 31, 2014 (10 yrs)	At least 1 pound in any year over this time period	635	67%	306	33%
Alternative 1B-5	August 1, 1999-July 31, 2014 (15 yrs)	≥1,000 lbs cumulative over this time period	646	69%	295	31%
Alternative 1B-6	August 1, 1994-July 31, 2014 (20 yrs)	At least 1 pound in 20% of years in time period (i.e., in at least 4 years over this 20-year period)	670	71%	271	29%
Alternative 1B-7	August 1, 1994-July 31, 2014 (20 yrs)	≥1,000 lbs cumulative over this time period	708	75%	233	25%

4.2.2 Commercial Quota Allocation (Issue 2)
This issue item contains options for modifying the current state-by-state commercial allocation. All of the alternatives below assume the retention of the current process of subtracting projected commercial discards from the commercial ACL to arrive at a given year's commercial quota. The alternatives below relate to how that commercial quota is distributed by state and throughout the fishing year. NMFS would remain responsible for final landings and overage accounting for each state (where applicable) and for coastwide accounting within the management unit.

Allocation changes through any of the alternatives in this action would be considered a one-time indefinite change. However, **the Council and Board intend to review any selected allocation in not more than 10 years from implementation of this action, to determine whether additional modifications may be warranted**. Following this planned review, the Council and Board may or may not initiate a future action to further revise commercial allocations in this fishery.

Alternative 2A: No Action/Status Quo
This alternative would make no changes to the current state allocation percentages. Currently, the coastwide quota is divided on a percentage basis to each of the states in the management unit (Maine-North Carolina) based on historical commercial landings from the period 1980-1989 (Table 15). Each state then sets measures to achieve, but not exceed, their annual state-specific commercial quotas. These allocations are included in both the Council and the Commission FMPs. When a state's quota has been landed in a given year, commercially targeting and/or landing summer flounder is prohibited in that state. Any quota overages by a state during the year are subtracted from that state's quota the following year.

State-by-state allocations based on 1980-1989 data were developed via Amendment 2 (1993)[8] to allow each state to develop specific management programs that were designed for the commercial fishery in their state. A simple annual coastwide system was determined to be infeasible because of the migratory patterns of summer flounder. Without some mitigating measures, fishermen at the southern end of the range could possibly catch all the quota before fishermen at the northern end of the range had access to the summer flounder.

In 1993, the state of Connecticut argued that during the early and mid-1980s, the state did not have the authority to collect landings data from offshore fishermen, nor did NMFS provide a port agent to the state. Thus, the state contended that their commercial landings during the allocation base years were underreported and that its quota share was too small. Amendment 4 (1993) increased Connecticut's quota share from 0.95% to 2.26%.[9] Amendment 5 (1993) allowed two or more states, with the consent of NMFS, to transfer or combine their summer flounder

---

[8] Estimated landings by state and year for 1980-1989, as of the time of Amendment 2 development, can be found in Table 2 (pounds) and Table 72 (percentage) of the Amendment 2 document, available at: http://www.mafmc.org/s/SFSCBSB_Amend_2.pdf.

[9] Revised 1980-1989 landings by state and year, and the resulting quota shares from Amendment 4 can be found in Table 1 of that document, at: http://www.mafmc.org/s/SFSCBSB_Amend_4.pdf.

commercial quota. These transfers do not permanently affect the state specific share of the coastwide quota that each state receives each year.
States are required to adopt appropriate measures to manage their quota shares, and employ a variety of quota periods, trip limits, and other such measures to do so. Quota periods and other quota management measures vary from state to state (see section 4.1, Table 18).

Table 18: Alternative 2A: No Action/Status Quo; current allocations based on 1980-1989 landings. Quota percentages are taken out to five decimal places in the FMPs and federal regulations.

State	Allocation (%)
ME	0.04756
NH	0.00046
MA	6.82046
RI	15.68298
CT	2.25708
NY	7.64699
NJ	16.72499
DE	0.01779
MD	2.03910
VA	21.31676
NC	27.44584
Total	100

Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution
Alternative 2B would adjust the current state-by-state quota allocations based on a regional shift in exploitable biomass derived from Northeast Fisheries Science Center (NEFSC) trawl survey data. This would create a basis for state allocations that combines both *status quo* allocations (based solely on landings history) and distribution of biomass (which was not used in development of the current allocations).

A 2017 NEFSC analysis calculated an approximate shift in the percentage of exploitable biomass in a Northern vs. Southern region within the management unit (divided approximately at Hudson Canyon), compared across the ten-year time periods of 1980-1989 and 2007-2016. Calculations were based on NEFSC spring and fall trawl survey catches, length-calibrated to R/V Albatross IV (ALB) equivalents. NEFSC trawl survey data was used because they represent the only data sets spatially and temporally comprehensive enough to describe changes in geographic distribution of the stock over time.

To focus on allocation of commercial landings, length cutoffs were used for summer flounder caught in the survey to identify biomass retainable by the commercial fishery. Given that the commercial minimum size has remained at either 13 or 14 inches over the entire time series, the commercial size frequency has not shifted substantially over the time series. Thus, a 14 inch = 36 cm length cut-off was used for both time periods to capture virtually all of the commercial landings length range in both periods (and some commercial discards), to derive an index of exploitable biomass.

Survey strata were grouped into two regions divided approximately at Hudson Canyon: a Northern region with waters approximately off the states of New York and north, and a Southern region with waters approximately off the states of New Jersey and south. Based on recommendations of the Council's Demersal Committee in November 2017, the analysis was revised to include additional survey strata in the Gulf of Maine and Georges Bank.

North and South indices were weighted by the area surveyed (NM^2) to provide seasonal total indices to express the Northern percentage of the total exploitable biomass for each season and period. The seasonal (spring and fall) exploitable biomass was then summed for each region to calculate total relative biomass for each region and period. Figure 31 shows the results for trends in spring relative biomass for 1980-1989 and 2007-2016 and Figure 32 shows the fall relative biomass over the same time periods.

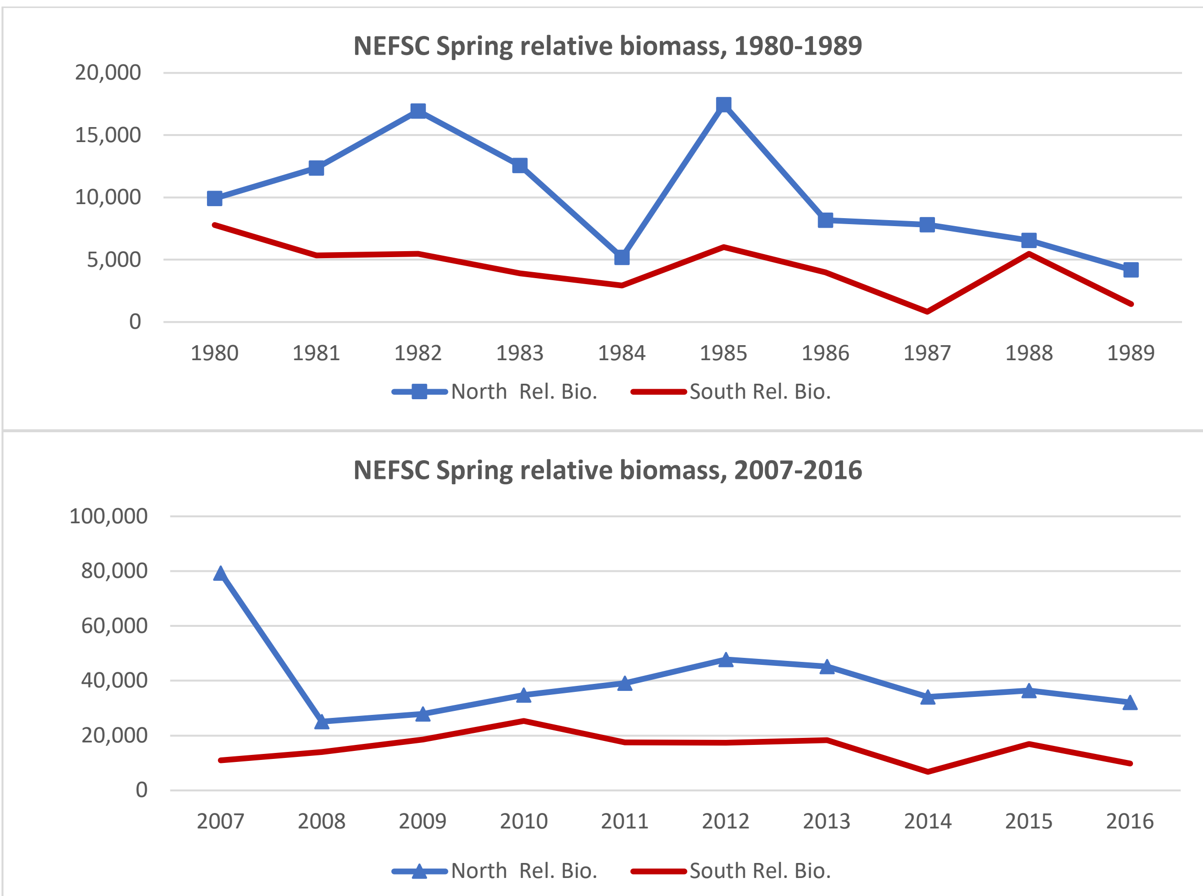


Figure 31: NEFSC spring survey relative biomass for 1980-1989 and 2007-2016; relative to area surveyed.

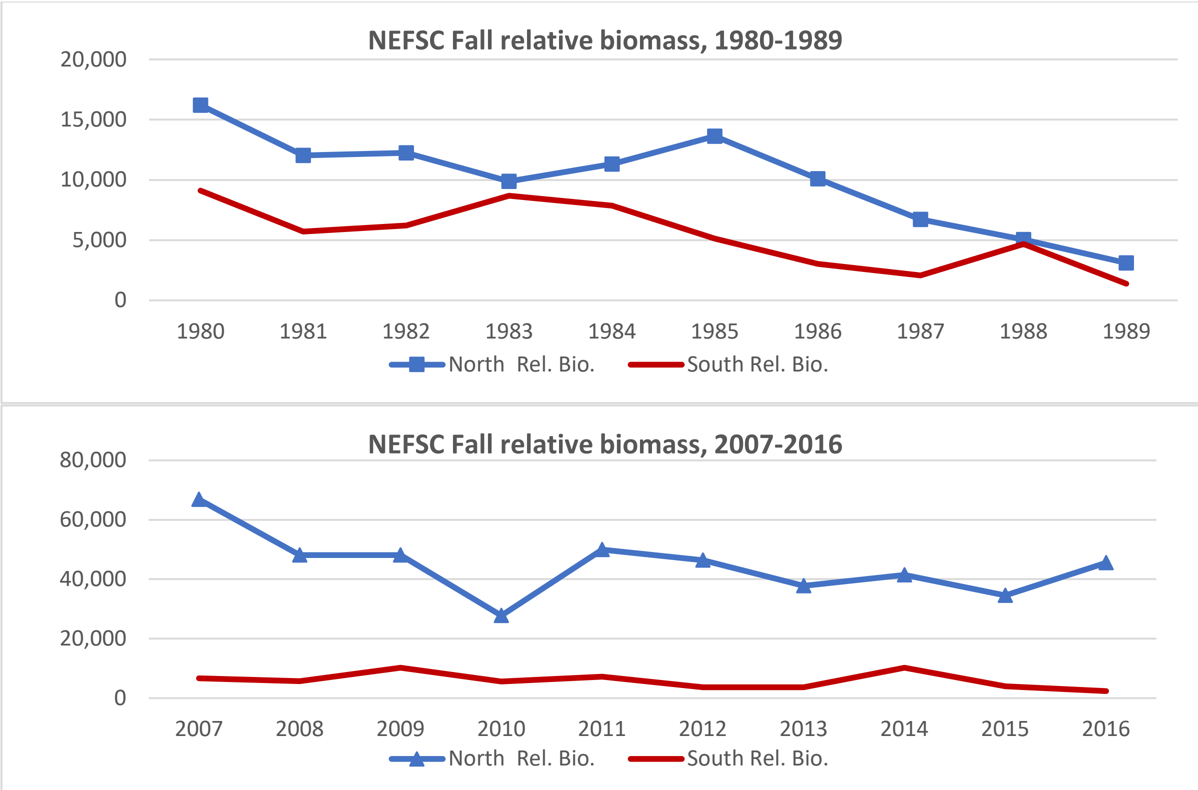


Figure 32: NEFSC fall survey relative biomass for 1980-1989 and 2007-2016; relative to area surveyed.

For relative exploitable biomass averaged over each period, the Northern region percentage increased from 67% on average during 1980-1989 to 80% on average during 2007-2016 (Figure 33), an absolute increase of 13% relative to the coast (+13% in the Northern region, -13% in the Southern region).

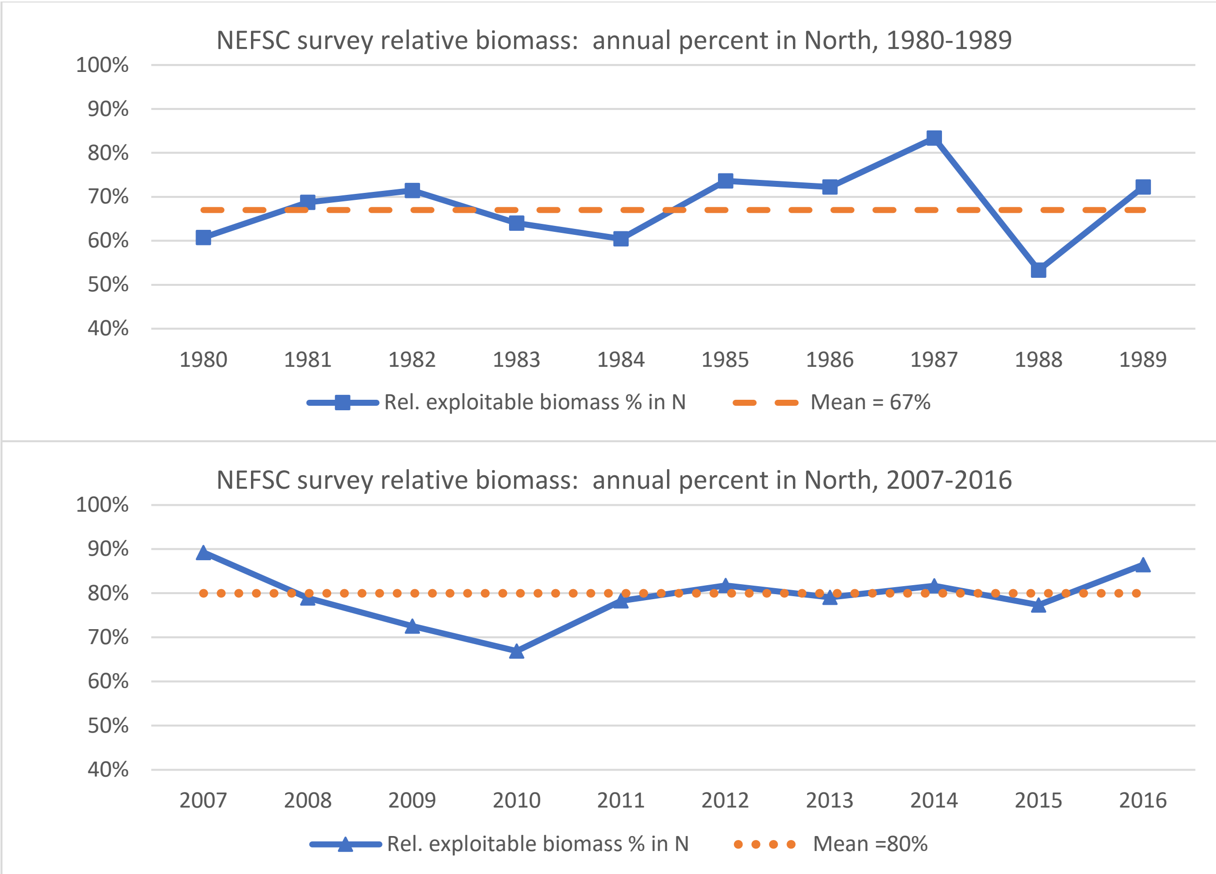


Figure 33: NEFSC survey relative biomass annual percent in Northern region, 1980-1989 and 2007-2016. The remaining relative biomass is attributable to the Southern region.

Under Alternative 2B, the change in Northern region relative exploitable biomass would serve as the basis for adjustments to the current state-by-state allocation percentages. Two mathematical methods are proposed as **two sub-alternatives under alternative 2B**, to translate the change in regional exploitable biomass into changes in allocation. These two different approaches, sub-alternatives 2B-1 and 2B-2 described below, are both mathematically justified but have a slightly different emphasis on how much of the revised allocation should be based on recent (2007-2016) exploitable biomass distribution.

The key difference in the sub-alternatives below is whether changes in biomass and allocation are calculated as an absolute shift relative to the coast, or as a percent change relative to the Northern region. For reference, **absolute change or shift** describes the simple difference between the proportions attributable to the Northern and Southern regions in each time period. (e.g., 67% relative exploitable biomass in the North on average from 1980-1989 grew to 80% relative exploitable biomass on average from 2007-2016, an absolute increase in the North of 13%). This describes how the proportions change in the North and South **relative to the coastwide total**.

Percent change expresses the change (percent increase or decrease) **relative to the original regional value.**[10] Because this is an expression of the change between two values relative to the regional starting value, this needs to be calculated using either the Northern or Southern region as the "starting value," with a subsequent adjustment to the other region to make the total allocations equal to 100%.

Regardless of the method, absolute change between the North and South, relative to the coastwide total allocation, will always be equivalent in magnitude (+ to the North, - to the South), since the total coastwide allocation is always 100%. However, the percentage change (% increase or decrease) in state/regional quotas relative to the previous state/regional quotas will never be equivalent in magnitude regardless of the method, because regional starting allocations are different (i.e., starting allocations are not 50/50). If allocations are adjusted using percent changes, a decision needs to be made to start with either the North or the South, and adjust the other region so that final allocations add to 100%.

Sub-Alternative 2B-1: Revised Allocation based on Northern Region Percent Change in Exploitable Biomass

For this sub-alternative, the method of translates the change in regional exploitable biomass into a relative change in allocation by taking the percentage change in biomass in the Northern region over the two time periods and applying this as a percentage change to the current Northern regional allocation.

Between 1980-1989 and 2007-2016, as a percent change, the Northern region relative exploitable biomass increased by 19% relative to the 1980-1989 average value ((80-67)/67)*100=**+**19%). This percentage is then applied to the current Northern regional allocation (combination of state allocations ME-NY) as a percent increase: (32.45%*1.19 = 38.62% revised allocation to the Northern region). The Southern region's allocation is then calculated as the remainder of the coastwide allocation, (i.e., 100%-38.62%=61.38%). Each regional allocation is divided into state shares based on each state's current proportion of the regional allocation (e.g., Rhode Island currently has 48.32% of the Northern region allocation; this percentage is applied to the revised regional quota allocation of 38.62%).

Alternative 2B-1 is designed to shift current regional allocations in proportion to the regional change in relative exploitable biomass, and maintains more of a connection to the *status quo* allocation compared to alternative 2B-2 while still accounting for how the regional exploitable biomass has shifted over time. The results of this approach produce a modest shift in allocation relative to the coast, shifting 6% of the coastwide allocation from the South to the North. Relative to the existing regional allocations as a percent change, this constitutes a 19% increase in the Northern region's allocation (relative to their starting allocation of ~32.5%), and a 9% decrease in the Southern region allocation (relative to their starting allocation of ~67.5%; again, these percent changes are not equivalent in magnitude because the starting allocation in each region

[10] Percent change is calculated by taking the increase or decrease between the two values, divided by the starting value, using the formula: Percent change = (New value-Old value)/Old Value x 100. Positive values indicate a percentage increase; negative values indicate a percentage decrease.

is different). A summary of the resulting regional and state allocations, as well as the changes relative to the coast and relative to the starting regional allocations, are shown in Table 19**.** Revised allocations are taken to five decimal places to be consistent with the current state level allocations.

Table 19: Allocation modification under Alternative 2B-1 described above. This option expresses the shift in relative exploitable biomass in the North as the percent change between 67 and 80% (=19%) and applies this change as a percent change to the Northern allocation. Southern allocations are calculated from this basis such that total allocations add to 100%. Example state quotas are provided based on an 8.12 million pound coastwide quota with comparison to status quo distribution under the same quota.

State	A) Status quo state allocation (%)	B) Status quo % of regional allocation	C) Status quo state % of regional total (N or S)	D) Revised regional allocation with 19% increase to N states (% change)	E) Revised state allocation under Alt 2B-1 (%)[a]	F) % Change relative to existing state allocation	G) Absolute change in total coastwide allocation	H) Alt 2B-1 allocation based on 8.12 million pound Quota	I) *Status Quo* allocation based on 8.12 million pound Quota
ME	0.04756	32.45553	0.14654	38.62208	**0.05660**	+19.0%	+0.00904	4,596	3,862
NH	0.00046		0.00142		**0.00055**	+19.0%	+0.00009	44	37
MA	6.82046		21.01479		**8.11635**	+19.0%	+1.29589	659,047	553,821
RI	15.68298		48.32144		**18.66275**	+19.0%	+2.97977	1,515,415	1,273,458
CT	2.25708		6.95438		**2.68593**	+19.0%	+0.42885	218,097	183,275
NY	7.64699		23.56144		**9.09992**	+19.0%	+1.45293	738,913	620,936
NJ	16.72499	67.54448	24.76145	61.37792	**15.19806**	-9.1%	-1.52693	1,234,083	1,358,069
DE	0.01779		0.02634		**0.01617**	-9.1%	-0.00162	1,313	1,445
MD	2.0391		3.01890		**1.85294**	-9.1%	-0.18616	150,459	165,575
VA	21.31676		31.55959		**19.37062**	-9.1%	-1.94614	1,572,894	1,730,921
NC	27.44584		40.63373		**24.94014**	-9.1%	-2.50570	2,025,139	2,228,602
Total	100	100	--	100	**100**	--	0	8,120,000	8,120,001

[a] Column E calculated by applying the *status quo* state percentage of regional allocation (column C) to the revised regional allocation with a 19% increase to the Northern region, as a percent change relative to the existing Northern region allocation (column D).

Sub-Alternative 2B-2: Revised Allocation based on Absolute Change in Regional Proportions
For this sub-alternative, the following method would calculate the change in proportion of relative exploitable biomass relative to the coast (+13% to the Northern region and -13% to the Southern region) and apply this change as an absolute shift in regional allocation. In other words, 13% of the coastwide quota (derived from the absolute shift in exploitable biomass) would be subtracted from the Southern region's quota and added to the Northern region's quota:

- (Existing Northern region allocation) + 13% = (New Northern region allocation), i.e.: (32.46% + 13%) = 45.46%
- (Existing Southern region allocation) - 13% = (New Southern region allocation), i.e.: (67.54% - 13%) = 54.54%

As with sub-alternative 2B-1 above, each regional allocation is then divided into state shares based on each state's current proportion of the regional allocation (e.g., Rhode Island currently has 48.32% of the Northern region allocation; this percentage is applied to the revised regional quota allocation of 45.45%).

Alternative 2B-2 creates a basis for allocation that is more based on recent relative exploitable biomass than alternative 2B-1, by more heavily factoring in recent biomass by region into the allocation. This option simply takes the change in regional exploitable biomass relative to the coast over the two time periods (13% shift) and applies this as additional quota in the Northern region. This creates an allocation with more of a basis in recent distribution by region, and less of a basis in *status quo* allocations/historical landings.

The results of this approach produce a more substantial shift in allocation relative to the coast, shifting 13% of the coastwide allocation to the Northern region and reducing the Southern region allocation by 13%. Relative to the existing regional allocations as a percent change, this constitutes a 40% increase in the Northern region's allocation (relative to their starting allocation of ~32.5%), and a 19% decrease in the Southern region allocation (relative to their starting allocation of ~67.5%; again, these percent changes are not equivalent in magnitude because the starting allocation in each region is different). A summary of the resulting regional and state allocations, as well as the changes relative to the coast and relative to the starting regional allocations, are shown in Table 20**.**

Table 20: Allocation modification under Sub-Alternative 2B-2 described above. This option uses the 13% absolute shift (67% to 80%) in relative exploitable biomass and applies this change additively to the existing regional allocations. Example state quotas are in lbs based on an 8.12 million pound coastwide quota with comparison to status quo distribution under the same quota.

State	A) Status quo state allocation (%)	B) Status quo % of regional allocation	C) Status quo state % of regional total (N or S)	D) Revised regional allocation with 13% additive increase to N region	E) Revised state allocation under Alt 2B-2[a]	F) % Change relative to existing state allocation	G) Absolute change in total coastwide allocation	H) Alt 2B-2 allocation based on 8.12 million pound Quota	I) *Status Quo* allocation based on 8.12 million pound quota
ME	0.04756	32.45553	0.14654	45.45553	**0.06661**	+40.1%	+0.01905	5,409	3,862
NH	0.00046		0.00142		**0.00064**	+40.1%	+0.00018	52	37
MA	6.82046		21.01479		**9.55238**	+40.1%	+2.73192	775,653	553,821
RI	15.68298		48.32144		**21.96477**	+40.1%	+6.28179	1,783,539	1,273,458
CT	2.25708		6.95438		**3.16115**	+40.1%	+0.90407	256,685	183,275
NY	7.64699		23.56144		**10.70998**	+40.1%	+3.06299	869,650	620,936
NJ	16.72499	67.54448	24.76145	54.54447	**13.50600**	-19.2%	-3.21899	1,096,687	1,358,069
DE	0.01779		0.02634		**0.01437**	-19.2%	-0.00342	1,167	1,445
MD	2.0391		3.01890		**1.64664**	-19.2%	-0.39246	133,707	165,575
VA	21.31676		31.55959		**17.21401**	-19.2%	-4.10275	1,397,778	1,730,921
NC	27.44584		40.63373		**22.16345**	-19.2%	-5.28239	1,799,672	2,228,602
Total	100	100	--	100	100	--	0	8,120,000	8,120,001

[a] Column E calculated by applying the *status quo* state percentage of regional allocation (column C) to the revised regional allocation with a 13% shift from the Southern to the Northern states (column D).

Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

This alternative would create state allocations that vary with overall stock abundance and resulting commercial quotas. For all years when the annual commercial quota is at or below a specified annual commercial quota trigger level, the state allocations would remain *status quo*. In years when the annual coastwide quota exceeded the specified trigger, the trigger amount would be distributed according to *status quo* allocations, and the additional quota beyond that trigger would be distributed differently, as described below. There are two sub-alternatives for commercial quota triggers under this alternative:

- **Alternative 2C-1**: 8.40-million-pound trigger based on the recent five-year average of commercial quotas (2014-2018) and;
- **Alternative 2C-2**: 10.71-million-pound trigger based on the recent ten-year average of commercial quotas (2009-2018).

The distribution of additional quota is the same under each sub-alternative; only the specified commercial coastwide quota trigger that determines the additional quota differs. The two sub-alternatives above were chosen to strike a balance between the trigger being unrealistically high relative to expected quota levels (and thus having no practical impact in the near future under the current quota regime), and being so low that the allocations would be modified very substantially in most future years. For both sub-alternatives, the commercial quota up to the trigger amount would be distributed according to *status quo* allocations. The additional quota above the trigger amount would be distributed as follows: states that currently have less than 1% of the current commercial quota allocation (Delaware, New Hampshire, and Maine) would evenly split 1% of the total additional quota (resulting in 0.333% each of the additional quota). The remaining states (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and North Carolina) would evenly split the remaining additional quota (resulting in each of these states getting 12.375% each of the additional quota beyond the trigger amount, on top of their current quota share of the base trigger amount). It is important to note that when the quota trigger is exceeded, it is only the additional quota that gets distributed differently, not the entire quota.

Under either sub-alternative, the commercial quota in each year would still be developed based on the recommendations of the Council's SSC and Technical Committee, and approved by the Council and Board based on the Council's risk policy. The "new" total allocation percentages by state under both sub-alternatives could not be calculated until the annual commercial quota was known (typically considered in August of any given year), since the state percentages of the coastwide allocation would vary depending on how much "additional" quota was available to be distributed If in future years the specified quota were at or below this trigger point, the quota allocation would revert to *status quo* (1980-1989 basis as shown in Table 18).

Given that state allocations would vary with the annual coastwide quota, the final state allocations in any given year are unknown; however, a range of reasonably expected allocations can be derived based on past annual quotas assuming future quotas do not change substantially from what has been implemented in the past. Table 21 below shows how often each of these triggers would have been exceeded if applied to historical quotas (1993-2018), and the resulting percent allocation for each state under the time series low coastwide quota (5.66 million pounds; 2017) and time series high quota (17.90

million pounds; 2005). For NC, VA, RI, and NJ, the highest allocation received within this range would be that under *status quo* conditions (i.e., when the trigger is not exceeded). For all other states, the highest allocation percentage corresponds with the highest annual coastwide quota within the range considered (Table 21).

Table 21: Summary of expected range of allocation outcomes of alternatives 2C-1 and 2C-2 given historical quotas.

	Alternative 2C-1		**Alternative 2C-2**	
Annual commercial quota trigger	8.40 million lb		10.71 million lb	
Frequency of historical quotas at or below trigger (1993-2018)	4 of 26		9 of 26	
Frequency of historical quotas exceeding trigger (1993-2018)	22 of 26		17 of 26	
State allocation under high and low quotas	**Alloc. % under low quota (5.66 m. lb) = *Status quo allocation***	**Alloc. % under high quota (17.9 m. lb) = revised allocation**	**Alloc. % under low quota (5.66 m. lb) = *Status quo allocation***	**Alloc. % under high quota (17.9 m. lb) = revised allocation**
ME	0.04756	0.19923	0.04756	0.16235
NH	0.00046	0.17712	0.00046	0.13417
MA	6.82046	9.76840	6.82046	9.05159
RI	15.68298	13.92735	15.68298	14.35424
CT	2.25708	7.62693	2.25708	6.32121
NY	7.64699	10.15627	7.64699	9.54612
NJ	16.72499	14.41634	16.72499	14.97770
DE	0.01779	0.18526	0.01779	0.14453
MD	2.0391	7.52463	2.0391	6.19078
VA	21.31676	16.57113	21.31676	17.72507
NC	27.44584	19.44735	27.44584	21.39225

The main difference between sub-alternatives 2C-1 and 2C-2 is how often the quota is expected to exceed each trigger, and the amount of "additional quota" that would be available under likely future coastwide quota scenarios. Figure 34 shows the time series of commercial quotas since 1993, compared to the quota triggers under 2C-1 (8.40 million pounds) and 2C-2 (10.71 million pounds). Additional details specific to the configuration of alternatives 2C-1 and 2C-2 are provided in the sections below.

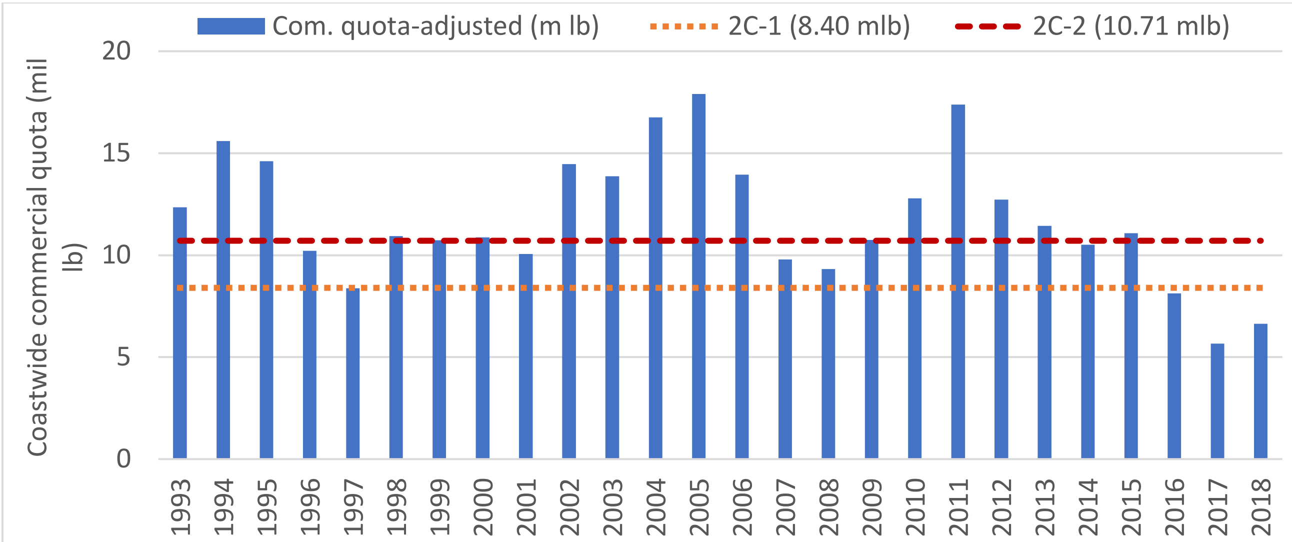


Figure 34: Time series of annual commercial quotas for summer flounder 1993-2018 and proposed commercial quota triggers under alternatives 2C-1 and 2C-2.

Sub-Alternative 2C-1: 5-year average commercial quota trigger (8.40 million lbs)

Under this sub-alternative, quota up to and including 8.40 million lbs would be distributed according to the current (*status quo*) allocation, and the **additional** quota above 8.40 million lbs would bedistributed differently. This trigger is based on the 5-year average commercial quota over the years 2014-2018.[11]

For the additional quota, states that currently have less than 1% of the current commercial quota allocation (Delaware, New Hampshire, and Maine) would evenly split 1% of the total additional quota (resulting in 0.333% each of the additional quota). The remaining states (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and North Carolina) would evenly split the remaining additional quota (resulting in each of these states getting 12.375% each of the **additional** quota beyond 8.40 million lbs, on top of their current quota share of the baseline quota of 8.40 million lbs).

In the hypothetical example in Table 22 below, if an 8.12 million pound coastwide annual quota were adopted, the quota would be distributed the same way it is currently (*status quo*; Alternative 2A) since the coastwide quota is below the allocation revision trigger in this sub-option (8.40 million lbs). Under a hypothetical 14.00 million pound coastwide quota, the additional quota would be 5.60 million lbs (14.00-8.40 = 5.60). In this case, the first 8.40 million lbs would be distributed based on *status quo* allocations, and the additional 5.60 million lbs would be distributed such that the states of NC, VA, MD, NJ, NY, CT, RI, and MA would each receive an additional 693,000 lbs of quota that year (each receiving 12.375% of 5.60 million lbs) and DE, NH, and ME would each receive an additional 18,666 lbs (each receiving 0.3333% of 5.60 million lbs; Table 21).

[11] After Research Set-Aside in years when it was deducted from the commercial quota.

Figure 35 shows that for quotas up to the 8.40 million pound trigger point under alternative 2C-1, allocations remain *status quo*. As the annual commercial quota level grows beyond the quota trigger, the state quota allocation percentages get closer together, i.e., with increasing quotas above the trigger, quota is distributed more evenly among the states.

Table 21: Allocations under Alternative 2C-1, with modified distribution of additional coastwide commercial quota beyond 8.40 million lbs (5-year average quota; 2014-2018). Hypothetical quota examples represent initial quotas prior to any transfers or deductions for overages.

State	Allocation (%) of baseline Quota ≤ 8.40 mil lbs	Allocation (%) of additional quota beyond 8.40 mil lbs	Example allocation under 8.12 mil pound Quota[a] (same as *status quo*)	Example allocation based on 14.00 million pound Quota[b]				Comparison to *Status quo* under 14.00 million pound Quota	
				Status Quo distribution of 8.40 mil pound base Quota	New distribution of 5.60 mil pound additional quota	Alt 2C-1 allocation under 14.00 mil pound Quota	Alt 2C-1 allocation (%) under 14.00 mil lbs Quota [c]	*Status quo* allocation in lbs	*Status quo* allocation (%)
ME	0.04756	0.3333	3,862	3,995	18,666	22,662	0.16187%	6,658	0.04756%
NH	0.00046	0.3333	37	39	18,666	18,705	0.13361%	64	0.00046%
MA	6.82046	12.375	553,821	572,919	693,000	1,265,919	9.04228%	954,864	6.82046%
RI	15.68298	12.375	1,273,458	1,317,370	693,000	2,010,370	14.35979%	2,195,617	15.68298%
CT	2.25708	12.375	183,275	189,595	693,000	882,595	6.30425%	315,991	2.25708%
NY	7.64699	12.375	620,936	642,347	693,000	1,335,347	9.53819%	1,070,579	7.64699%
NJ	16.72499	12.375	1,358,069	1,404,899	693,000	2,097,899	14.98499%	2,341,499	16.72499%
DE	0.01779	0.3333	1,445	1,494	18,666	20,161	0.14401%	2,491	0.01779%
MD	2.03910	12.375	165,575	171,284	693,000	864,284	6.17346%	285,474	2.03910%
VA	21.31676	12.375	1,730,921	1,790,608	693,000	2,483,608	17.74006%	2,984,346	21.31676%
NC	27.44584	12.375	2,228,602	2,305,451	693,000	2,998,451	21.41750%	3,842,418	27.44584%
Total	100	100	8,120,001	8,400,000	5,600,000	14,000,000	100%	14,000,000	100%

[a] Allocation is divided based on *status quo* allocation percentages due to coastwide quota being lower than 8.40 million lbs. This hypothetical quota results in the same quota distribution as in Alternative 2A.

[b] Allocation of first 8.40 million lbs is divided based on *status quo* allocation percentages. Additional 5.60 million lbs (14.00-8.40) is divided evenly between all remaining states after the states of NH, DE, and ME split 1% of the coastwide quota.

[c] Note that total revised state allocation percentages will vary with varying coastwide quotas, depending on how much "additional" quota is available.

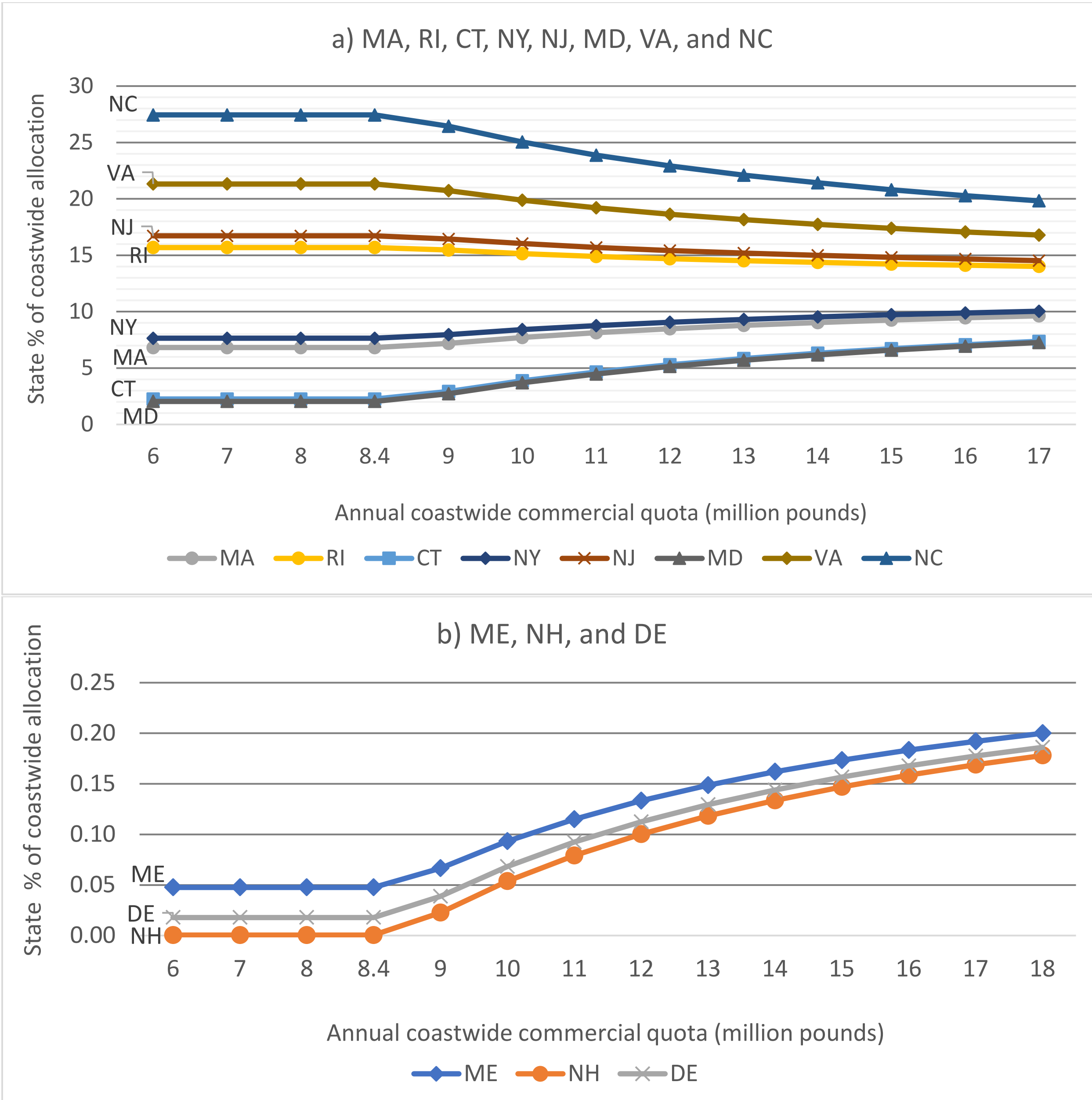


Figure 35: State quota allocation percentage with varying annual coastwide quotas under alternative 2C-1 (8.40 million pound trigger) for a) States with over 1% of the current allocation, and b) Maine, Delaware, and New Hampshire.

Sub-Option 2C-2: 10-year average commercial quota trigger (10.71 million lbs)

Under this sub-alternative, quota up to and including **10.71 million lbs** would be distributed according to the current (*status quo*) allocation, and the **additional** quota above 10.71 million lbs would be distributed differently. This trigger is based on the 10-year average commercial quota over the years 2009-2018.[12]

As with alternative 2C-1, for the additional quota, states that currently have less than 1% of the current commercial quota allocation (Delaware, New Hampshire, and Maine) would evenly split 1% of the total additional quota (resulting in 0.3333% each of the additional quota). The remaining states (Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Virginia, and North Carolina) would evenly split the remaining additional quota (resulting in each of these states getting 12.375% each of the **additional** quota beyond 10.71 million lbs, on top of their current quota share of the baseline quota of 10.71 million lbs).

In the hypothetical example in Table 22 below, with an 8.12 million lbs coastwide quota, the quota would be distributed the same way it is currently (*status quo*; Alternative 2A) since the coastwide quota is below the allocation revision trigger (10.71 million lbs). Under a hypothetical 14.00 million lbs coastwide quota, the additional quota would be 5.60 million lbs (14.00-10.71 = 3.29). In this case, the first 10.71 million lbs would be distributed based on *status quo* allocations, and the additional 3.29 million lbs would be distributed such that the states of North Carolina, Virginia, Maryland, New Jersey, New York, Connecticut, Rhode Island, and Massachusetts would each receive an additional 407,138 lbs of quota that year (each receiving 12.375% of 3.29 million lbs) and Delaware, New Hampshire, and Maine would each receive an additional 10,967 lbs (each receiving 0.3333% of 3.29 million lbs; Table 22).

Figure 36 shows that for quotas up to the 10.71 million pound trigger point under alternative 2C-2, allocations remain *status quo*. As the annual commercial quota level grows beyond the quota trigger, the state quota allocation percentages get closer together, i.e., with increasing quotas above the trigger, quota is distributed more evenly among the states. As with alternative 2C-1, states with current allocations above 12.375% of the coastwide quota (NC, VA, RI, and NJ) will lose allocation percentage as the quota grows beyond the trigger point.

[12] After Research Set-Aside in years when it was deducted from the commercial quota.

Table 22: Alternative 2C-2: modified distribution of additional commercial quota beyond 10.71 million lbs (10-yr commercial quota trigger). Hypothetical quota examples represent initial quotas prior to any transfers or deductions for overages.

State	Allocation (%) of baseline Quota ≤ 10.71 mil lbs	Allocation (%) of additional quota beyond 10.71 mil lbs	Example allocation under 8.12 mil lbs Quota (same as *status quo*)[a]	Example allocation under 14.00 million lbs Quota[b]				Comparison to *status quo* under 14.000 million lbs Quota	
				Status quo distribution of 10.71 mil lbs base Quota	New distribution of 3.29 mil lbs additional quota	Alt 2C-2 allocation under 14.00 mil lbs Quota	Alt 2C-2 allocation (%) under 14.00 mil lbs Quota	*Status quo* allocation in lbs	*Status quo* allocation (%)
ME	0.04756%	0.333%	3,862	5,094	10,967	16,060	0.115%	6,658	0.04756%
NH	0.00046%	0.333%	37	49	10,967	11,016	0.079%	64	0.00046%
MA	6.82046%	12.375%	553,821	730,471	407,138	1,137,609	8.126%	954,864	6.82046%
RI	15.68298%	12.375%	1,273,458	1,679,647	407,138	2,086,785	14.906%	2,195,617	15.68298%
CT	2.25708%	12.375%	183,275	241,733	407,138	648,871	4.635%	315,991	2.25708%
NY	7.64699%	12.375%	620,936	818,993	407,138	1,226,130	8.758%	1,070,579	7.64699%
NJ	16.72499%	12.375%	1,358,069	1,791,246	407,138	2,198,384	15.703%	2,341,499	16.72499%
DE	0.01779%	0.333%	1,445	1,905	10,967	12,872	0.092%	2,491	0.01779%
MD	2.03910%	12.375%	165,575	218,388	407,138	625,525	4.468%	285,474	2.03910%
VA	21.31676%	12.375%	1,730,921	2,283,025	407,138	2,690,162	19.215%	2,984,346	21.31676%
NC	27.44584%	12.375%	2,228,602	2,939,449	407,138	3,346,587	23.904%	3,842,418	27.44584%
Total	100	100%	8,120,001	10,710,000	3,290,000	14,000,000	100%	14,000,000	100

[a] Under this hypothetical quota, allocation is divided based on *status quo* allocation percentages due to coastwide quota being lower than 10.71 million lbs. **This hypothetical quota results in the same quota distribution as in Alternative 2A and 2C-1.**

[b] Allocation of first 10.71 million lbs is divided based on *status quo* allocation percentages. Additional 3.29 million lbs (14.00-10.71) is divided evenly between all remaining states after the states of NH, DE, and ME split 1% of the coastwide quota.

[c] Note that total revised state allocation percentages will vary with varying coastwide quotas, depending on how much "additional" quota is available.

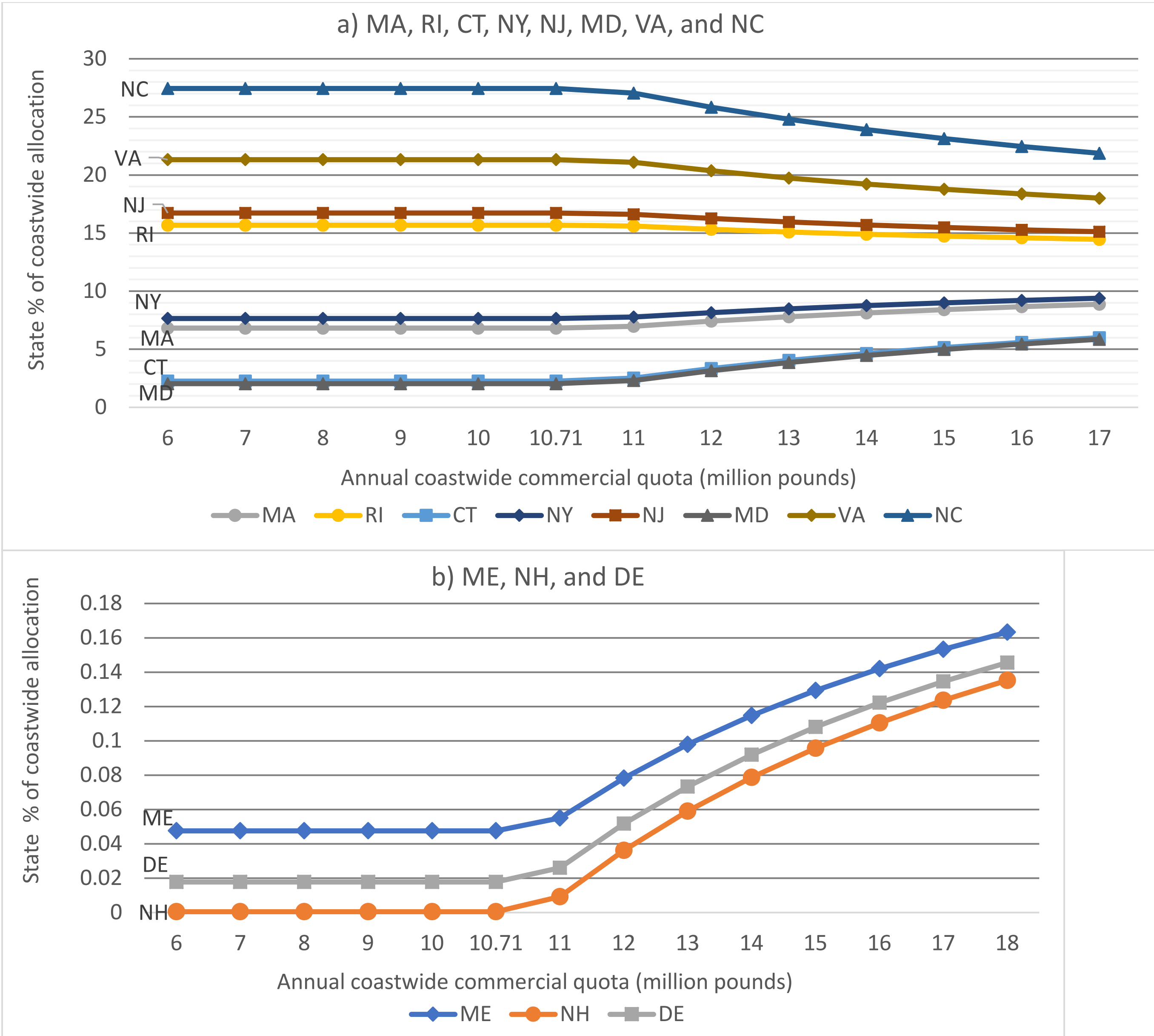


Figure 36: State quota allocation percentage with varying annual coastwide quotas under alternative 2C-2 (10.71 million pound trigger) for a) States with over 1% of the current allocation, and b) Maine, Delaware, and New Hampshire.

Alternative 2D: "Scup Model" Quota System for Summer Flounder

This alternative would allocate the annual summer flounder commercial quota into three unequal periods, similar to the way the commercial scup fishery is currently managed (hence the "scup model" descriptor; this alternative is modeled after the scup fishery but has no impact on scup management). In the two winter periods, January-April (Winter I) and November-December (Winter II), a coastwide quota system would be implemented in conjunction with a system of coastwide landings limits and other measures to constrain landings to the seasonal allocation.

During the winter periods, measures would apply throughout the management unit (i.e., no state-specific measures would be implemented), and vessels could land in any port along the coast provided they have the appropriate state specific permits. All commercial landings during the winter period would count toward the quota for that period. When the period quota has been landed, fishing for and/or landing summer flounder would be prohibited for the remainder of the period. Landings in excess of the allocation for the period would be subtracted from the following year's quota for the same period.

In the Summer period, May-October, the quota would continue to be managed on a coastwide basis in federal waters, but a state-by-state quota system would be implemented by the Commission, but with different state allocations compared to *status quo* given that they would only apply during the summer. Summer quota shares would be managed by individual states, which would be responsible for implementing appropriate possession limits and other management measures during the summer period. As is done for scup, any overall summer period quota overages would be subtracted from the next year's overall summer period quota, and the Commission would work out the appropriate reductions in state quotas according to which states contributed to the overage. States would be allowed to transfer or combine summer quotas through the Commission's process.

For this alternative, there are **two sub-alternatives for consideration that relate to how the state of Maryland would be dealt with in this system**. The state of Maryland has indicated that coastwide management during the winter periods would conflict with their current system of managing commercial summer flounder quota under an Individual Fishing Quota (IFQ) program. **Sub-alternative 2D-1**, described below, would exempt the state of Maryland from this management system and allow them to retain their current state allocation. **Sub-alternative 2D-2** would implement this quota system <u>without</u> an exemption for Maryland. These sub-options are described in detail below.

Sub-Alternative 2D-1: Exemption/Status Quo Management for Maryland

This sub-alternative would implement the "scup model" system for commercial summer flounder with an exemption for the state of Maryland, which manages their commercial summer flounder fishery under an IFQ program. This strategy allows the small number of participants in Maryland's fishery (currently seven IFQ holders) to manage their own allocation as they wish throughout the year. This type of management would not integrate well with coastwide management periods. If Maryland had no state-specific quota during the winter periods, IFQ holders could not be allowed an individual allocation to manage during this time.

Sub-alternative 2D-1 proposes that Maryland's existing state commercial quota percentage for summer flounder (2.03910%) be maintained as a separate state-specific allocation outside of the seasonal period allocation system. Maryland could continue to manage their fishery under an IFQ year-round, and landings from Maryland IFQ vessels during the winter periods would count only toward the annual MD-specific quota rather than the coastwide winter quota. Vessels not licensed to participate in the Maryland fishery would remain unable to land summer flounder commercially in Maryland, except in circumstances related to safe harbor or other inter-state

agreements involving the state of Maryland. Similarly, Maryland vessels would be required to land their summer flounder in the state of Maryland rather than anywhere along the coast.
The proposed configuration of sub-alternative 2D-1 is summarized in Table 24, and described below. Example allocations under hypothetical quota scenarios are described.

- **Quota period dates** are proposed to be Winter I: January 1-April 30; Summer: May 1-October 31, and Winter II: November 1-December 31. These are the same dates as previously used for scup, prior to the recent modification of quota period dates (83 FR 17314; April 19, 2018). October is proposed to be in the Summer period based on feedback from advisors as well as initial analysis indicating that the characteristics of the October summer flounder fishery generally align more with the summer fishery in terms of area fished (state vs. federal waters), vessel tonnage, and gear types used. **The Council and Board have requested specific comments from the public on the proposed quota period dates, especially the month of October.**
- **Allocation between quota periods** under alternative 2D-1 is based on summer flounder landings by period over the past 20 years (1997-2016), for all states in the management unit except Maryland.[13] 55.26% of the annual quota would be allocated to Winter I, 27.65% to Summer, and 17.10% to Winter II (Table 23). The commercial fishery would close coastwide (in federal and state waters) when the allocation for a given Winter period is projected to be reached. The Regional Administrator would close the EEZ to fishing for summer flounder by commercial vessels when the quota has been landed, and states would be responsible for state waters closures.
- **Quota rollover provisions** would be similar to those in place for the scup fishery. If the full Winter I quota is not harvested, unused quota would be added to the quota for the Winter II period in the same fishing year. Quota is unable to be rolled over from one fishing year to the next under the current FMP.[14]
- **Coastwide possession limits** would be needed during the two winter periods. Specific possession limits are not proposed through this action but would need to be developed and reviewed annually by the Summer Flounder, Scup, and Black Sea Bass Monitoring Committee (MC), accounting for changes in the fishery and the annual quota. These recommendations would then be adopted by the Council and Board during the annual specifications process
- **Summer period state allocations** under 2D-1 are based on the percentage contribution of each state's summer period (May-October) landings from 1997-2016; Table 23).

[13] Past state-level seasonal regulations (e.g., closures, possession limits) are not explicitly accounted for in this analysis.
[14] For additional discussion of this issue, see page 19 of http://www.mafmc.org/s/Commercial-Range-of-Alts-Discussion-Doc-4-May-2017.pdf

Table 23: Percentage of commercial summer flounder landings by proposed quota periods, 1997-2016. EXCLUDES landings from the state of Maryland. Data source: NMFS dealer data (AA tables) as of May 2017.

Year	Winter I (Jan 1-Apr 30)	Summer (May 1-Oct 31)	Winter II (Nov 1 -Dec)	Total
1997	58.97%	40.04%	0.99%	100.00%
1998	51.23%	27.29%	21.48%	100.00%
1999	56.97%	28.14%	14.89%	100.00%
2000	57.89%	25.82%	16.28%	100.00%
2001	51.07%	25.24%	23.69%	100.00%
2002	54.06%	26.49%	19.45%	100.00%
2003	53.59%	26.01%	20.40%	100.00%
2004	52.63%	25.11%	22.26%	100.00%
2005	58.93%	24.68%	16.39%	100.00%
2006	57.13%	26.14%	16.73%	100.00%
2007	61.24%	30.14%	8.63%	100.00%
2008	56.64%	27.82%	15.54%	100.00%
2009	51.85%	29.34%	18.81%	100.00%
2010	50.51%	29.00%	20.49%	100.00%
2011	57.45%	27.38%	15.16%	100.00%
2012	53.85%	29.68%	16.47%	100.00%
2013	58.49%	25.56%	15.95%	100.00%
2014	54.43%	28.39%	17.18%	100.00%
2015	52.27%	29.42%	18.32%	100.00%
2016	57.76%	28.83%	13.41%	100.00%
Average	55.26%	27.65%	17.10%	100.00%

Table 24: Summary of proposed allocation configuration of Alternative 2D-1 (Maryland exemption), with examples using hypothetical coastwide quotas at 8.12 million lb and 14.00 million lb.

Quota Period	Allocation % (of annual coastwide commercial quota LESS 2.03910% allocated to Maryland)		Measures	Example allocation (lbs) based on 8.12 million lb quota		Example allocation (lbs) based on 14.00 million lb quota	
Winter I (January 1-April 30)	**55.26%**		Coastwide (except MD)	4,486,850		7,735,948	
Summer (May 1-October 31)	**27.65%**		State-specific	2,244,955		3,870,612	
State-specific summer allocations	**ME**	0.015%		**ME**	347	**ME**	598
	NH	0.000%		**NH**	0	**NH**	2
	MA	19.332%		**MA**	433,988	**MA**	748,255
	RI	22.476%		**RI**	504,568	**RI**	869,945
	CT	3.566%		**CT**	80,052	**CT**	138,021
	NY	18.553%		**NY**	416,495	**NY**	718,095
	NJ	29.667%		**NJ**	666,004	**NJ**	1,148,283
	DE	0.045%		**DE**	1,013	**DE**	1,746
	MD	--[a]		**MD**	--	**MD**	--
	VA	5.648%		**VA**	126,785	**VA**	218,594
	NC	0.699%		**NC**	15,702	**NC**	27,072
Winter II (November 1 - December 31)	**17.10%**		Coastwide (except MD)	1,388,195		2,393,440	
Total	**100%**		--	8,120,000		14,000,000	

[a] Under Alternative 2D-1, Maryland would have an annual allocation of 2.03910% of the coastwide quota (and thus no specific seasonal allocation for the summer period quota).

Sub-Alternative 2D-2: No Exemption for Maryland

Sub-alternative 2D-2 is similar to alternative 2D-1 except that it would not provide an exemption for Maryland. Maryland IFQ holders would not be able to preserve their current year-round management of their own allocation; instead they would be subject to coastwide measures and closures during the winter periods and state measures during the summer period.

The proposed configuration of sub-alternative 2D-2 is summarized in Table 25, and described below. Example allocations under hypothetical quota scenarios are described below.

- **Allocation between quota periods** for alternative 2D-2 is based on average summer flounder landings in each proposed period from 1997-2016, in all states Maine through North Carolina. 58.68% would be allocated to the Winter I period, 28.28% to Summer, and 17.04% to Winter II (Table 24).
- **Quota rollover provisions and coastwide possession limit processes** are the same as those described above for alternative 2D-1.
- **Summer period state allocations** under 2D-2 are based on the percentage contribution of each state's summer period (May-October) landings over the period 1997-2016 (Table 25).

Table 24: Percentage of commercial summer flounder landings by proposed quota periods, 1997-2016. Includes all states ME-NC. Data source: NMFS dealer data (AA tables) as of May 2017.

Year	Winter I (Jan 1-Apr 30)	Summer (May 1-Oct 31)	Winter II (Nov 1 -Dec)	Total
1997	58.50%	40.54%	0.97%	100.0%
1998	50.80%	28.08%	21.12%	100.0%
1999	56.26%	28.92%	14.82%	100.0%
2000	56.96%	26.65%	16.39%	100.0%
2001	51.00%	25.57%	23.43%	100.0%
2002	53.35%	27.24%	19.41%	100.0%
2003	52.89%	26.95%	20.16%	100.0%
2004	52.14%	25.85%	22.02%	100.0%
2005	58.19%	25.64%	16.16%	100.0%
2006	56.56%	26.70%	16.74%	100.0%
2007	59.76%	31.72%	8.52%	100.0%
2008	55.51%	28.49%	16.00%	100.0%
2009	51.48%	29.83%	18.68%	100.0%
2010	50.05%	29.36%	20.59%	100.0%
2011	56.98%	27.94%	15.09%	100.0%
2012	53.62%	29.94%	16.44%	100.0%
2013	58.05%	25.70%	16.24%	100.0%
2014	54.03%	29.04%	16.93%	100.0%
2015	52.08%	29.53%	18.40%	100.0%
2016	56.90%	29.21%	13.89%	100.0%
Average	**54.68%**	**28.28%**	**17.04%**	**100.0%**

Table 25: Summary of proposed allocation configuration of Alternative 2D-2 (includes Maryland), with examples using hypothetical coastwide quotas at 8.12 million lb and 14.00 million lb.

Quota Period	Allocation % (of annual coastwide commercial quota)		Measures	Example allocation (lbs) based on 8.12 million lb quota		Example allocation (lbs) based on 14.00 million lb quota	
Winter I (January 1-April 30)	**54.68%**		Coastwide	4,440,145		7,655,422	
Summer (May 1-October 31)	**28.28%**		State-specific	2,296,255		3,959,060	
State-specific summer allocations	**ME**	0.015%		**ME**	340	**ME**	586
	NH	0.000%		**NH**	0	**NH**	2
	MA	18.525%		**MA**	425,389	**MA**	733,429
	RI	21.538%		**RI**	494,571	**RI**	852,708
	CT	3.417%		**CT**	78,466	**CT**	135,287
	NY	17.779%		**NY**	408,243	**NY**	703,867
	NJ	28.429%		**NJ**	652,808	**NJ**	1,125,531
	DE	0.043%		**DE**	993	**DE**	1,711
	MD	4.171%		**MD**	95,782	**MD**	165,141
	VA	5.412%		**VA**	124,272	**VA**	214,263
	NC	0.670%		**NC**	15,391	**NC**	26,536
Winter II (November 1 - December 31)	**17.04%**		Coastwide	1,383,599		2,385,516	
Total	**100%**		--	8,120,000		14,000,000	

Between sub-alternatives 2D-1 and 2D-2, the timing of the seasonal quota periods is proposed to be the same. In addition, seasonal quota rollover provisions and the process for setting coastwide management measures is proposed to be the same. What would differ between the two options, based on whether or not Maryland was exempted, are the seasonal quota allocations and the state-by-state summer allocations. Since these are based on landings history from 1997-2016, the proposed sub-alternatives are based on analysis with (2D-2) and without

(2D-1) data from the state of Maryland. Table 26 compares the differences in seasonal quota period and state summer period allocations under the two sub-options.

Table 26: Comparison of allocation differences between sub-alternatives 2D-1 and 2D-2.

	Alt. 2D-1: based on 1997-2016 landings without Maryland	Alt. 2D-2: based on 1997-2016 landings with Maryland	Absolute Difference
Quota Period Allocations			
Winter I	55.26%	54.68%	**0.58%**
Summer	27.65%	28.28%	0.63%
Winter II	17.10%	17.04%	0.06%
State Summer Period Allocations			
ME	0.02%	0.01%	**0.01%**
NH	0.00%	0.00%	**0.00%**
MA	19.33%	18.53%	**0.80%**
RI	22.48%	21.54%	**0.94%**
CT	3.57%	3.42%	**0.15%**
NY	18.55%	17.78%	**0.77%**
NJ	29.67%	28.43%	**1.24%**
DE	0.05%	0.04%	**0.01%**
MD	--[a]	4.17%	**--**
VA	5.65%	5.41%	**0.24%**
NC	0.70%	0.67%	**0.03%**

[a] Maryland would have an annual allocation of 2.03910% of the coastwide quota (and thus no specific seasonal allocation for the summer period quota).

4.2.3 Landings Flexibility Provisions (Issue 3)

This issue item considers whether to add "landings flexibility" policies to the list of issues in the Council's FMP that can be modified through a framework action. Framework actions are modifications to the Council's FMP that are typically (though not always) more efficient than a full amendment. While amendments may take several years to complete and address a variety of issues, frameworks can often be completed in 5-8 months and address one or a few issues in a fishery. Framework actions can only modify existing measures and/or those that have been previously considered in an FMP amendment. Because the Commission does not do framework actions and instead can address issues of this scope through FMP addenda, this alternative set does not apply to the Commission's FMP.

Landings flexibility, as described below, may allow for commercial vessels to land or possess summer flounder in states where they are not permitted at the state level. Landings flexibility differs from “safe harbor” agreements between some states, which are based on state level agreements and allow a state to accept landings from a vessel on a temporary basis under certain emergency situations (e.g., weather, mechanical breakdown, injured crew member). Landings flexibility, on the other hand, would be a broader policy that would require a state to accept vessels that do not necessarily meet state level permitting or landing license criteria, as described under alternative 3B below.

This action would not implement any landings flexibility policies at this time, but instead would simply allow these policies to be implemented via a future framework action (for the Council; with corresponding addendum from the Commission) rather than through an amendment process. **The impacts of any future framework action related to landings flexibility would be analyzed through a separate action**, which would include public comment opportunities and documentation of compliance with all applicable laws. Depending on the proposed configuration of landings flexibility in a future action, **the level of analysis required may vary and an EIS may be required if impacts are expected to be significant.**

Alternative 3A: No Action/Status Quo

Under this alternative, no changes would be made to the framework provisions of the FMP. Broad coastwide landings flexibility would remain inconsistent with the current FMP, and any future programs of this type would likely have to be implemented through an amendment to the FMP. While the Commission may be able to implement coastwide landings flexibility through an addendum, doing so could create inconsistencies between the two FMPs. States would remain free to develop landings flexibility agreements through state-level agreements, provided that such agreements are consistent with other Council and Commission FMP requirements and would not require modification to the federal management measures.

Alternative 3B: Add landings flexibility as a framework provision in the FMP

Under alternative 3B, “landings flexibility” policies for the commercial summer flounder fishery would be added to the list of frameworkable items in the summer flounder, scup, and black sea bass FMP. This would allow for landings flexibilities policies to be implemented through future framework actions (for the Council) and FMP addenda (for the Commission), rather than through a more complex amendment process. **This alternative is primarily administrative in that it does not implement any landings flexibility policies, but simply modifies the way that landings flexibility policies may be implemented in the future.** A brief overview of what may be considered in a future framework action for these types of policies is provided here.

"Landings flexibility" means the ability to land or possess summer flounder in any state (or, in some configurations, any participating state) without requiring that vessel to be permitted in that state. The Council and Board's intent is to allow for consideration of multiple possible configurations of landings flexibility through future framework actions, including allowing vessels to land in any port/state, developing multi-state landings agreements, and/or allowing vessels to possess multiple state possession limits at one time for separate offloading. The specific details of how landings flexibility would work in practice would be determined at the time of a future framework action. No specific proposals for framework actions have been put forward at this time.

In its most commonly discussed form, landings flexibility would allow vessels with a federal summer flounder moratorium permit to commercially land summer flounder in any port of their choosing within the management unit, in any state, regardless of state level permits. This has been suggested as a means of addressing rising fishing costs, fuel use (for both environmental impact and cost reasons), increasing adaptability to market conditions, addressing safety concerns, adapting to a changing distribution of fish, and improving efficiency. It has been suggested that landings flexibility would reduce long steam times and operating costs associated with strict requirements to land fish in a specific state or states. With more flexibility in where they can offload fish, fishermen that fish farther from their home state could make multiple fishing trips before making the trip home.

Landings flexibility as previously discussed by the Council and Board is intended to work within the existing state-by-state quota system, as landings flexibility would not be necessary under a coastwide system (or "scup model" under alternative 2D). Some questions remain about how state quotas could be effectively managed if landings were open to any state/port. Quota transfers would likely be required to properly attribute landed summer flounder amounts to the permit state rather than the state of landing. GARFO has indicated that it would likely be impossible to track landings at the individual permit/vessel level and attribute them to the correct state without a quota transfer, at least with the level of timeliness and accuracy required of in-season commercial management. Thus, properly assigning landings to the appropriate state would require quota transfers between states each time a vessel landed in a non-permitted state. If a vessel is permitted in multiple states, there would need to be a clear process to specify against which state's quota the landings should be counted (i.e., which state needs to participate in a quota transfer). Under a broad coastwide landings flexibility policy, **each state would be required to accept commercial vessels desiring to land summer flounder in that state**, and would likely be required to participate in the associated quota transfer.

Additional analysis under any future framework action would be needed to determine how state level trip limits and other state-specific measures would be enforced if any vessel could land in any state. Specifically, the Council and Board would need to specify if a vessel would be subject to the possession/trip limits and seasons of the state in which they land, or to those of the state in which they are permitted (the vessel's "home state").

4.3 RECREATIONAL MANAGEMENT MEASURES

There is a significant recreational fishery for summer flounder, primarily in state waters when the fish migrate inshore during the warm summer months. For the recreational sector, Amendment 2 required each state to adopt the same minimum size and possession limit as established in Federal waters, allowing only for different open seasons. The consistent measures were intended to achieve conservation equivalency in all state and Federal waters throughout the range of the resource. However, states soon found that one set of measures applied coastwide did not achieve equivalent conservation due to the significant geographic differences in summer flounder abundance and size composition. To address this disparity, the FMP was amended via Addendum IV and Framework 2 (2001) and Addendum VIII (2003) to allow for the use of state conservation equivalency to manage recreational harvests.

The Council and Commission determine annually whether to manage the recreational fishery under coastwide measures or conservation equivalency. Under conservation equivalency, state- or region- specific measures are developed through the Commission’s management process and submitted to NMFS. The combined state or regional measures must achieve the same level of conservation as would a set of coastwide measures developed to adhere to the overall recreational harvest limit. If NMFS considers the combination of the state- or region- specific measures to be "equivalent" to the coastwide measures, they may then waive the coastwide regulation in federal waters. Anglers fishing in federal waters are then subject to the measures of the state in which they land summer flounder.

The recreational fishery has been managed using conservation equivalency each year since 2001. From 2001 through 2013, measures were developed under state-by-state conservation equivalency. Since 2014, a regional approach has been used, under which the states within each region must have identical size limits, possession limits, and season length.

Until 2014, state-by-state harvest targets were developed based on the proportion of estimated state recreational landings in 1998 as reported in the Marine Recreational Fisheries Statistical Survey (MRFSS). Starting in 2014, the Commission has adopted regional conservation equivalency measures each year in an effort to address concerns over equitable access to the summer flounder fisheries. Factors contributing to the perceived inequity included: reliance upon recreational harvest estimates for a single year (1998) as the basis for individual state allocations; a change in the abundance and distribution of the resource; and changes in the socio-economic characteristics of the fishery. Under regional conservation equivalency each year from 2014-2017, the 1998 base-year targets are not used, and ad hoc adjustments to the state and regional measures are determined by the Board with a focus on constraining the overall coastwide harvest to the recreational harvest limit. Recreational measures for 2017 are shown in Table 27.

Table 27: 2017 regional measures for summer flounder and preliminary landings (in thousands of fish) by state and region, 2017.

Region	State	Min. Size (inches)	Poss. Limit	Open Season	Prelim. 2017 Landings ('000 fish)
1	**MA**	17	4 fish	May 22-Sept. 23	26
2	**RI**	19	4 fish	May 1-Dec. 31	59
3	**CT**	19	3 fish	May 17- Sept. 21	87
		17 (41 designated shore sites)			
	NY	19	3 fish	May 17- Sept. 21	214
	NJ	18	3 fish	May 25-Sept. 5	433
		16 (1 shore site)	2 fish		
		17 (NJ Delaware Bay)	3 fish		
4	**DE**	17	4 fish	Jan. 1- Dec. 31	33
	MD	16	4 fish	Jan. 1- Mar. 31	26
		17		April 1- Dec.31	
	PRFC	16	4 fish	Jan. 1- Dec.31	--
	VA	17	4 fish	Jan. 1- Dec. 31	90
5	**NC**	15	4 fish	Jan. 1- Dec. 31	26

4.4 IMPACTS OF THE FISHERY MANGEMENT PROGRAM

This Amendment includes several options which could carry potential biological, social, and economic impacts. **Analysis on impacts for each of the management alternatives can be found in Appendix I.**

4.5 ALTERNATIVE STATE MANAGEMENT REGIMES

4.5.1 General Procedures

A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission. Such changes shall be submitted to the Chair of the Plan Review Team (PRT), who shall distribute the proposal to appropriate groups, including the Board, the PRT, the TC, and the AP.

The PRT is responsible for gathering the comments of the TC and the AP. The PRT is also responsible for presenting these comments to the Board for decision.

The Board will decide whether to approve the state proposal for an alternative management program if it determines that it is consistent with the target fishing mortality rate applicable as well as the goals and objectives of this amendment.

In order to maintain consistency within a fishing season, new rules should be implemented prior to the start of the fishing season. Given the time needed for the TC, AP, and Board to review the proposed regulations, as well as the time required by an individual state to promulgate new regulations, it may not be possible to implement new regulations for the on-going fishing season. In this case, new regulations should be effective at the start of the following season after a determination to do so has been made.

4.5.2 Management Program Equivalency

The TC, under the direction of the PRT, will review any alternative state proposals under this section and provide its evaluation of the adequacy of such proposals to the Board. The PRT can also ask for reviews by the Law Enforcement Committee (LEC) or the AP.

4.5.3 De minimis Fishery Guidelines

The Summer Flounder FMP is a joint plan prepared under both the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended, and the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). Under the ACFCMA, if a state does not implement measures required by an FMP, the Federal government may impose a moratorium on the landing of the species covered by the FMP in that state.

The Commission's Interstate Fisheries Management Program Charter defines *de minimis* as a situation in which, under existing conditions of the stock and scope of the fishery, conservation and enforcement actions taken by an individual state would be expected to contribute insignificantly to a coastwide conservation program required by an FMP or amendment. Commission FMP's commonly include *de minimis* provisions to relieve regulatory and monitoring burdens for states that meet predetermined conditions and follow a defined request process. Any state in which commercial summer flounder landings during the last preceding calendar year for which data are available were less than 0.1 percent of the total coastwide quota for that year could be granted *de minimis* status for the summer flounder commercial fishery by NMFS and Commission upon the annual recommendation of the Council and Commission, by way of a formal written request from the state and subsequent review and recommendation of the Summer Flounder Monitoring Committee. The following conditions would apply:

(1) The *de minimis* status will be valid only for that year for which the specifications are in effect, and will be effective upon filing by the NMFS of the final specifications for the commercial summer flounder fishery with the Office of the Federal Register.
(2) The total quota allocated to each *de minimis* state will be set equal to 0.1 percent of the total yearly allocation, and will be subtracted from the coastwide quota before the remainder is allocated to the other states.
(3) In applying for *de minimis* status, a state must show that it has implemented reasonable steps to prevent landings from exceeding its *de minimis* allocation.

4.6 ADAPTIVE MANAGEMENT

The Board may vary the requirements specified in this Amendment as a part of adaptive management in order to conserve the Summer flounder resource. The elements that can be modified by adaptive management are listed in *Section 4.6.2*. The process under which adaptive management can occur is provided below.

4.6.1 General Procedures

The PRT will monitor the status of the fishery and the resource and report on that status to the Board annually or when directed to do so by the Board. The PRT will consult with TC, the SASC, and the AP in making such review and report.

The Board will review the report of the PRT, and may consult further with the TC, or AP. The Board may, based on the PRT report or on its own discretion, direct the FMAT to prepare an addendum to make any changes it deems necessary. The addendum shall contain a schedule for the states to implement the new provisions.

The PDT will prepare a draft addendum as directed by the Board, and shall distribute it to all states for review and comment. A public hearing will be held in any state that requests one. The PDT will also request comment from federal agencies and the public at large. After a 30-day review period, staff, in consultation with the PDT, will summarize the comments received and prepare a final version of the addendum for the Board.

The Board shall review the final version of the addendum prepared by the PDT, and shall also consider the public comments received and the recommendations of the TC, LEC, and AP. The Board shall then decide whether to adopt, or revise and then adopt, the addendum.

Upon adoption of an addendum by the Board, states shall prepare plans to carry out the addendum, and submit them to the Board for approval according to the schedule contained in the addendum.

4.6.2 Measures Subject to Change

The following measures are subject to change under adaptive management upon approval by the Board:

(1.) Minimum fish size.
(2.) Maximum fish size.
(3.) Gear restrictions.
(4.) Gear requirements or prohibitions.
(5.) Permitting restrictions.
(6.) Recreational possession limit.
(7.) Recreational seasons.
(8.) Closed areas.
(9.) Commercial seasons.
(10.) Commercial trip limits.
(11.) Commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch.
(12.) Recreational harvest limit.
(13.) Annual specification quota setting process.
(14.) FMP Technical Monitoring Committee composition and process
(15.) Description and identification of essential fish habitat (EFH) and fishing gear management measures that impact EFH.
(16.) Description and identification of habitat areas of particular concern.
(17.) Overfishing definition and related thresholds and targets.
(18.) Regional gear restrictions.
(19.) Regional season restrictions (including option to split seasons).
(20.) Restrictions on vessel size (LOA and GRT) or shaft horsepower.
(21.) Operator permits
(22.) Any other commercial or recreational management measure
(23.) Any other management measures currently included in the FMP.
(24.) Set aside quotas for scientific research.

4.7 EMERGENCY PROCEDURES

Emergency procedures may be used by the Board to require any emergency action that is not covered by, is an exception to, or a change to any provision in this Amendment. Procedures for implementation are addressed in the ASMFC Interstate Fisheries Management Program Charter, Section Six (c)(10) (ASMFC 2016).

4.8 MANAGEMENT INSTITUTIONS

4.8.1 Atlantic States Marine Fisheries Commission and ISFMP Policy Board

The Commission and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans and amendments, including this Amendment. The ISFMP Policy Board reviews any non-compliance recommendations of the various Boards and, if it concurs, forwards them to the Commission for action.

4.8.2 Summer Flounder, Scup, and Black Sea Bass Management Board

The Board was established under the provisions of the Commission's ISFMP Charter (Section Four; ASMFC 2016) and is generally responsible for carrying out all activities under this Amendment.

The Board establishes and oversees the activities of the PDT, PRT, TC, and the AP. In addition, the Board makes changes to the management program under adaptive management, reviews state programs implementing the amendment, and approves alternative state programs through conservation equivalency. The Board reviews the status of state compliance with the management program annually, and if it determines that a state is out of compliance, reports that determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

4.8.3. Summer Flounder Fishery Management Action Team

The Fishery Management Action Team (FMAT) is composed of personnel from state and federal agencies who have scientific knowledge of Summer Flounder and management abilities. The FMAT is responsible for preparing and developing management documents, including amendments, using the best scientific information available and the most current stock assessment information. The ASMFC FMP Coordinator is a member of the FMAT. The FMAT will either disband or assume inactive status upon completion of this Amendment.

4.8.4 Summer Flounder Plan Review Team

The Plan Review Team (PRT) is composed of personnel from state and federal agencies who have scientific and management ability and knowledge of Summer Flounder. The PRT is responsible for providing annual advice concerning the implementation, review, monitoring, and enforcement of this Amendment once it has been adopted by the Commission. After final action on the Amendment, the Board may elect to retain members of the PDT as members of the PRT, or appoint new members.

4.8.5 Summer Flounder, Scup, and Black Sea Bass Technical Committee

The Summer Flounder, Scup, and Black Sea Bass Technical Committee (TC) consists of representatives from state or federal agencies, Regional Fishery Management Councils, the Commission, a university, or other specialized personnel with scientific and technical expertise, and knowledge of the summer flounder fishery. The Board appoints the members of the TC and may authorize additional seats as it sees fit. The role of the TC is to assess the species' population, provide scientific advice concerning the implications of proposed or potential management alternatives, and respond to other scientific questions from the Board, PDT, or PRT. The SASC reports to the TC.

4.8.6 Summer Flounder, Scup, and Black Sea Bass Advisory Panel

The Summer Flounder, Scup, and Black Sea Bass Advisory Panel (AP) is established according to the Commission's Advisory Committee Charter. Members of the AP are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about Summer flounder conservation and management. The AP provides the Board with advice directly concerning the Commission's Summer flounder management program.

4.8.7 Federal Agencies

4.8.7.1 Management in the Exclusive Economic Zone

Management of summer flounder in the EEZ is within the jurisdiction of one Regional Fishery Management Council (the Mid-Atlantic Fishery Management Council) under the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.). The Council annually makes recommendations on catch and landings limits as well as gear modifications to the NMFS through the specification process. More information can be found in section 4.1.

4.8.7.2 Federal Agency Participation in the Management Process

The Commission has accorded USFWS and NOAA Fisheries voting status on the ISFMP Policy Board and the Summer Flounder, Scup, and Black Sea Bass Management Board in accordance with the Commission's ISFMP Charter. NOAA Fisheries can also participate on the Summer Flounder FMAT, PRT, and TC.

4.8.7.3 Consultation with Fishery Management Councils

At the time of adoption of this Amendment, the Mid-Atlantic Fishery Management Council is the only Regional Fishery Management Council to have implemented a management plan for summer flounder; no other Councils have indicated an intent to develop a plan.

4.9 RECOMMENDATIONS TO THE SECRETARY OF COMMERCE FOR COMPLEMENTARY ACTIONS IN FEDERAL JURISDICTIONS

The summer flounder, scup, and black sea bass fishery management plan is jointly managed between the Commission, Council, and NOAA Fisheries. The proposed alternatives in this Amendment will affect both state and federal permit holders operating in the commercial summer flounder fishery in both state and federal waters. The Atlantic states (through the Commission), the Council, and NOAA Fisheries through joint management coordinate to ensure consistency in management between state and federal waters. Therefore, a specific recommendation to the Secretary of Commerce for complementary action in federal jurisdictions is unnecessary at this time. The Board may consider further recommendations to the Secretary if changes to this Amendment occur through the adaptive management process (*Section 4.6*).

4.10 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS

The Board will cooperate, when necessary, with other management institutions during the implementation of this amendment, including NOAA Fisheries and the New England, Mid-Atlantic, and South Atlantic Fishery Management Council.

5.0 COMPLIANCE

The full implementation of the provisions included in this amendment is necessary for the management program to be equitable, efficient, and effective. States are expected to implement these measures faithfully under state laws. ASMFC will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan.

The Board sets forth specific elements that the Commission will consider in determining state compliance with this fishery management plan, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the ASMFC Interstate Fishery Management Program Charter (ASMFC 2016).

5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

A state will be determined to be out of compliance with the provision of this fishery management plan according to the terms of Section Seven of the ISFMP Charter if:

- Its regulatory and management programs to implement this Amendment have not been approved by the Board; or
- It fails to meet any schedule required by Section 5.2, or any addendum prepared under adaptive management (*Section 4.6*); or
- It has failed to implement a change to its program when determined necessary by the Board; or
- It makes a change to its regulations required under *Section 4* or any addendum prepared under adaptive management (*Section 4.6*), without prior approval of the Board.

5.1.1 Regulatory Requirements

To be considered in compliance with this fishery management plan, all state programs must include a regime of restrictions on summer flounder fisheries consistent with the requirements of *Section 3.1: Commercial Catch and Landings Programs; Section 3.4: Biological Data Collection Programs;* and *Section 4.1: Commercial Fishery Management Measures*. A state may propose an alternative management program under *Section 4.5: Alternative State Management Regimes*, which, if approved by the Board, may be implemented as an alternative regulatory requirement for compliance.

States may begin to implement the Amendment after final approval by the Commission. Each state must submit its required summer flounder regulatory program to the Commission through

ASMFC staff for approval by the Board. During the period between submission and Board approval of the state's program, a state may not adopt a less protective management program than contained in this Amendment or contained in current state law. The following lists the specific compliance criteria that a state/jurisdiction must implement in order to be in compliance with this Amendment:

- Commercial fishery management measures as specified in *Section 4.2* including the Federal Moratorium Requalification (*Section 4.2.1*), Commercial Quota Allocation (*Section 4.2.2*), and Landings Flexibility Provisions (*Section 4.2.3*).
- Monitoring requirements as specified in *Section 3.1*
- Fishery dependent data collection programs as specified in *Section 3.5.1*
- All state programs must include law enforcement capabilities adequate for successful implementation of the compliance measures contained in this Amendment.
- There are no mandatory research requirements at this time; however, research requirements may be added in the future under Adaptive Management, *Section 4.6*.
- There are no mandatory habitat requirements in this Amendment.

5.2 COMPLIANCE SCHEDULE

States must implement this Amendment according to the following schedule:

Month Day, 201X:	Submission of state programs to implement the Amendment for approval by the Board. Programs must be implemented upon approval by the Board.
Month Day, 201X:	States with approved management programs must implement the Amendment. States may begin implementing management programs prior to this deadline if approved by the Board.

5.3 COMPLIANCE REPORT CONTENT

Each state must submit to the Commission an annual report concerning its summer flounder fisheries and management program for the previous year, no later than June 1st. A standard compliance report format has been prepared and adopted by the ISFMP Policy Board. States should follow this format in completing the annual compliance report.

The report shall cover:

Request for *de minimis*, where applicable.

Any state that has commercial landings of less than 0.1% of the total coastwide commercial landings in the last preceding year for which data are available is eligible for *de minimis* status.

III. Previous calendar year's fishery

a. Activities of fishery dependent monitoring (provide a brief review of results including monitoring of gear restrictions; prohibition of transfers at sea; and minimum size limit).
b. Activities of fishery independent monitoring (provide a brief review of results).
c. Copy of regulations that were in effect for the most recent year. Has the state implemented the required measures as mandated in the FMP, listed below? Please answer with either 'yes' or 'no'.

Commercial

Has the state implemented the required measure?	yes	no
14" minimum size		
5.5" diamond or 6" square minimum mesh throughout the entire net		
Threshold to trigger minimum mesh size requirements: (200 lbs 11/1-4/30; 100 lbs from 5/1-10/31)		
Prohibition of transfers at sea		

Recreational

Provide state specific measures for the previous and current fishing season

d. Harvest broken down by commercial (by gear type where applicable) and recreational, and non-harvest losses (when available).

IV. Planned management programs for the current calendar year

Summarize any changes from previous years.

5.4 PROCEDURES FOR DETERMINING COMPLIANCE

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section Seven (ASMFC 2016). In brief, all states are responsible for the full and effective implementation and enforcement of fishery management plans in areas subject to their jurisdiction. Written compliance reports as specified in the Amendment must be submitted annually by each state with a declared interest. Compliance with this Amendment will be reviewed at least annually; however, the Board, ISFMP Policy Board, or the Commission may request the PRT to conduct a review of state's implementation and compliance with Amendment at any time.

The Board will review the written findings of the PRT within 60 days of receipt of a State's compliance report. Should the Board recommend to the Policy Board that a state be determined out of compliance, a rationale for the recommended noncompliance finding will be addressed in a report. The report will include the required measures of this Amendment that the state has not implemented or enforced, a statement of how failure to implement or enforce required measures jeopardizes summer flounder conservation, and the actions a state must take in order to comply with requirements of this Amendment.

The ISFMP Policy Board will review any recommendation of noncompliance from the Board within 30 days. If it concurs with the recommendation, it shall recommend to the Commission that a state be found out of compliance.

The Commission shall consider any noncompliance recommendation from the ISFMP Policy Board within 30 days. Any state that is the subject of a recommendation for a noncompliance finding is given an opportunity to present written and/or oral testimony concerning whether it should be found out of compliance. If the Commission agrees with the recommendation of the ISFMP Policy Board, it may determine that a state is not in compliance with this Amendment, and specify the actions the state must take to come into compliance.

Any state that has been determined to be out of compliance may request that the Commission rescind its noncompliance findings, provided the state has revised its summer flounder conservation measures.

5.5 ANALYSIS OF ENFORCEABILITY OF PROPOSED MEASURES

All state programs must include law enforcement capabilities adequate for successfully implementing that state's summer flounder regulations. The LEC will monitor the adequacy of a state's enforcement activity.

6.0 MANAGEMENT AND RESEARCH NEEDS

The following lists of research needs have been identified to enhance knowledge of the Summer Flounder resource. These research needs are drawn from the 2013 benchmark stock assessment; the MAFMC's Five Year Research Plan (2016-2020); and the Commission's Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management. The list of research recommendations are classified into 1) stock assessment and population dynamics; 2) research and data needs. Research and data needs is further broken down by category: fishery dependent data; fishery independent data; Life History/Biology/Habitat; and socioeconomic.

6.1 STOCK ASSESSMENT AND POPULATION DYNAMICS

1. Evaluate uncertainties in biomass to determine potential modifications to default Overfishing Limit (OFL) CV.

2. Evaluate the size distribution of landed and discarded fish, by sex, in the summer flounder fisheries.

3. Evaluate past and possible future changes to size regulations on retention and selectivity in stock assessments and projections.

4. Incorporate sex -specific differences in size at age into the stock assessment.

5. Continued evaluation of natural mortality and the differences between males and females. This should include efforts to estimate natural mortality, such as through mark-recapture programs, telemetry.

6. Continue efforts to improve understanding of sexually dimorphic mortality and growth patterns. This should include monitoring sex ratios and associated biological information in the fisheries and all ongoing surveys to allow development of sex-structured models in the future.

7. Conduct sensitivity analyses to identify potential causes of the recent retrospective pattern. Efforts should focus on identifying factors in both survey and catch data that could contribute to the decrease in cohort abundance between initial estimates based largely on survey observations and subsequent estimates influenced by fishery dependent data as the cohort recruits to the fishery.

6.2 RESEARCH AND DATA NEEDS

6.2.1 Fishery Dependent

1. Conduct more comprehensive collection of otoliths, for all components of the catch-at-age matrix, on a continuing basis for fish larger than 60 cm (~7 years). The collection of otoliths and the proportion at sex for all of the catch components could provide a better indicator of stock productivity.

2. Collect data to evaluate the length, weight, and age compositions of landed and discarded fish in the summer flounder fisheries (recreational and commercial) by sex. Focus should be placed on age sampling of summer flounder 24 inches or larger in total length, using paired hard part samples (i.e., scales, and when possible, otoliths).
3. Evaluate gear modifications to reduce discard mortality in the recreational fishery.

6.2.2 Fishery Independent

1. Collect information on overall fecundity for the stock, both egg condition and production, as a better indicator of stock productivity.

2. Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop independent catch-at-age and CPUE should focus on YOY and the southern region.

6.2.3 Life History/Biology/Habitat

1. Develop comprehensive study to determine the contribution of summer flounder nursery area to the overall summer flounder population.

2. Evaluate range expansion and/or changes in distribution and their implications for stock assessment and management.

6.2.4 Socioeconomic

1. Investigate social and economic implications of alternative allocations among fishery sectors.

7.0 PROTECTED SPECIES

Numerous protected species inhabit the affected environment of the Summer Flounder, Scup, and Black Sea Bass FMP. These species are under NMFS jurisdiction and are afforded protection under the Endangered Species Act (ESA) of 1973 and/or the Marine Mammal Protection Act (MMPA) of 1972.

Cusk, alewife, and blueback herring are NMFS "candidate species" under the ESA. Candidate species are those petitioned species for which NMFS has determined that listing may be warranted under the ESA and those species for which NMFS has initiated an ESA status review through an announcement in the Federal Register. If a species is proposed for listing the conference provisions under Section 7 of the ESA apply (see 50 CFR 402.10); however, candidate species receive no substantive or procedural protection under the ESA. As a result, these species will not be discussed further in this and the following sections; however, NMFS recommends that project proponents consider implementing conservation actions to limit the potential for adverse effects on candidate species from any proposed action. Additional information on cusk, alewife, and blueback herring can be found at: http://www.nmfs.noaa.gov/pr/species/esa/candidate.htm.

7.1 MARINE MAMMAL PROTECTION ACT (MMPA) REQUIREMENTS

Since its passage in 1972, one of the underlying goals of the MMPA has been to reduce the incidental serious injury and mortality of marine mammals in the course of commercial fishing operations to insignificant levels approaching a zero mortality and zero serious injury rate. Under the 1994 Amendments, the Act requires NMFS to develop and implement a take reduction plan to assist in the recovery of, or prevent the depletion of, each strategic stock that interacts with a Category I or II fishery. A strategic stock is defined as a stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal (PBR)[15] level; (2) which is declining and is likely to be listed under the Endangered Species Act (ESA) in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. Category I and II fisheries are those that have frequent or occasional incidental mortality and serious injury of marine mammals, whereas Category III fisheries are those which have a remote likelihood of incidental mortality and serious injury to marine mammals. Each year NMFS publishes a List of Fisheries (LOF), which classifies commercial fisheries into one of these three categories.

Under 1994 mandates, the MMPA also requires fishermen in Category I and II fisheries to register under the Marine Mammal Authorization Program (MMAP). The purpose of this is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA. All fishermen, regardless of the category of fishery in which they participate, must report all incidental injuries and mortalities caused by commercial fishing operations within 48 hours.

Section 101(a)(5)(E) of the MMPA allows for authorization of the incidental take of ESA-listed marine mammals in the course of commercial fishing operations if it is determined that: (1) incidental mortality and serious injury will have a negligible impact on the affected species or stock; (2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and (3) where required under MMPA Section 118, a monitoring program has been established, vessels engaged in such fisheries are registered, and a take reduction plan has been developed or is being developed for such species or stock. MMPA Section 101(a)(5)(E) permits are not required for Category III fisheries, but any serious injury or mortality of a marine mammal must be reported.

7.2 ENDANGERED SPECIES ACT (ESA) REQUIREMENTS

The taking of endangered sea turtles and marine mammals is prohibited and considered unlawful under Section 9(a)(1) of the ESA. In addition, NMFS or the USFWS may determine Section 4(d) protective regulations to be necessary and advisable to provide for the conservation of threatened species. There are several mechanisms established in the ESA which allow for exceptions to the prohibited take of protected species listed under the ESA. Section 10(a)(1)(A) of the ESA authorizes NMFS to allow the taking of listed species through the issuance of research permits, which allow ESA species to be taken for scientific purposes or to enhance the propagation and survival of the species. Section 10(a)(1)(B) authorizes NMFS to permit, under prescribed terms and conditions, any taking otherwise prohibited by Section 9(a)(1)(B) of the ESA if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. In recent years, some Atlantic state fisheries have obtained section 10(a)(1)(B) permits for state

[15] PBR is the number of human-caused deaths per year each stock can withstand and still reach an optimum population level. This is calculated by multiplying the minimum population estimate by the stock's net productivity rate and a recovery factor ranging from 0.1 for endangered species to 1.0 for healthy stocks.

fisheries. Recent examples are at http://www.nmfs.noaa.gov/pr/permits/esa_review.htm#esa10a1b.

Section 7(a)(2) requires federal agencies to consult with NMFS to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species. If, following completion of the consultation, an action is found to jeopardize the continued existence of any listed species or cause adverse modification to critical habitat of such species, reasonable and prudent alternatives need to be identified so that jeopardy or adverse modification to the species does not occur. Section (7)(o) provides the actual exemption from the take prohibitions established in Section 9(a)(1), which includes Incidental Take Statements that are provided at the end of consultation via the ESA Section 7 Biological Opinions.

7.3 PROTECTED SPECIES WITH POTENTIAL FISHERY INTERACTIONS

Table 26 provides a list of protected species of seas turtle, marine mammal, and fish species present in the affected environment of the summer flounder fishery that may also be affected by the operation of this fishery. These species are described in the sections below, and the potential for these species to interact with summer flounder gear types is described in section 1.4

Table 26: Species Protected Under the ESA and/or MMPA that may occur in the Affected Environment of the summer flounder fishery. Marine mammal species (cetaceans and pinnipeds) italicized and in bold are considered MMPA strategic stocks.[1]

Species	Status	Potentially affected by this action?
Cetaceans		
North Atlantic right whale (Eubalaena glacialis)	***Endangered***	***Yes***
Humpback whale, West Indies DPS (Megaptera novaeangliae)	Protected (MMPA)	Yes
Fin whale (Balaenoptera physalus)	***Endangered***	***Yes***
Sei whale (Balaenoptera borealis)	***Endangered***	***Yes***
Blue whale (Balaenoptera musculus)	***Endangered***	***No***
Sperm whale (Physeter macrocephalus	***Endangered***	***No***
Minke whale (*Balaenoptera acutorostrata*)	Protected (MMPA)	Yes
Pilot whale (Globicephala spp.)[2]	***Protected (MMPA)***	***Yes***
Pygmy sperm whale (*Kogia breviceps*)	Protected (MMPA)	No
Dwarf sperm whale (*Kogia sima*)	Protected (MMPA)	No
Risso's dolphin (*Grampus griseus*)	Protected (MMPA)	Yes
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	Protected (MMPA)	Yes
Short Beaked Common dolphin (*Delphinus delphis*)	Protected (MMPA)	Yes
Atlantic Spotted dolphin (*Stenella frontalis*)	Protected (MMPA)	No
Striped dolphin (*Stenella coeruleoalba*)	Protected (MMPA)	No
Bottlenose dolphin (Tursiops truncatus)[3]	***Protected (MMPA)***	***Yes***
Harbor porpoise (*Phocoena phocoena*)	Protected (MMPA)	Yes
Sea Turtles		

Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Yes
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Yes
Green sea turtle, North Atlantic DPS (*Chelonia mydas*)	Threatened	Yes
Loggerhead sea turtle (*Caretta caretta*), Northwest Atlantic Ocean DPS	Threatened	Yes
Hawksbill sea turtle (*Eretmochelys imbricate*)	Endangered	No
Fish		
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered	No
Atlantic salmon (*Salmo salar*)	Endangered	Yes
Atlantic sturgeon *(Acipenser oxyrinchus)*		
Gulf of Maine DPS	Threatened	Yes
New York Bight DPS, Chesapeake Bay DPS, Carolina DPS & South Atlantic DPS	Endangered	Yes
Cusk (*Brosme brosme)*	Candidate	Yes
Alewife *(Alosa pseudoharengus)*	Candidate	Yes
Blueback herring *(Alosa aestivalis)*	Candidate	Yes
Pinnipeds		
Harbor seal (*Phoca vitulina*)	Protected (MMPA)	Yes
Gray seal (*Halichoerus grypus*)	Protected (MMPA)	Yes
Harp seal (*Phoca groenlandicus*)	Protected (MMPA)	Yes
Hooded seal (*Cystophora cristata*)	Protected (MMPA)	Yes
Critical Habitat		
North Atlantic Right Whale	ESA (Protected)	No
Northwest Atlantic DPS of Loggerhead Sea Turtle	ESA (Protected)	No

[1] A strategic stock is defined under the MMPA as a marine mammal stock for which: (1) the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; and/or (3) is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA (Section 3 of the MMPA of 1972).
[2] There are 2 species of pilot whales: short finned (*G. melas melas*) and long finned (*G. macrorhynchus*). Due to the difficulties in identifying the species at sea, they are often just referred to as *Globicephala spp*.
[3] This includes the Western North Atlantic Offshore, Northern Migratory Coastal, and Southern Migratory Coastal Stocks of Bottlenose Dolphins. See Waring *et al*. (2016) and Hayes et al. 2017 for further details.

7.3.1 Marine Mammals

Table 27 provides the species of large whales that occur in the area of operation for the summer flounder fishery. For additional information on the biology, status, and range wide distribution of each whale species please refer to: Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; NMFS 1991, 2005, 2010b, 2011a, 2012.

Table 27: Large whale species present in the area of operation for the summer flounder fishery.

Species	Listed Under the ESA	Protected Under the MMPA	MMPA Strategic Stock[1]
North Atlantic Right Whale	Yes-Endangered	Yes	Yes
Humpback Whale	No	Yes	Yes
Fin Whale	Yes-Endangered	Yes	Yes
Sei Whale	Yes-Endangered	Yes	Yes
Minke Whale	No	Yes	No

Notes:
[1]A strategic stock is defined under the MMPA as a marine mammal stock: for which the level of direct human-caused mortality exceeds the potential biological removal level; which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or which is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.
Source: Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016

Right, humpback, fin, sei, and minke whales are found throughout the waters of the Northwest Atlantic Ocean. In general, these species follow an annual pattern of migration between low latitude (south of 35ºN) wintering/calving grounds and high latitude spring/summer foraging grounds (primarily north of 41ºN; Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; NMFS 1991, 2005, 2010b, 2011a, 2012). This, however, is a simplification of whale movements, particularly as it relates to winter movements. It remains unknown if all individuals of a population migrate to low latitudes in the winter, although, increasing evidence suggests that for some species (e.g., right and humpback whales), some portion of the population remains in higher latitudes throughout the winter (Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; Cole *et al*. 2013; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012). Although further research is needed to provide a clearer understanding of large whale movements and distribution in the winter, the distribution and movements of large whales to foraging grounds in the spring/summer is well understood. Movements of whales into higher latitudes coincide with peak productivity in these waters. As a result, the distribution of large whales in higher latitudes is strongly governed by prey availability and distribution, with large numbers of whales coinciding with dense patches of preferred forage (Mayo and Marx 1990; Kenney *et al*. 1986, 1995; Baumgartner *et al*. 2003; Baumgartner and Mate 2003; Payne *et al*.1986, 1990; Brown *et al.* 2002; Kenney and Hartley 2001; Schilling *et al.* 1992). For additional information on the biology, status, and range wide distribution of each whale species please refer to: Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; NMFS 1991, 2005, 2010b, 2011a, 2012.

To further assist in understanding how fisheries may overlaps in time and space with the occurrence of large whales, a general overview on species occurrence and distribution in the area of operation for the summer flounder fishery is provided in Table 28.

Table 28: Large whale occurrence in the area of operation for the summer flounder fishery.

Species	Prevalence and Approximate Months of Occurrence
North Atlantic Right Whale	• Distributed throughout all continental shelf waters from the Gulf of Maine to the South Atlantic Bight throughout the year. • New England waters (Gulf of Maine and Georges Bank regions) = **Foraging Grounds** (January through October). Seasonally important foraging grounds include: › Cape Cod Bay (January-April); › Great South Channel (April-June); › western Gulf of Maine (April-May, and July-October); › Jordan Basin (August-October); › Wilkinson Basin (April-July); › northern edge of Georges Bank (May-July); • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern calving grounds. • SAB (Coastal waters from Cape Fear, North Carolina, to 28°N (northeastern Florida) = **Calving and Nursing Grounds** (mid- November-early April). • Increasing evidence of wintering areas (approximately November – January) in: › Cape Cod Bay; › Jeffreys and Cashes Ledges; › Jordan Basin; and › Massachusetts Bay (e.g., Stellwagen Bank).
Humpback	• Distributed throughout all continental shelf waters of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank throughout the year. • New England waters (Gulf of Maine and Georges Bank regions) = **Foraging Grounds** (March-November). • Mid-Atlantic waters: Migratory pathway to/from northern (high latitude) foraging and southern (West Indies) calving grounds. • Increasing evidence of whales remaining in mid- and high- latitudes throughout the winter. Specifically, increasing evidence of wintering areas (for juveniles) in Mid-Atlantic (e.g., waters in the vicinity of Chesapeake and Delaware Bays; peak presence approximately January through March) and Southeastern coastal waters.
Fin	• Distributed throughout all continental shelf waters of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank throughout the year. • Mid-Atlantic waters: › Migratory pathway to/from northern (high latitude) foraging and southern (low latitude) calving grounds; and › Possible offshore calving area (October-January). • New England (Gulf of Maine and Georges Bank)/ Southern New England waters = **Foraging Grounds** (greatest densities March-August; lower densities September-November). Important foraging grounds include: › Massachusetts Bay (esp. Stellwagen Bank); › Great South Channel; › Waters off Cape Cod (~40-50 meter contour); › Gulf of Maine; › Perimeter (primarily eastern) of Georges Bank; and › Mid-shelf area off the east end of Long Island. • Evidence of wintering areas in mid-shelf areas east of New Jersey Stellwagen Bank; and eastern perimeter of Georges Bank.

Species	Prevalence and Approximate Months of Occurrence
Sei	• Uncommon in shallow, inshore waters of the Mid-Atlantic (SNE included), Georges Bank, and Gulf of Maine; however, occasional incursions during peak prey availability and abundance. • Primarily found in deep waters along the shelf edge, shelf break, and ocean basins between banks. • Spring through summer, found in greatest densities in offshore waters of the Gulf of Maine and Georges Bank; sightings concentrated along the northern, eastern (into Northeast Channel) and southwestern (in the area of Hydrographer Canyon) edge of Georges Bank.
Minke	• Widely distributed throughout continental shelf waters (<100m deep) of the Mid-Atlantic (Southern New England included), Gulf of Maine, and Georges Bank. • Most common in the EEZ from spring through fall, with greatest abundance found in New England waters
Sources: NMFS 1991, 2005, 2010b, 2011a, 2012; Hain *et al.* 1992; Payne *et al*. 1984; Good 2008; Pace and Merrick 2008; McLellan *et al*. 2004; Hamilton and Mayo 1990; Schevill *et al*. 1986; Watkins and Schevill 1982; Payne *et al*.1990; Winn *et al.* 1986; Kenney et al. 1986, 1995; Khan *et al*. 2009, 2010, 2011, 2012; Brown *et al*. 2002; NOAA 2008; 50 CFR 224.105; CETAP 1982; Clapham *et al*. 1993; Swingle *et al*. 1993; Vu *et al*. 2012; Baumgartner *et al*. 2011; Cole *et al*. 2013; Risch *et al*. 2013; Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; 81 FR 4837(January 27, 2016); NMFS 2015b; Bort et al. 2015.	

Atlantic large whales are at risk of becoming entangled in fishing gear because the whales feed, travel, and breed in many of the same ocean areas used for fishing. Below we provide the best available information on large whale interaction risks with gear types primarily used in the commercial summer flounder fishery (i.e., trawl (bottom or mid-water), gillnet, and hook and line (rod/reel)).

Bottom Trawl Gear

With the exception of one species, there have been no observed interactions with large whales and trawl gear. The one exception is minke whales, which have been observed seriously injured and killed in bottom trawl gear. In bottom trawl gear, to date, interactions have only been observed in the northeast bottom trawl fisheries. From the period of 2008-2012, the estimated annual mortality attributed to this fishery was 7.8 minke whales for 2008 and zero minke whales from 2009-2012; no serious injuries were reported during this time (Waring *et al*. 2015). Based on this information, from 2008-2012, the estimated annual average minke whale mortality and serious injury attributed to the northeast bottom trawl fishery was 1.6 (CV=0.69) whales (Waring *et al*. 2015). Lyssikatos (2015) estimated that from 2008-2013, mean annual serious injuries and mortalities from the northeast bottom trawl fishery were 1.40 (CV=0.58) minke whales.
Based on above information, trawl gear is likely to pose a low interaction risk to any large whale species. Should an interaction occur, serious injury or mortality to any large whale is possible; however, relative to other gear types discussed below (i.e., fixed gear), trawl gear represents a low source serious injury or mortality to any large whale.

Hook and Line Gear

Large whales have been reported or observed with hook and line or monofilament line wrapped around or trailing from appendages of the whale's body. In the most recent (2010-2014) mortality and serious injury determinations for baleen whales, the majority of cases identified with confirmed hook and line or monofilament entanglement did not result in the serious injury or mortality to the whale (89.5% observed/reported whales had a serious injury value of 0; 10.5% had a serious injury value of 0.75; none of the cases resulted in mortality; Henry *et al*. 2016).[16] In fact, 85.0% of the whales observed or reported with a hook/line or monofilament entanglement were resighted gear free and healthy; confirmation of the health of the other remaining whales remain unknown as no resightings had been made over the timeframe of the assessment (Henry *et al*. 2016). Based on this information, while large whale interactions with hook and line gear are possible, there is a low probability that an interaction will result in serious injury or mortality to any large whale species. Therefore, relative to other gear types discussed below (i.e., fixed gear), hook and line gear is expected to be low source serious injury or mortality to any large whale.

Gillnet Gear

The greatest entanglement risk to large whales is posed by fixed fishing gear that includes lines (vertical or ground) that rise into the water column. This includes both gillnet and pot/trap gear, although pot/trap gear is not described further in this document as it is rarely used to target summer flounder and does not account for a substantial portion of the summer flounder landings. Any line can become entangled in the mouth (baleen), flippers, and/or tail of the whale when the animal is transiting or foraging through the water column (Johnson *et al*. 2005; NMFS 2014a,c; Kenney and Hartley 2001; Hartley *et al*. 2003; Whittingham *et al*. 2005a,b; Waring *et al*. 2016). For instance, in a study of right and humpback whale entanglements, Johnson *et al*. (2005) attributed: (1) 89% of entanglement cases, where gear could be identified, to fixed gear consisting of pot and gillnets and (2) entanglement of one or more body parts of large whales (e.g., mouth and/or tail regions) to four different types of line associated with fixed gear (the buoy line, groundline, floatline, and surface system lines).[17] Although available data (e.g., Johnson *et al*. (2005), Waring *et al*. (2016); Henry *et al*. (2016)) provides insight into large whale entanglement risks with fixed fishing gear, determining which part of fixed gear creates the most entanglement risk for large whales is difficult (Johnson *et al.* 2005). The difficulties arise from uncertainties surrounding the nature of the entanglement event, as well as unknown biases associated with reporting effort and the lack of information about the types and amounts of gear being used. As a result, any type or part of fixed gear is considered to create an entanglement risk to large whales and should be considered potentially dangerous to large whale species (Johnson *et al.* 2005).

The effects of entanglement to large whales range from no injury to death (NMFS 2014a,c; Johnson *et al*. 2005; Angliss and Demaster 1998; Moore and Van der Hoop 2012). The risk of injury or death in the event of an entanglement may depend on the characteristics of the whale

[16] Any injury leading to a significant health decline (e.g., skin discoloration, lesions near the nares, fat loss, increased cyamid loads) is classified as a serious injury (SI) and will result in a SI value set at 1 (Henry *et al*. 2015, 2016).

[17] Buoy line connects the gear at the bottom to the surface system. Groundline in trap/pot gear connects traps/pots to each other to form trawls; in gillnet gear, groundline connects a gillnet, or gillnet bridle to an anchor or buoy line. Floatline is the portion of gillnet gear from which the mesh portion of the net is hung. The surface system includes buoys and high-flyers, as well as the lines that connect these components to the buoy line.

involved (species, size, age, health, etc.), the nature of the gear (e.g., whether the gear incorporates weak links designed to help a whale free itself), human intervention (e.g., the feasibility or success of disentanglement efforts), or other variables (NMFS 2014c). Although the interrelationships among these factors are not fully understood, and the data needed to provide a more complete characterization of risk are not available, available data indicates that entanglement in fishing gear is a significant source of serious injury or mortality for Atlantic large whales (Table 28 Henry *et al*. 2017; Waring *et al*. 2016).

Table 29 summarizes confirmed human-caused serious injury and mortality to humpback, fin, sei, minke, and North Atlantic right whales along the Gulf of Mexico Coast, U.S. East Coast, and Atlantic Canadian Provinces from 2011 to 2015 (Henry *et al.* 2017). The data provided in Table 29 is specific to confirmed serious injury or mortality to whales from entanglement in fishing gear. As many entanglement events go unobserved, and because the gear type, fishery, and/or country of origin for reported entanglements are often not traceable, the information presented in Table 29 likely underestimates the rate of large whale serious injury and mortality due to entanglement. Studies looking at scar rates for right whales and humpbacks suggest that entanglements may be occurring more frequently than the observed incidences indicate (NMFS 2014c; Robbins 2009; Knowlton *et al.* 2012).

Table 29: Summary of confirmed serious injury or mortality to fin, minke, humpback, sei, and North Atlantic right whales from 2011-2015 due to fisheries entanglements.[1]

Species	Total Confirmed Entanglement: Serious Injury[2]	Total Confirmed Entanglement: Non-Serious Injury	Total Confirmed Entanglement: Mortality	Entanglement Events: Total Average Annual Injury and Mortality Rate (US waters/Canadian waters/unassigned waters)
North Atlantic Right Whale	19	35	5	4.55 (0.4/0/4.15)
Humpback Whale	32	61	5	6.45 (1.5/0.3/4.65)
Fin Whale	6	2	4	1.85 (0.2/0.8/0.85)
Sei Whale	0	0	0	0
Minke Whale	20	12	22	7.75 (1.9/3.25/2.6)

Notes:
[1]Information presented in this table is based on confirmed human-caused injury and mortality events along the Gulf of Mexico Coast, US East Coast, and Atlantic Canadian Provinces; it is not specific to US waters only.
[2] NMFS defines a serious injury as an injury that is more likely than not to result in mortality (for additional details see: http://www.nmfs.noaa.gov/pr/pdfs/serious_injury_procedure.pdf)
Source: Henry *et al.* 2017

As noted in section 7.1, pursuant to the MMPA, NMFS publishes a List of Fisheries annually, classifying U.S. commercial fisheries into one of three categories based on the relative frequency of incidental serious injurious and mortalities of marine mammals in each fishery. Large whales, in particular, humpback, fin, minke, and North Atlantic right whales, are known to interact with Category I and II fisheries in the (Northwest) Atlantic Ocean. As fin and North Atlantic right whales are listed as endangered under the ESA, these species are considered strategic stocks under the

MMPA (see section 7.1). Section 118(f)(1) of the MMPA requires the preparation and implementation of a Take Reduction Plan (TRP) for any strategic marine mammal stock that interacts with Category I or II fisheries. In response to its obligations under the MMPA, in 1996 NMFS established the Atlantic Large Whale Take Reduction Team (ALWTRT) to develop a plan (Atlantic Large Whale Take Reduction Plan (ALWTRP)) to reduce serious injury and mortality of large whales, specifically, humpback, fin, and North Atlantic right whales, due to incidental entanglement in U.S. commercial fishing gear.[18] The ALWTRP was implemented in 1997, and has been modified several times since as NMFS and the ALWTRT learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. Recent adjustments include the Sinking Groundline Rule and Vertical Line Rules (72 FR 57104, October 5, 2007;79 FR 36586, June 27, 2014; 79 FR 73848, December 12, 2014; 80 FR 14345, March 19, 2015; 80 FR 30367, May 28, 2015).[19]

The ALWTRP consists of regulatory (e.g., universal gear requirements, modifications, and requirements; area-and season- specific gear modification requirements and restrictions; time/area closures) and non-regulatory measures (e.g., gear research and development, disentanglement, education and outreach) that, in combination, seek to assist in the recovery of North Atlantic right, humpback, and fin whales by addressing and mitigating the risk of entanglement in gear employed by commercial fisheries, specifically trap/pot and gillnet fisheries (http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/; 73 FR 51228; 79 FR 36586; 79 FR 73848; 80 FR 14345; 80 FR 30367). The plan recognizes trap/pot and gillnet Management Areas in Northeast, Mid-Atlantic, and Southeast regions of the U.S, and identifies gear modification requirements and restrictions for Category I and II gillnet and trap/pot fisheries in these regions; these Category I and II fisheries must comply with all regulations of the Plan.[20]. For further details on the ALWTRP please see:
http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/

Small Cetaceans

Table 30 provides the species of small cetaceans that occur in the area of operation for the summer flounder commercial fishery.

[18] The measures identified in the ALWTRP are also beneficial to the survival of the minke whale, which are also incidentally taken in commercial fishing gear.

[19] The most recent rule (Vertical Line Rule) focused on trap/pot vertical line reduction as the ALWTRT determined that gillnets represent less than 1% of the total vertical lines on the East Coast and that the impacts from this gear on large whales is minimal (NMFS 2014c); however, even with the new rule, gear will still be subject to existing restrictions under the ALWTRP for gillnet gear.

[20] The fisheries currently regulated under the ALWTRP include: Northeast/Mid-Atlantic American lobster trap/pot; Atlantic blue crab trap/pot; Atlantic mixed species trap/pot; Northeast sink gillnet; Northeast anchored float gillnet; Northeast drift gillnet; Mid-Atlantic gillnet; Southeastern U.S. Atlantic shark gillnet; and Southeast Atlantic gillnet (NMFS 2014c).

Table 30: Small cetacean species that occur in the area of operation for the summer flounder fishery. Animals in bold are MMPA strategic stocks.

Species	Listed Under the ESA	Protected Under the MMPA	MMPA Strategic Stock
Atlantic White-Sided Dolphin	No	Yes	No
Short-Finned Pilot Whale	No	Yes	No
Long-Finned Pilot Whale	No	Yes	No
Risso's Dolphin	No	Yes	No
Short-Beaked Common Dolphin	No	Yes	No
Harbor Porpoise	No	Yes	No
Bottlenose Dolphin (*Western North Atlantic Offshore Stock*)	No	Yes	No
Bottlenose Dolphin (*Western North Atlantic Northern Migratory Coastal Stock*)	**No**	**Yes**	**Yes[1]**
Bottlenose Dolphin (*Western North Atlantic Southern Migratory Coastal Stock*)	**No**	**Yes**	**Yes[1]**

Notes:
[1] Considered a strategic stock as stocks are designated as depleted under the MMPA. Depleted is defined by the MMPA as any stock in which: (1) the Secretary, after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals, determines that a species or population stock is below its optimum sustainable population; (2) a State, to which authority for the conservation and management of a species or population stock is transferred under section 109, determines that such species or stock is below its optimum sustainable population; or (3) a species or population stock is listed as an endangered species or a threatened species under the ESA.
Source: Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016.

Small cetaceans can be found throughout the year in waters of the Northwest Atlantic Ocean (Waring et al. 2014a; Waring et al. 2015; Waring et al. 2016). Within this range, however, there are seasonal shifts in species distribution and abundance. To further assist in understanding how fisheries may overlap in time and space with the occurrence of small cetaceans, a general overview of species occurrence and distribution in the area of operation for the summer flounder fishery is provided in Table 31. For additional information on the biology, status, and range-wide distribution of each species please refer to Waring et al. (2014a), Waring et al. (2015), and Waring et al. (2016).

Table 31: Small cetacean occurrence in the area of operation for the summer flounder fishery.

Species	Prevalence and Approximate Months of Occurrence
Atlantic White-Sided Dolphin	• Distributed throughout the continental shelf waters (primarily to 100 meter isobath) of the Mid-Atlantic (north of 35°N), Southern New England, Georges Bank, and Gulf of Maine; however, most common in continental shelf waters from Hudson Canyon (~ 39°N) to Georges Bank, and into the Gulf of Maine. • **January-May**: low densities found from Georges Bank to Jeffreys Ledge. • **June-September**: large densities found from Georges Bank through the Gulf of Maine. • **October-December**: intermediate densities found from southern Georges Bank to southern Gulf of Maine. • South of Georges Bank (Southern New England and Mid-Atlantic), low densities found year round, with waters off Virginia and NC representing southern extent of species range during winter months.
Short-Beaked Common Dolphin	• Regularly found throughout the continental shelf-edge-slope waters (primarily between the 100-2,000 meter isobaths) of the Mid-Atlantic, Southern New England, and Georges Bank (esp. in Oceanographer, Hydrographer, Block, and Hudson Canyons). • Less common south of Cape Hatteras, NC, although schools have been reported as far south as the Georgia /South Carolina border. • **January-May**: occur from waters off Cape Hatteras, NC, to Georges Bank (35° to 42°N). • **Mid-summer-fall**: occur primarily on Georges Bank with small numbers present in the Gulf of Maine; Peak abundance found on Georges Bank in the autumn.
Risso's Dolphin	• **Spring through fall**: Distributed along the continental shelf edge from Cape Hatteras, NC, to Georges Bank. • **Winter**: distributed in the Mid-Atlantic Bight, extending into oceanic waters. • Rarely seen in the Gulf of Maine; primarily a Mid-Atlantic continental shelf edge species (can be found year round).
Harbor Porpoise	• Distributed throughout the continental shelf waters of the Mid-Atlantic (north of 35°N), Southern New England, Georges Bank, and Gulf of Maine. • **July-September**: concentrated in the northern Gulf of Maine (waters < 150 meters); low numbers can be found on Georges Bank. • **October-December**: widely dispersed in waters from NJ to Maine; seen from the coastline to deep waters (>1,800 meters). • **January-March**: intermediate densities in waters off NJ to NC; low densities found in waters off NY to Gulf of Maine. • **April-June**: widely dispersed from NJ to ME; seen from the coastline to deep waters (>1,800 meters).
Bottlenose Dolphin	**<u>Western North Atlantic Offshore Stock</u>** • Distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic from Georges Bank to FL. • Depths of occurrence: ≥40 meters **<u>Western North Atlantic Northern Migratory Coastal Stock</u>** • Warm water months (e.g., July-August): distributed from the coastal waters from the shoreline to approximately the 25-meter isobaths between the Chesapeake Bay mouth and Long Island, NY.

Species	Prevalence and Approximate Months of Occurrence
	• Cold water months (e.g., January-March): stock occupies coastal waters from Cape Lookout, NC, to the NC/VA border. **<u>Western North Atlantic Southern Migratory Coastal Stock</u>** • **October-December**: stock occupies waters of southern NC (south of Cape Lookout) • **January-March**: stock moves as far south as northern FL. • **April-June**: stock moves north to waters of NC. • **July-August**: stock is presumed to occupy coastal waters north of Cape Lookout, NC, to the eastern shore of VA.
Pilot Whales: ***Short- and Long-Finned***	**<u>Short-Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur south of 40°N (Mid-Atlantic and Southern New England waters); although low numbers have been found along the southern flank of Georges Bank, but no further than 41°N. • May through December (approximately): distributed primarily near the continental shelf break of the Mid-Atlantic and Southern New England; individuals begin shifting to southern waters (i.e., 35°N and south) beginning in the fall. **<u>Long-Finned Pilot Whales</u>** • Except for area of overlap (see below), primarily occur north of 42°N. • Winter to early spring (November through April): primarily distributed along the continental shelf edge-slope of the Mid-Atlantic, Southern New England, and Georges Bank. • Late spring through fall (May through October): movements and distribution shift onto/within Georges Bank, the Great South Channel, and Gulf of Maine. **<u>Area of Species Overlap:</u>** between approximately 38°N and 41°N.
Notes: [1] Information presented in table is representative of small cetacean occurrence in the Northwest Atlantic continental shelf waters out to the 2,000 meter isobath. *Sources*: Waring *et al*. 1992, 2007, 2014a, 2015, 2016; Payne and Heinemann 1993; Payne *et al.* 1984; Jefferson *et al*. 2009.	

Pinnipeds

Table 32 provides the species of pinnipeds that occur in the area of operation for the summer flounder fishery.

Table 32: Pinniped species that occur in in the area of operation for the summer flounder fishery.

Species	Listed Under the ESA	Protected Under the MMPA	MMPA Strategic Stock
Harbor Seal	No	Yes	No
Gray Seal	No	Yes	No
Harp Seal	No	Yes	No
Hooded Seal	No	Yes	No
Source: Waring *et al*. 2007; Waring *et al*. 2014a, Waring *et al*. 2015, Waring *et al*. 2016.			

Pinnipeds are found in the nearshore, coastal waters of the Northwest Atlantic Ocean. They are primarily found throughout the year or seasonally from New Jersey to Maine; however, increasing evidence indicates that some species (e.g., harbor seals) may be extending their range seasonally into waters as far south as Cape Hatteras, North Carolina (35ºN) (Waring *et al*. 2007, 2014a, 2015, 2016). To further assist in understanding how fisheries may overlap in time and space with the occurrence of pinnipeds, a general overview of species occurrence and distribution in the area of operation for the summer flounder fishery is provided in the following table (Table 33). For additional information on the biology, status, and range-wide distribution of each species of pinniped please refer to Waring *et al*. (2007), Waring *et al*. (2014a), Waring *et al*. (2015), and Waring *et al*. (2016).

Table 33: Pinniped occurrence in the area of operation for the summer flounder fishery.

Species	Prevalence
Harbor Seal	• Primarily distributed in waters from NJ to ME; however, increasing evidence indicates that their range is extending into waters as far south as Cape Hatteras, NC (35ºN). • **Year Round**: waters of ME • **September-May**: waters from New England to NJ.
Gray Seal	• Distributed in waters from NJ to ME. • **Year Round**: waters from ME to MA. • **September-May**: waters from Rhode Island to NJ.
Harp Seal	• Winter-Spring (approximately January-May): waters from ME to NJ.
Hooded Seal	• Winter-Spring (approximately January-May): waters of New England.
Sources: Waring *et al*. 2007 (for hooded seals); Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016	

Small cetaceans and pinnipeds are found throughout the waters of the Northwest Atlantic. As they feed, travel, and breed in many of the same ocean areas used for fishing, they are at risk of becoming entangled or caught in various types of fishing gear. Interactions can result in serious injury or mortality to the animal. Below we provide the best available information on small cetaceans and pinniped interaction risks with gear types primarily used in the commercial summer flounder fishery (i.e., trawl (bottom or mid-water), gillnet, and hook and line (rod/reel)).

Hook and Line

Over the past several years, observer coverage has been limited for fisheries prosecuted with hook and line gear. In the absence of extensive observer data for these fisheries, stranding data provides the next best source of information on species interactions with hook and line gear. It is important to note, however, stranding data underestimates the extent of human-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in human interactions are discovered, reported, or show signs of entanglement. Additionally, if gear is present, it is often difficult to definitively attribute the animal's death to the gear interaction, or if pieces of gear are absent, attribute the death or serious injury to a specific fishery or fishing gear type. As a result, the conclusions below should be taken with these considerations in mind, and with an understanding that interactions may occur more frequently than what we are able to detect at this time.

At the beginning of section 7.3, Table 26 provides the list of small cetacean and pinniped species that may be affected by the summer flounder fishery. Of these species, only several bottlenose dolphin stocks have been identified as species at risk of becoming seriously injured or killed by hook and line gear. For each dolphin stock identified in Table 26, stranding data provides the best source of information on species interaction history with hook and line gear types. Specifically, based on stranding data from 2007-2013, estimated mean annual mortality for each stock due to interactions with hook and line gear was approximately one annual mortality for each stock (Waring *et al*. 2014a; Waring *et al*. 2016).[21] Based on this and the best available information, hook and line gear is not expected to pose an interaction risk to pinniped species, and interaction risks to small cetaceans (specifically bottlenose dolphins) are expected to be low. Should an interaction with a small cetacean occur, serious injury or mortality to the animal is possible; however, relative to other gear types discussed below (i.e., trawl or gillnet gear), hook and line or trap/pot gear represents a low source serious injury or mortality to any small cetacean.

Gillnet and Bottom Trawl Gear

Small cetaceans and pinnipeds are vulnerable to interactions with gillnet and trawl gear. Species that have been observed (incidentally) seriously injured and/or killed by List of Fisheries Category I and II gillnet or trawl fisheries that operate in the affected environment of the summer flounder fishery are provided in Table 34 (Read *et al*. 2006; Waring *et al*. 2014a; Waring *et al*. 2015; Waring *et al*. 2016; 82 FR 3655 (January 12, 2017)). Based on the most recent (i.e., 2009 to 2013) information provided in Waring *et al*. (2016) and the January 12, 2017, MMPA List of Fisheries (82 FR 3655), of the gear types primarily used to prosecute the summer flounder fishery (i.e., bottom trawl; gillnets; and hook and line), Northeast and Mid-Atlantic gillnet fisheries, followed by the Northeast and Mid-Atlantic bottom trawl fisheries (Category I and II fisheries, respectively) pose the greatest risks of serious injury and mortality to small cetaceans and pinnipeds (i.e., approximately 80.6% of the estimated total mean annual mortality to marine mammals [small cetaceans + seals, large whales excluded] is attributed to gillnet fisheries, 18.9% attributed to bottom trawl, 0.14% attributed to mid-water trawl; 0.16% attributed to pot/trap (bottlenose dolphin stocks only); and 0.12% attributed to hook and line (bottlenose dolphin stocks only; Figure 36).[22]

---

[21] Stranding data provided in Waring *et al*. 2015 was not considered in estimating mean annual mortality as not all bottlenose dolphin stocks are addressed in this stock assessment report. As all bottlenose dolphin stocks are considered in Waring *et al.* (2014a) and Waring *et al*. (2016), these stock assessment reports were used to estimate mean annual mortality. Estimates of mean annual mortality were calculated based on the total number of animals that stranded between 2007-2013, and that were determined to have incurred serious injuries or mortality as result of interacting with hook and line gear. Any animals released alive with no serious injuries were not included in the estimate. Also, if maximum or minimum number of animals stranded were provided, to be conservative, we considered the maximum estimated number in calculating our mean annual estimate of mortality.

[22] Data used in the assessment was from 2009-2013 (Waring *et al*. 2016; MMPA LOF 82 FR 3655). Northeast anchored float gillnet, Southeast Atlantic gillnet, and Southeastern U.S. Atlantic shark gillnet fisheries were not included in the analysis as mean annual mortality estimates have not been provided for the species affected by these fisheries (Waring *et al*. 2016). In addition, for harp seals, the assessment used data from Waring *et al.* (2014a) as serious injury and mortality estimates for harp seals have not been updated since Waring *et al*. (2014a).

Table 34: Small cetacean and pinniped species observed seriously injured and/or killed by Category I and II gillnet or trawl fisheries in the affected environment of the summer flounder fishery.

Fishery	Category	Species Observed or reported Injured/Killed
Northeast Sink Gillnet	I	Bottlenose dolphin (offshore)
		Harbor porpoise
		Atlantic white sided dolphin
		Short-beaked common dolphin
		Risso's dolphin
		Long-finned pilot whales
		Harbor seal
		Hooded seal
		Gray seal
		Harp seal
Mid-Atlantic Gillnet[1]	I	Bottlenose dolphin (Northern Migratory coastal)
		Bottlenose dolphin (Southern Migratory coastal)
		Bottlenose dolphin (offshore)
		White-sided dolphin
		Harbor porpoise
		Short-beaked common dolphin
		Risso's dolphin
		Harbor seal
		Harp seal
		Gray seal
Northeast Bottom Trawl	II	Harp seal
		Harbor seal
		Gray seal
		Long-finned pilot whales
		Short-beaked common dolphin
		White-sided dolphin
		Harbor porpoise
		Bottlenose dolphin (offshore)
		Risso's dolphin
Mid-Atlantic Bottom Trawl	II	White-sided dolphin
		Pilot whales (spp)
		Short-beaked common dolphin
		Risso's dolphin
		Bottlenose dolphin (offshore)
		Gray seal
		Harbor seal

Notes:
[1,2] MMPA 2017 LOF (82 FR 3655, January 12, 2017) describes the gear used in the Mid-Atlantic Gillnet fishery (Category I) or Southeastern U.S. Atlantic Shark Gillnet fishery (Category II) as sink and drift gillnets.
Sources: Waring *et al*. 2016; MMPA LOF 82 FR 3655 (January 12, 2017).

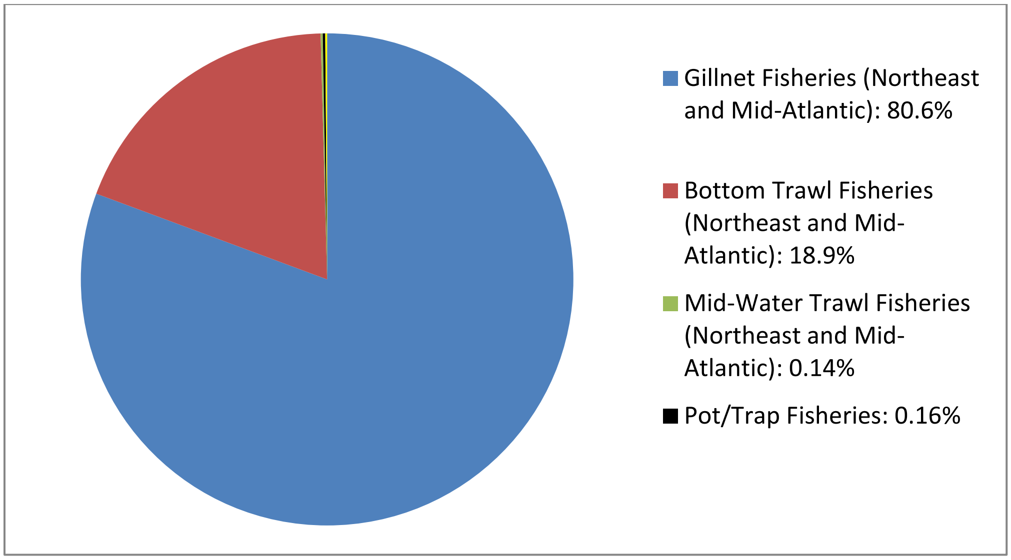


Figure 37: Estimated Total Mean Annual Mortality of Small Cetaceans and Pinnipeds by Greater Atlantic Region Fisheries from 2009-2013 (source Waring et al. 2016; MMPA LOF 82 FR 3655 (January 12, 2017).[23]

Although there are multiple Category I and II fisheries that have the potential to result in the serious injury and mortality of small cetaceans and pinnipeds in the Greater Atlantic Region, the risk of an interaction with a specific fishery is affected by multiple factors, including where and when fishing effort is focused, the type of gear being used, and how effort overlaps in time and space with specific species in the affected area. For instance Figure 36 and Figure 37 show observed marine mammal takes (large whales excluded) in gillnet and trawl gear in waters of the Gulf of Maine, Georges Bank, and Southern New England. As shown in these figures, over the last five years there appear to be particular areas in the Gulf of Maine, Georges Bank, and Southern New England where fishing effort is overlapping in time and space with small cetacean or pinniped occurrence. Although uncertainties remain, due to shifting fishing effort patterns and data on true density (or even presence/absence) for some species, the available observer data, as shown in Figure 38 and Figure 39, does provide some insight into areas in the ocean where the likelihood of species interactions is high. These figures provide a baseline to consider potential impacts of future shifts or changes in fishing effort on small cetaceans and pinnipeds. For additional maps showing observed small cetacean and pinniped interactions with gear types used to prosecute fisheries in New England or the Mid-Atlantic see Appendix I in Waring *et al*. (2014a), Waring *et al*. (2015) or Waring *et al*. (2016).

[23] For harp seals, mean annual mortality estimates from 2007-2011 were considered as serious injury and mortality estimates have not been updated since Waring *et al.* (2014a).

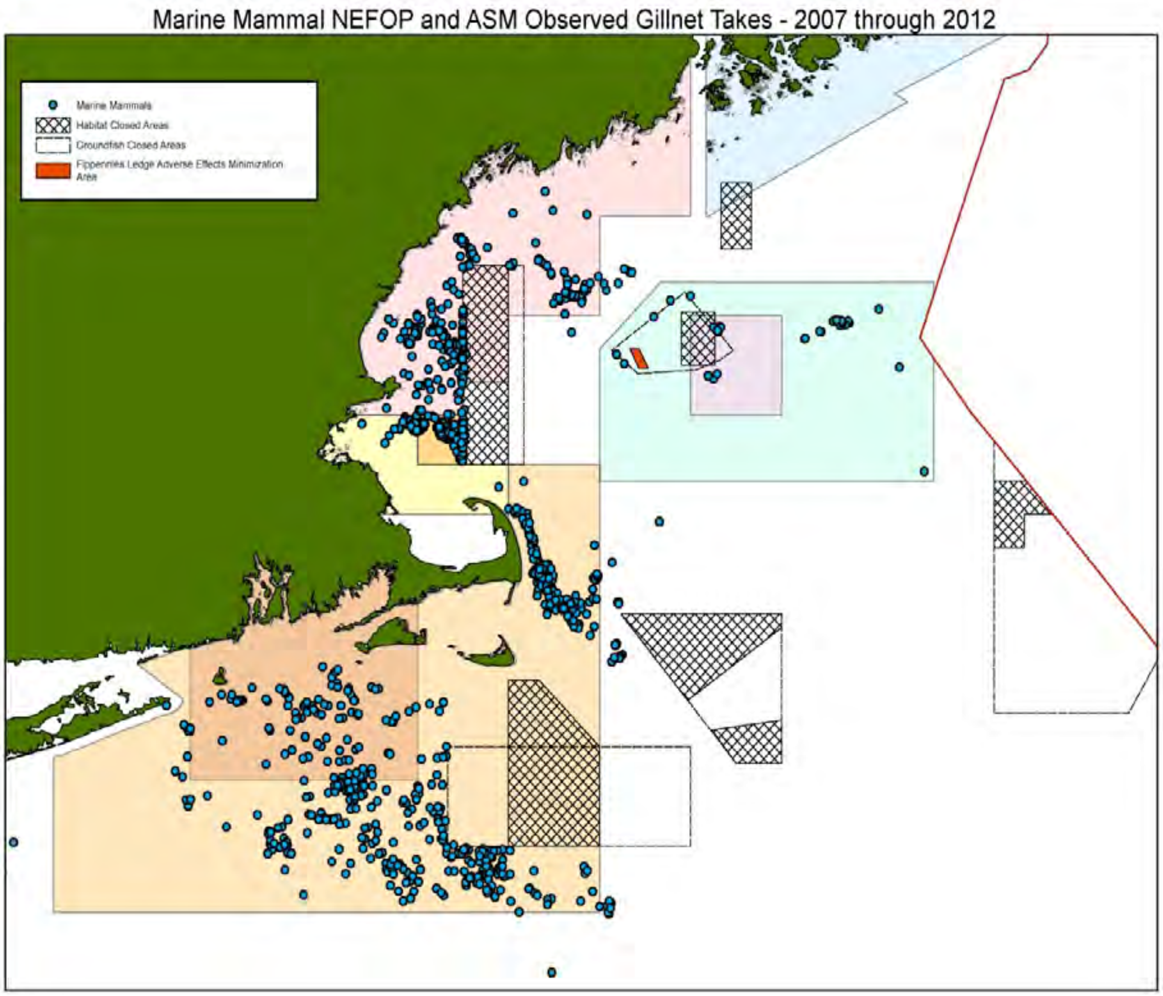


Figure 38: Map of Marine Mammal Bycatch in Gillnet Gear in the New England Region (Excluding Large Whales) Observed by Northeast Fisheries Observer Program (NEFOP) and At Sea Monitoring (ASM) Program Between 2007 and 2012.

Map legend: blue dot=observed marine mammal takes; cross hatched areas= Habitat Closure Areas; white box with hatched outline=Groundfish Closed Areas; orange box=Fippennies Ledge Area; pastel shaded boxes=harbor porpoise take reduction plan management areas. ***Notes***: Small cetacean and pinnipeds have been observed taken primarily in: (1) the waters west of the Gulf of Maine Habitat/Groundfish closed area: Harbor seals, harp seals, and harbor porpoise; (2) off of Cape Cod, MA: Gray seals, harbor seals, and harbor porpoise; (3) west of the Nantucket Lightship Closed Area: Harbor porpoise, short-beaked common dolphin, gray seals, harp seals, and harbor seals; and (4) waters off southern MA and RI: Gray seals and harbor seals, and some harbor porpoise and short-beaked common dolphin.

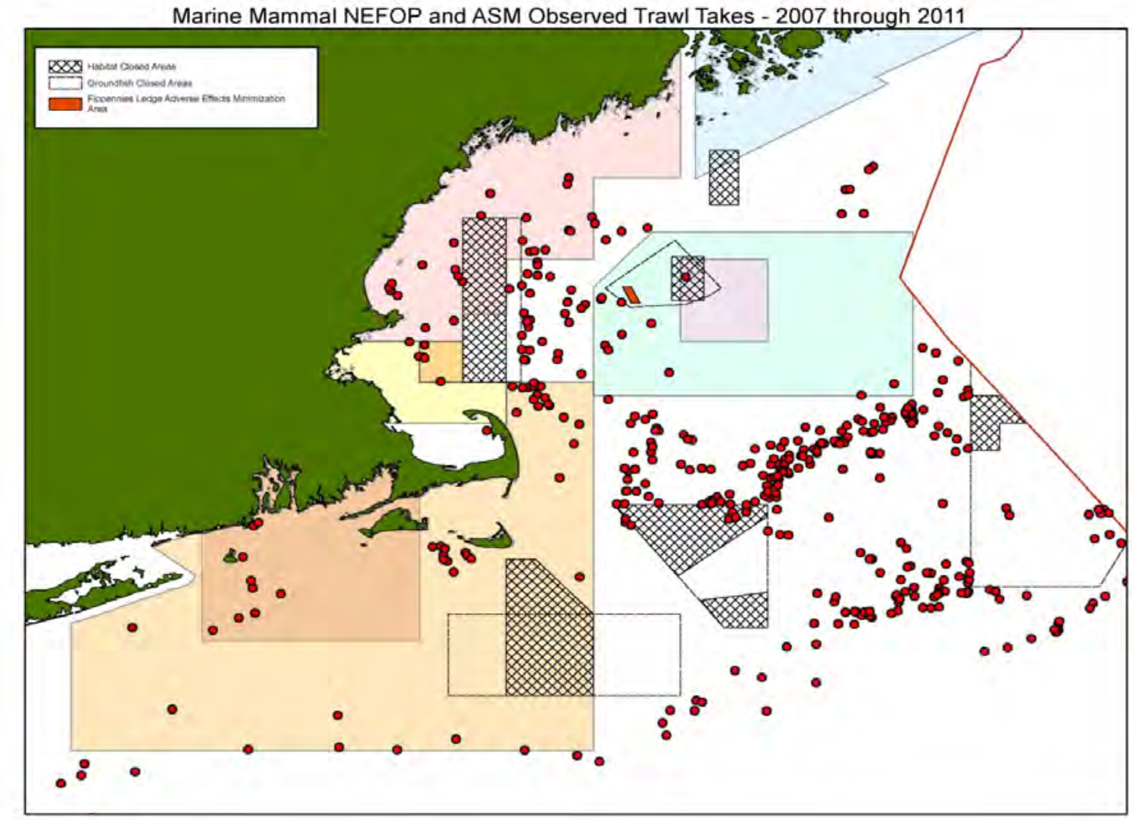


Figure 39: Map of Marine Mammal Bycatch in Trawl Gear in the New England Region (Excluding Large Whales) Observed by the Northeast Fisheries Observer Program (NEFOP) and At-Sea Monitoring (ASM) Program Between 2007 and 2011.

Map legend: red dot=observed marine mammal takes; cross hatched areas= Habitat Closure Areas; white box with hatched outline=Groundfish Closed Areas; orange box=Fippennies Ledge Area; pastel shaded boxes=Harbor Porpoise Take Reduction Plan Management Areas. ***Notes*****:** Small cetacean and pinnipeds observed taken primarily in: (1) the waters between and around CA I and CA II (Groundfish closed areas): Short-beaked common dolphin, pilot whales, white-sided dolphins, gray seals, and some Risso's dolphins and harbor porpoise; and (2) eastern side of the Gulf of Maine Habitat/Groundfish closed area: White-sided dolphins, and some pilot whales and harbor seals.

7.3.2 Sea Turtles

Kemp's ridley, leatherback, the North Atlantic DPS of green and the Northwest Atlantic DPS of loggerhead sea turtle are the four ESA-listed species of sea turtles that occur in the area of operation for the summer flounder fishery. Three of the four species are hard-shelled turtles (i.e., green, loggerhead, and Kemp's ridley). Additional background information on the range-wide status, descriptions, and life histories of these four species can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b; Conant *et al.* 2009; NMFS and USFWS 2013b;NMFS and USFWS 2015; Seminoff et al. 2015), and recovery plans for the loggerhead sea turtle (Northwest Atlantic DPS; NMFS and USFWS 2008), leatherback sea turtle (NMFS and USFWS 1992, 1998a), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991, 1998b).

A general overview of sea turtle occurrence and distribution in waters of the Northwest Atlantic Ocean is provided below to assist in understanding how the summer flounder fishery may overlap in time and space with sea turtles. Maps depicting the range wide distribution and occurrence of sea turtles in the Greater Atlantic Region can be found at the following websites: https://www.greateratlantic.fisheries.noaa.gov/protected/section7/listing/index.html; http://marinecadastre.gov/; and, http://seamap.env.duke.edu/.

Hard-shelled Sea Turtles

In U.S. Northwest Atlantic waters, hard-shelled turtles commonly occur throughout the continental shelf from Florida to Cape Cod, Massachusetts, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008; TEWG 2009). While hard-shelled turtles are most common south of Cape Cod, MA, they are known to occur in the Gulf of Maine. Loggerheads, the most common hard-shelled sea turtle in the Greater Atlantic Region, feed as far north as southern Canada. Loggerheads have been observed in waters with surface temperatures of 7 °C to 30 °C, but water temperatures ≥11 °C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). Sea turtle presence in U.S. Atlantic waters is also influenced by water depth. While hard-shelled turtles occur in waters from the beach to beyond the continental shelf, they are most commonly found in neritic waters of the inner continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Hard-shelled sea turtles occur year-round in waters off Cape Hatteras, North Carolina and south. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast United States and also move up the Atlantic Coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2002; Morreale and Standora 2005; Griffin *et al.* 2013), occurring in Virginia foraging areas as early as late April and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by September, but some remain in Mid-Atlantic and Northeast areas until late fall. By December, sea turtles have migrated south to waters offshore of NC, particularly south of Cape Hatteras, and further south (Shoop and Kenney 1992; Epperly *et al.* 1995b; Hawkes *et al.* 2011; Griffin *et al.* 2013).

Leatherback Sea Turtles

Leatherbacks, a pelagic species, are known to use coastal waters of the U.S. continental shelf and to have a greater tolerance for colder water than hard-shelled sea turtles (James *et al.* 2005; Eckert *et al.* 2006; Murphy *et al.* 2006; NMFS and USFWS 2013b; Dodge *et al.* 2014). Leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992; James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014). They are found in more northern waters (i.e., Gulf of Maine) later in the year (i.e., similar time frame as hard-shelled sea turtles), with most leaving the Northwest Atlantic shelves by mid-November (James *et al.* 2005; James *et al*. 2006; Dodge *et al.* 2014).

Sea turtle interactions with trawl and gillnet gear have been observed in the Gulf of Maine, Georges Bank, and the Mid-Atlantic; however, most of the observed interactions have occurred in the Mid-Atlantic (see Murray 2011; Warden 2011a, b; Murray 2013; Murray 2015a, Murray 2015b). As few sea turtle interactions have been observed in the Gulf of Maine and Georges Bank regions of the Northwest Atlantic, there is insufficient data available to conduct a robust model-based analysis on sea turtle interactions with trawl and gillnet gear in these regions or produce a bycatch estimate for these regions. As a result, the bycatch estimates and discussion below are for trawl or gillnet gear in the Mid-Atlantic.

Bottom Trawl Gear

Bottom trawl gear poses an injury and mortality risk to sea turtles, specifically due to forced submergence (Sasso and Epperly 2006). Green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles have been documented interacting (e.g., bycaught) with bottom trawl gear. However, estimates are available only for loggerhead sea turtles. Warden (2011a,b) estimated that from 2005-2008, the average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[24] was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls, but released through a Turtle Excluder Device (TED; see below for details on TEDs). The 292 average annual observable loggerhead interactions equates to approximately 44 adult equivalents (Warden 2011a,b). Most recently, Murray (2015b) estimated that from 2009-2013, the total average annual loggerhead interactions in bottom trawl gear in the Mid-Atlantic[25] was 231 (CV=0.13, 95% CI=182-298); this equates to approximately 33 adult equivalents (Murray 2015b). Bycatch estimates provided in Warden (2011a) and Murray (2015b) are a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, which Murray (2008) estimated at 616 sea turtles (CV=0.23, 95% CI over the nine-year period: 367-890). This decrease is likely due to decreased fishing effort in high-interaction areas (Warden 2011a, b).

TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. In the Greater Atlantic Region, TEDs are required for summer flounder trawlers in the summer flounder fishery-sea turtle protection area. This area is bounded on the north by a line extending along 37°05'N (Cape Charles, VA) and on the south by a line extending out from the North Carolina-South Carolina border (Figure 40). Vessels north of Oregon Inlet, NC, are exempt from the TED requirement from January 15 through March 15 each year (50 CFR 223.206); vessels operating south of Oregon Inlet, NC are required to have TEDS year round.

---

[24] Warden (2011a) defined the Mid-Atlantic as south of Cape Cod, Massachusetts, to approximately the North Carolina/South Carolina border.

[25] Murray 2015b defined the Mid-Atlantic as the boundaries of the Mid-Atlantic Ecological Production; roughly waters west of 71°W to the North Carolina/South Carolina border)

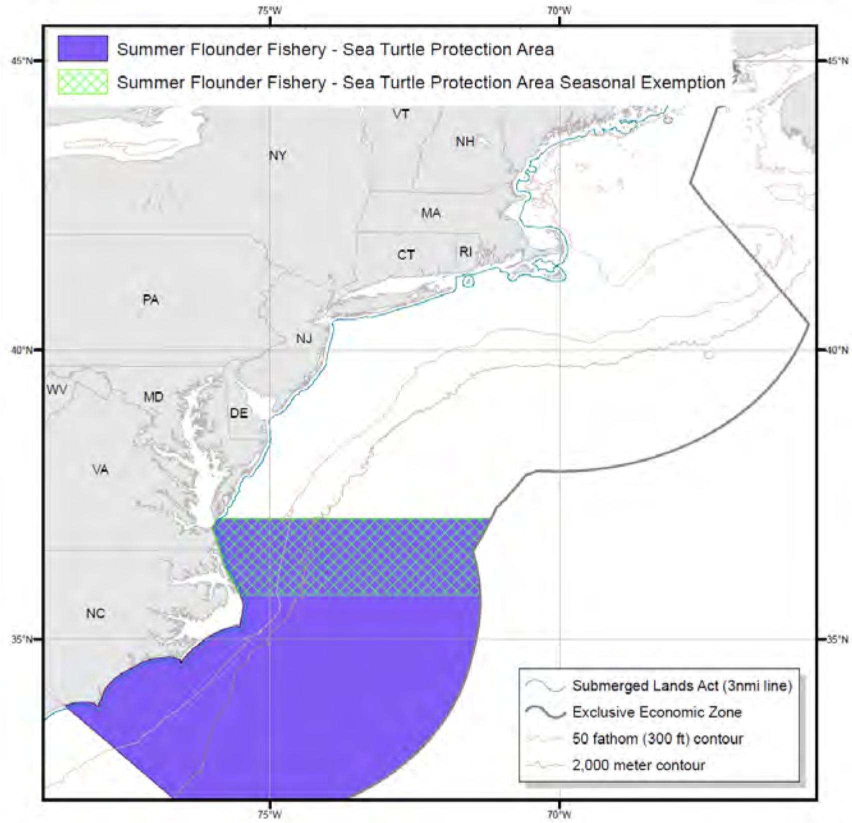


Figure 40: Summer Flounder Fishery Sea Turtle Protection Area.

Gillnet Gear

Gillnet gear of all types (drift sink, drift float, anchored sink, and drift large pelagic) pose an injury and mortality risk to all sea turtle species. Observers have documented green, Kemp's ridley, leatherback, loggerhead, and unidentified sea turtles in these gillnet gears. This section, however, focuses on sink gillnets where possible, and does not include drift pelagic gillnets as these type of gillnet does not catch summer flounder.

Murray (2013) conducted an assessment of loggerhead and unidentified hard-shell turtle interactions in Mid-Atlantic gillnet gear during 2007-2011.[26] Based on Northeast Fisheries Observer Program data from 2007-2011, interactions between loggerhead and hard-shelled sea turtles (loggerheads plus unidentified hard-shelled) and commercial gillnet gear in the Mid-Atlantic averaged 95 hard-shelled turtles and 89 loggerheads (equivalent to 9 adults) annually

[26] Based on NEFOP observed hauls in Mid-Atlantic gillnet fisheries, Murray (2013) classified the observed gillnet hauls as follows: anchored to the bottom (65% of hauls), unanchored but fishing on the ocean bottom (32% of hauls), or drift/floating (3% of hauls).

(Murray 2013).[27] However, average estimated interactions in large mesh gear in warm, southern Mid-Atlantic waters have declined relative to those from 1996-2006 (Murray 2009), as did the total commercial effort (Murray 2013).

Beginning in the spring of 1995, and continuing in subsequent years, large numbers of sea turtles stranded along the coastline of North Carolina. These stranding events coincided with the monkfish and dogfish large mesh gillnet fisheries operating offshore, and in fact, some of the stranded turtles coming ashore had large mesh gillnet gear wrapped around their bodies. Because of the documented strandings and subsequent investigation, NMFS enacted the Mid-Atlantic large mesh gillnet rule in waters of the EEZ on December 3, 2002 (67 FR 71895); this rule was subsequently revised on April 26, 2006 (71 FR 24776). The Mid-Atlantic large mesh gillnet rule establishes seasonally adjusted gear restrictions by closing portions of the Mid-Atlantic EEZ to fishing with gillnets with a mesh size ≥ 7–inch (17.8–cm) stretched mesh to protect migrating sea turtles (Figure 41).

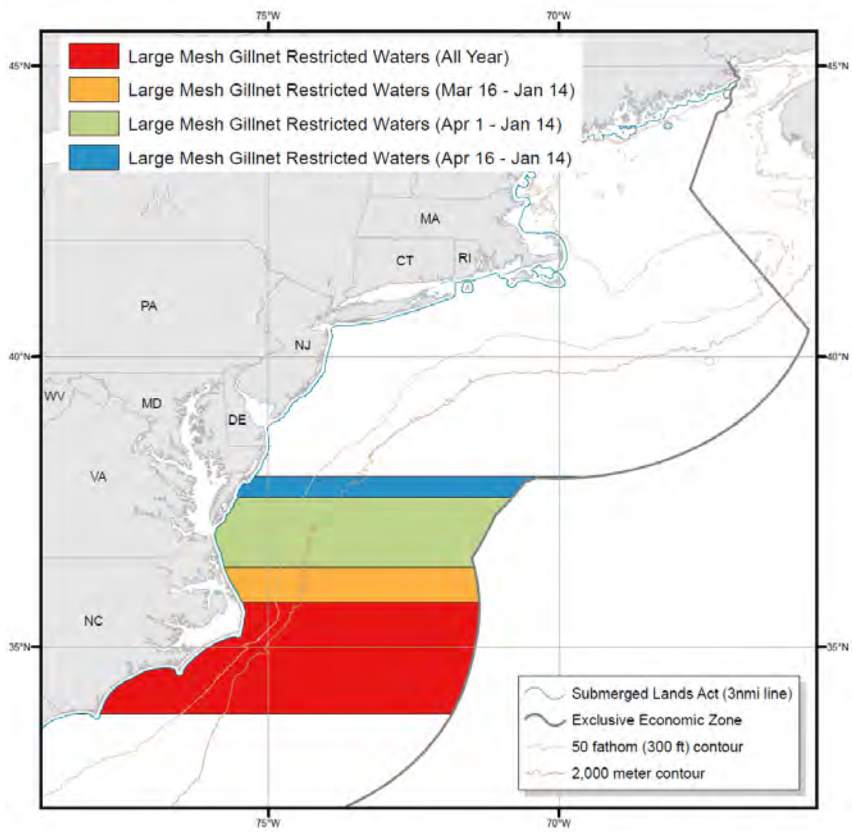


Figure 41: Mid-Atlantic Large Mesh Gillnet Restriction Area.

[27] At Sea Monitoring (ASM) data was also considered in Murray (2013); however, as the ASM program began May 1, 2010, trips (1,085 hauls), trips observed by at-sea monitors from May 2010 – December 2011 were pooled with the NEFOP data. Further, as most of the ASM trips occur in the Gulf of Maine, only a small portion (9%) of ASM data was used in the Murray (2013) analysis.

Summary of Observed Locations of Turtle Interactions with Bottom Trawl and Gillnet Gear

Figure 42 shows the observed locations of sea turtle interactions with gillnet and bottom trawl gear in the Greater Atlantic Region from 1989 to 2014 (all months included). This figure also includes scallop dredge gear, although this gear type is not described further in this document as it is not used to target summer flounder and does not account for a substantive portion of summer flounder landings.

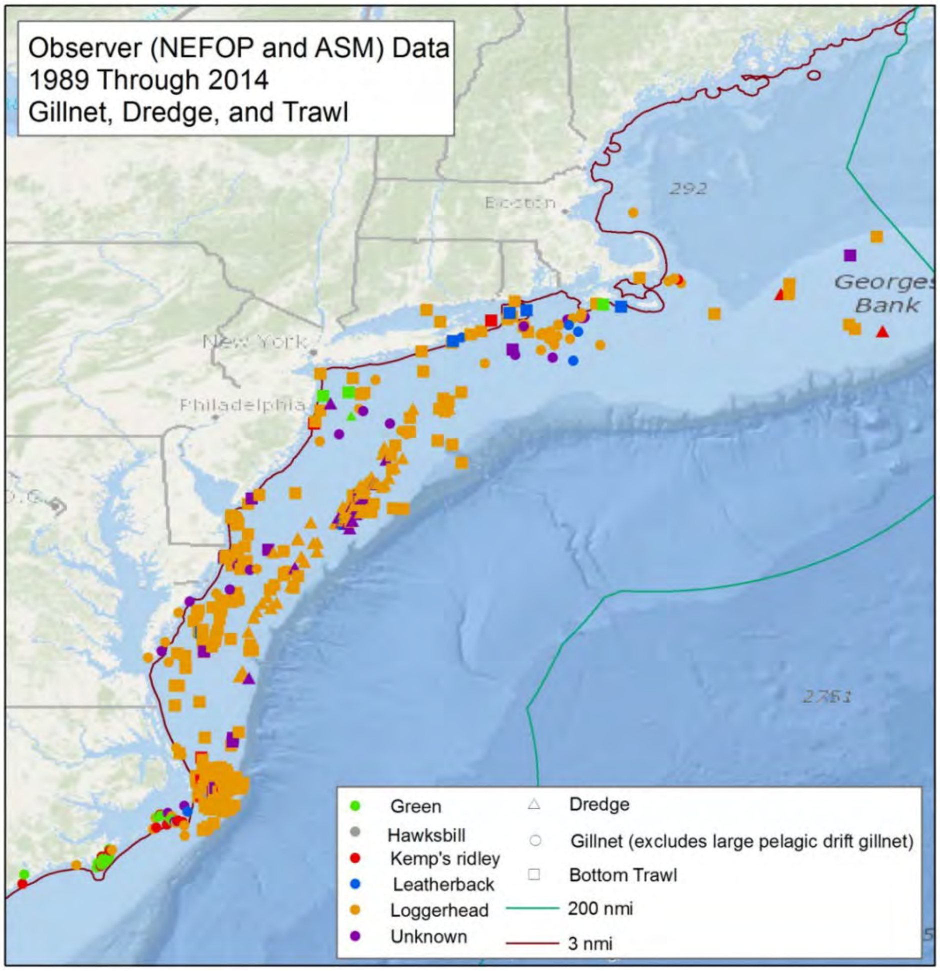


Figure 42: Observed Location of Turtle Interactions in Bottom Tending Gears in the Greater Atlantic Region 1989-2014.

Hook and Line

ESA-listed species of sea turtles are known to interact with hook and line gear and are more commonly reported in nearshore, southern waters (Sea Turtle Disentanglement Network; NMFS 2013). Hook and line gear can cause injury and mortality to sea turtles, and therefore, can pose a risk to these species. However, the extent to which these interactions impact sea turtle populations is still under investigation and, therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of sea turtle populations.

Factors Affecting Sea Turtle Interactions

The risk of a gear interaction is affected by multiple factors, including where and when fishing effort is focused, the type of gear being used, environmental conditions, and sea turtle occurrence and distribution. Murray and Orphanides (2013) recently evaluated fishery-independent and fishery-dependent data to identify environmental conditions associated with turtle presence and the subsequent risk of a bycatch encounter if fishing effort is present. They concluded that encounter rates were a function of latitude, sea surface temperature (SST), depth, and salinity, when looking at fishery-independent data. When the model was fit to fishery-dependent data (gillnet, bottom trawl, and scallop dredge), Murray and Orphanides (2013) found a decreasing trend in encounter rates as latitude increased; an increasing trend as SST increased; a bimodal relationship between encounter rates and salinity; and higher encounter rates in depths between 25 and 50 m. Similar findings were found in Warden (2011a), Murray (2013), and Murray (2015a, b).

7.3.3 Atlantic Sturgeon

Table 36 lists the five DPSs of Atlantic sturgeon likely to occur in the Greater Atlantic Region. For additional information on the biology, status, and range-wide distribution of each distinct population segment please refer to 77 FR 5880 and 77 FR 5914 (finalized February 6, 2012), as well as the Atlantic Sturgeon Status Review Team's (ASSRT) 2007 status review of Atlantic sturgeon.

Table 36: Atlantic Sturgeon DPSs that occur in the area of operation for the summer flounder fishery.

Species	Listed Under the ESA
Gulf of Maine (GOM) DPS	threatened
New York Bight (NYB) DPS	endangered
Chesapeake Bay (CB) DPS	endangered
Carolina DPS	endangered
South Atlantic (SA) DPS	endangered

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. Atlantic sturgeon from all five DPSs have the potential to be located anywhere in this marine range (See Figure 43; ASSRT 2007; Dovel and Berggren 1983; Dadswell *et al*. 1984; Kynard *et al*. 2000; Stein *et al*. 2004a; Dadswell 2006; Laney *et al*. 2007; Dunton *et al*. 2010; Dunton *et al*. 2012; Dunton *et al*. 2015; Erickson *et al*. 2011; Wirgin *et al*. 2012; O'Leary *et al*. 2014; Waldman *et al.* 2013; Wirgin *et al*. 2015a,b).

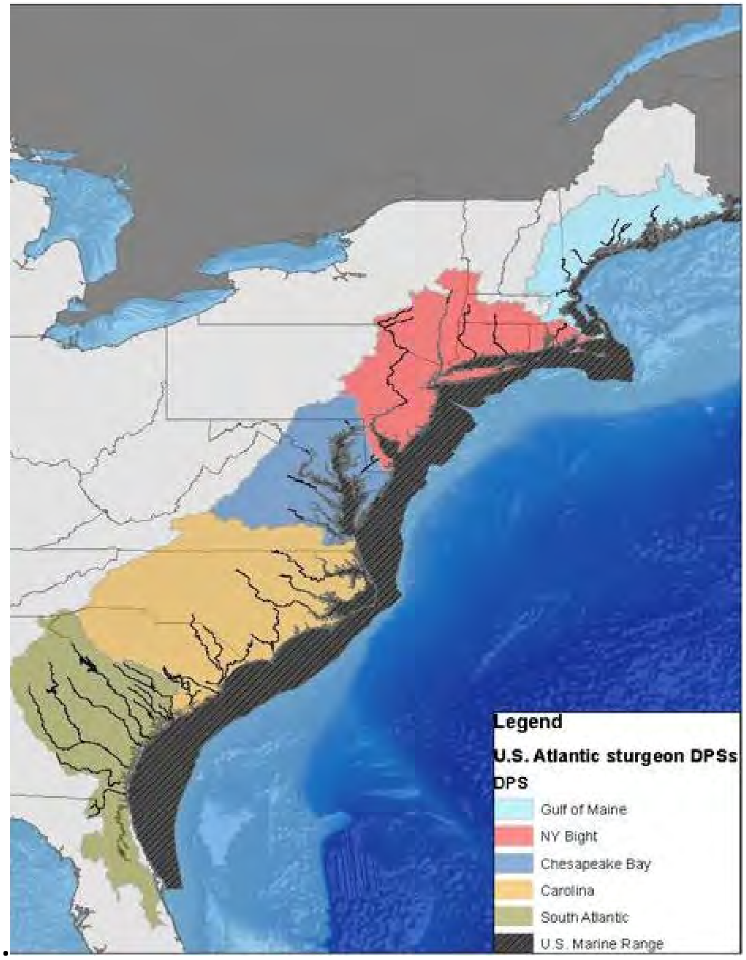


Figure 43: Geographic Locations for the Five ESA-listed DPSs of Atlantic Sturgeon (NMFS 2013).

Based on fishery-independent and -dependent data, as well as data collected from tracking and tagging studies Atlantic sturgeon appear to primarily occur inshore of the 50-meter depth contour (Stein *et al*. 2004 a,b; Erickson *et al*. 2011; Dunton *et al*. 2010); however, Atlantic sturgeon are not restricted to these depths, as excursions into deeper continental shelf waters have been documented (Timoshkin 1968; Collins and Smith 1997; Stein *et al*. 2004a,b; Dunton *et al*. 2010; Erickson *et al*. 2011). Data from fishery-independent surveys and tagging and tracking studies also indicate that Atlantic sturgeon undertake seasonal movements along the coast. For instance, satellite-tagged adult sturgeon from the Hudson River are found to have concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 20 meters, during winter and spring, while in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 20 meters (Erickson *et al.* 2011). A similar seasonal trend was found by Dunton *et al*. 2010. Analysis of fishery-independent survey data indicated a coastwide distribution of Atlantic sturgeon during the spring and fall; a southerly (e.g., North Carolina, Virginia) distribution during the winter; and a centrally located (e.g., Long Island to Delaware) distribution during the summer. Although studies such as Erickson *et al*. (2011) and Dunton *et al*. (2010) provide some indication that Atlantic sturgeon are undertaking seasonal movements horizontally and vertically along the U.S. eastern coastline, there is no evidence to date that all Atlantic sturgeon make these seasonal movements. For instance, during inshore surveys conducted by the Northeast Fisheries Science Center in the Gulf of Maine, Atlantic sturgeon have been caught in the fall, winter, and spring between the Saco and Kennebec Rivers (Dunton *et al*. 2010; Wipplehauser 2012).

Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard. Depths in these areas are generally no greater than 25 meters (Stein *et al*. 2004a; Laney *et al*. 2007; Dunton *et al*. 2010; Erickson *et al*. 2011). Although additional studies are still needed to clarify why these particular sites are chosen by Atlantic sturgeon, there is some indication that they may serve as thermal refuges, wintering sites, or marine foraging areas (Stein *et al*. 2004a; Dunton *et al*. 2010; Erickson *et al*. 2011). The following are the currently known marine aggregation sites located within the operational range of Greater Atlantic Region fisheries:

- Waters off North Carolina, including Virginia/North Carolina border (Laney *et al*. 2007);
- Waters off the Chesapeake and Delaware Bays (Stein *et al*. 2004a; Dunton *et al*. 2010; Erickson *et al*. 2011; Oliver *et al*. 2013);
- New York Bight (e.g., waters off Sandy Hook, New Jersey, and Rockaway Peninsula, New York; Stein *et al*. 2004a; Dunton *et al.* 2010; Erickson *et al*. 2011; O'Leary *et al*. 2014;);
- Massachusetts Bay (Stein *et al.* 2004a);
- Long Island Sound (Bain *et al.* 2000; Savoy and Pacileo 2003; Waldman *et al.* 2013);
- Connecticut River Estuary (Waldman *et al.* 2013);
- Kennebec River Estuary (Wipplehauser 2012; Whipplehauser and Squiers 2015).

In addition, since listing of the five Atlantic sturgeon DPSs, numerous genetic studies have addressed DPS distribution and composition in marine waters of the Northwest Atlantic (e.g., Wirgin *et al*. 2012; Wirgin *et al*. 2015a,b; Waldman *et al*. 2013; O'Leary *et al*. 2014; Dunton et al. 2012).[28] These studies show that Atlantic sturgeon from multiple DPSs can be found at any single locaton along the Northwest Atlantic coast, with the Mid-Atlantic locations consistently comprised of all five DPSs (Wirgin *et al*. 2012; Wirgin *et al*. 2015a,b;Waldman *et al*. 2013; O'Leary *et al*. 2014; Dunton *et al*. 2012; Damon-Randall *et al*. 2013). Although additional studies are needed to further clarify the DPS distribution and composition in non-natal estuaries and coastal locations, these studies provide some initial insight on DPS distribution and co-occurrence in particular areas along the U.S. eastern seaboard.

Atlantic sturgeon feed, migrate, and rest in many of the same ocean areas used for fishing, and therefore may interact with fishing gear (see section 7.3.1). Below we provide the best available

[28] Genetic studies did not sample Atlantic sturgeon south of North Carolina.

information on Atlantic sturgeon interaction risks with gear types primarily used in the summer flounder fishery (i.e., bottom trawls, gillnet, and hook/line).

Gillnets and Bottom Trawls

Atlantic sturgeon interactions (i.e., bycatch) with sink gillnet and bottom trawl gear have been observed since 1989; these interactions have the potential to result in the injury or mortality of Atlantic sturgeon (NMFS NEFSC FSB 2015, 2016). Three documents, covering three time periods, that use data collected by the Northeast Fisheries Observer Program to describe bycatch of Atlantic sturgeon in gillnet and bottom trawl gear: Stein et al. (2004b) for 1989-2000; ASMFC (2007) for 2001-2006; and Miller and Shepard (2011) for 2006-2010; none of these documents provide estimates of Atlantic sturgeon bycatch by Distinct Population Segment.[29] Miller and Shepard (2011), the most of the three documents, analyzed fishery observer data and VTR data in order to estimate the average annual number of Atlantic sturgeon interactions in gillnet and otter trawl in the Northeast Atlantic that occurred from 2006 to 2010. This timeframe included the most recent, complete data and as a result, Miller and Shepard (2011) is considered to represent the most accurate predictor of annual Atlantic sturgeon interactions in the Northeast gillnet and bottom trawl fisheries (NMFS 2013).

Based on the findings of Miller and Shepard (2011), NMFS (2013) estimated that the annual bycatch of Atlantic sturgeon in gillnets to be 1,239 sturgeon and 1,342 sturgeon in bottom otter trawl gear. Miller and Shepard (2011) observed Atlantic sturgeon interactions in trawl gear with small (< 5.5 inches) and large (≥ 5.5 inches) mesh sizes, as well as gillnet gear with small (< 5.5 inches), large (5.5 to 8 inches), and extra-large mesh (>8 inches) sizes. Although Atlantic sturgeon were observed to interact with trawl and gillnet gear with various mesh sizes, Miller and Shepard (2011) concluded that, based on NEFOP observed sturgeon mortalities, gillnet gear, in general, posed a greater risk of mortality to Atlantic sturgeon than did trawl gear. Estimated mortality rates in gillnet gear were 20.0%, while those in otter trawl gear were 5.0% (Miller and Shepard 2011; NMFS 2013). Similar conclusions were reached in Stein *et al*. (2004b) and ASMFC (2007) reports; after review of observer data from 1989-2000 and 2001-2006, both studies concluded that observed mortality is much higher in gillnet gear than in trawl gear. However, an important consideration to these findings is that observed mortality is considered a minimum of what actually occurs and therefore, the conclusions reached by Stein *et al*. (2004b), ASMFC (2007), and Miller and Shepard (2011) are not reflective of the total mortality associated with either gear type. To date, total Atlantic sturgeon mortality associated with gillnet or trawl gear remains uncertain.

Hook and Line Gear

ESA-listed species of Atlantic sturgeon are known to interact with hook and line gear, particularly in nearshore waters from the Gulf Maine to Southern New England (Network; NMFS 2013). Injury

[29] Atlantic sturgeon bycatch analysis conducted by Stein et al. (2004b) was limited to otter trawl, sink gillnet, and drift gillnet gear. ASMFC (2007) and Miller and Shepard (2011) estimates of Atlantic sturgeon bycatch are based on NEFOP observed sink gillnet and otter trawl trips.

and mortality to Atlantic sturgeon can be incurred by hook and line gear interactions, and therefore, can pose a risk to these species. However, the extent to which these interactions are impacting Atlantic sturgeon DPSs is still under investigation and therefore, no conclusions can currently be made on the impact of hook and line gear on the continued survival of Atlantic sturgeon DPSs (NMFS 2013; NMFS 2011b).

7.4 PROPOSED FEDERAL REGULATIONS/ACTIONS PERTAINING TO RELEVANT PROTECTED SPECIES

In May 2016, NMFS proposed areas of Atlantic Sturgeon critical habitat along the Atlantic coast. The proposed critical habitat primarily consisted of rivers including the Penobscot River in Maine, the Hudson River in New York, the Potomac River in Maryland, and the Neuse River in North Carolina (81 FR 36077; 81 FR 35701). Comments on the proposal were accepted through the fall of 2016; however, a final rule has not yet been released.

7.5 POTENTIAL IMPACTS TO ATLANTIC COASTAL STATE AND INTERSTATE FISHERIES

There are several take reduction teams, whose management actions have potential impacts to summer flounder fisheries. The Harbor Porpoise Take Reduction Plan (HPTRP) and the Bottlenose Dolphin Take Reduction Plan (BDTRP) were developed and implemented for these species.[30] The following provides a brief overview and summary for each Plan; however, additional information on each Plan can be found at: http://www.greateratlantic.fisheries.noaa.gov/protected/porptrp/ or http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm

Harbor Porpoise Take Reduction Plan

To address the high levels of incidental take of harbor porpoise in the groundfish sink gillnet fishery, a Take Reduction Team was formed in 1996. A rule (63 FR 66464) to implement the Harbor Porpoise Take Reduction Plan to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was published on December 2, 1998. The Plan became effective on January 1, 1999 and was amended on February 19, 2010 (75 FR 7383), and October 4, 2013 (78 FR 61821). Since gillnet operations differ between the New England and Mid-Atlantic regions, the following sets of measures were devised for each region:

- **New England Region**: The New England component of the Plan pertains to all fishing with sink gillnets and other gillnets capable of catching multispecies in New England waters from Maine through Rhode Island. This portion of the Plan includes time and area closures, as well as closures to multispecies gillnet fishing unless pingers are used in the manner prescribed in the Plan regulations. For additional details see 50 CFR 229.33 and the outreach guide at:

[30] Although the most recent U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessment (Waring *et al.* 2016) no longer designates harbor porpoise as a strategic stock, HPTRP regulations are still in place per the mandates provided in Section 118(f)(1).

http://www.greateratlantic.fisheries.noaa.gov/prot_res/porptrp/doc/HPTRPNewEnglandGuide.pdf).

- **Mid-Atlantic Region:** The Mid-Atlantic portion of the Plan pertains to the Mid-Atlantic shoreline from the southern shoreline of Long Island, New York to the North Carolina/South Carolina border. It includes four management areas (Waters off New Jersey, Mudhole North (located in Waters off New Jersey Management Area), Mudhole South (located in Waters off New Jersey Management Area), and Southern Mid-Atlantic), each with time and area closures to gillnet fishing unless the gear meets certain specifications. Additionally, during regulated periods, gillnet fishing in each management area of the Mid-Atlantic is regulated differently for small mesh (> 5 inches to < 7 inches) and large (7-18 inches) mesh gear. The Plan also includes some time and area closures in which gillnet fishing is prohibited regardless of the gear specifications. For additional details see 50 CFR 229.34 and the outreach guide at: http://www.greateratlantic.fisheries.noaa.gov/prot_res/porptrp/doc/HPTRPMidAtlanticGuide_Feb%202010.pdf

Bottlenose Take Reduction Plan

In April 2006, NMFS published a final rule to implement the BDTRP for the western North Atlantic coastal stock of bottlenose dolphin (April 26, 2006, 71 FR 24776) to reduce the incidental mortality and serious injury in the Mid-Atlantic gillnet fishery and eight other coastal fisheries operating within the dolphin's distributional range.[31] The measures contained in the Plan include gillnet effort reduction, gear proximity requirements, gear or gear deployment modifications, and outreach and educational measures to reduce dolphin bycatch below the marine mammals stock's PBR. On July 31, 2012 (77 FR 45268), the BDTRP was amended to permanently continue nighttime fishing restrictions of medium mesh gillnets operating in North Carolina coastal state waters. The Plan was most recently amended on February 9, 2015 (80 FR 6925) to reduce the incidental serious injury and mortality of strategic stocks of bottlenose dolphins in Virginia pound net fishing gear, and to provide consistent state and Federal regulations for Virginia pound net fishing gear. For additional details on the Plan please visit: http://www.nmfs.noaa.gov/pr/interactions/trt/bdtrp.htm

Atlantic Trawl Gear Take Reduction Strategy

In addition to the Harbor Porpoise and Bottlenose Dolphin take reduction plans, in 2006, the Atlantic Trawl Gear Take Reduction Team was convened to address the incidental mortality and serious injury of long-finned pilot whales (*Globicephala melas*), short-finned pilot whales (*Globicephala macrorhynchus*), common dolphins (*Delphinus delphis*), and white-sided dolphins (*Lagenorhynchus acutus*) incidental to bottom and mid-water trawl fisheries operating in both the Northeast and Mid-Atlantic regions. Because none of the marine mammal stocks of concern

[31] The final rule issued on April 26, 2006, for the BDTRP also revised the large mesh size restriction under the Mid-Atlantic large mesh gillnet rule for conservation of endangered and threatened sea turtles to provide consistency among Federal and state management measures.

to the Team are classified as a "strategic stock," nor do they currently interact with a Category I fishery, a take reduction plan was not necessary.[32]

In lieu of a take reduction plan, the Team agreed to develop an Atlantic Trawl Gear Take Reduction Strategy. The Strategy identifies informational and research tasks, as well as education and outreach needs the Team believes are necessary, to decrease mortalities and serious injuries of marine mammals to insignificant levels approaching zero. The Strategy also identifies several voluntary measures that can be adopted by certain trawl fishing sectors to potentially reduce the incidental capture of marine mammals. For additional details on the Strategy, please visit: http://www.greateratlantic.fisheries.noaa.gov/Protected/mmp/atgtrp/

[32] A strategic stock is defined under the MMPA as a marine mammal stock: for which the level of direct human-caused mortality exceeds the potential biological removal level; which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or which is listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.

8.0 REFERENCES

Able, K.W., R.E. Matheson, W.W. Morse, M.P. Fahay, and G. Shepherd. 1990. Patterns of summer flounder *Paralichthys dentatus* early life history in the Mid-Atlantic Bight and New Jersey estuaries. Fish. Bull. (U.S.) 88: 1-12.

Amos, A.F. 1989. The occurrence of hawksbills (*Eretmochelys imbricate*) along the Texas coast. Pages 9-11 in S.A. Eckert, K.L. Eckert, and T.H. Richardson, compilers. Proceedings of the ninth annual workshop on sea turtle conservation and biology. NOAA technical memorandum NMFS/SEFC-232.

Angliss, R.P. and D. P. DeMaster. 1998. Differentiating Serious and Non-Serious Injury of Marine Mammals Taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop 2 April 1997, Silver Spring, Maryland. NOAA Technical Memorandum NMFS-OPR-13, January 1998.

Atlantic States Marine Fisheries Commission (ASMFC). 2007. Special Report to the Atlantic Sturgeon Management Board: Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. 95 pp.

Atlantic States Marine Fisheries Commission (ASMFC). 2017. 2017 Atlantic sturgeon benchmark stock assessment and peer review report. October 18, 2017. 456 pp.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Bain, M. B., N. Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary: Lessons for Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.

Blaylock, J. and G.R. Shepherd. 2016. Evaluating the vulnerability of an atypical protogynous hermaphrodite to fishery exploitation: results from a population model for black sea bass (*Centropristis striata*). Fishery Bulletin 114(4): 476-489.

Baum, E.T. 1997. Maine Atlantic Salmon - A National Treasure. Atlantic Salmon Unlimited, Hermon, Maine.

Baumgartner, M.F., T.V.N. Cole, R.G. Campbell, G.J. Teegarden and E.G. Durbin. 2003. Associations between North Atlantic right whales and their prey, *Calanus finmarchicus*, over diel and tidal time scales. Mar. Ecol. Prog. Ser. 264: 155–166.

Baumgartner, M.F. and B.R. Mate. 2003. Summertime foraging ecology of North Atlantic right whales. Mar. Ecol. Prog. Ser. 264: 123–135.

Baumgartner, M.F., N.S.J. Lysiak, C. Schuman, J. Urban-Rich, and F.W. Wenzel. 2011. Diel vertical migration behavior of *Calanus finmarchicus* and its influence on right and sei whale occurrence. Marine Ecology Progress Series 423:167-184.

Bell R.J., Richardson D.E., Hare J.A., Lynch P., Fratantoni P.S., 2014. Disentangling the effects of climate, abundance and size on the distribution of marine fish: an example based on four stocks from the Northeast U.S. Shelf. ICES Journal of Marine Science. https://doi.org/10.1093/icesjms/fsu217

Bort, J., S. Van Parijs, P. Stevick, E. Summers and S. Todd. 2015. North Atlantic right whale *Eubalaena glacialis* vocalization patterns in the central Gulf of Maine from October 2009 through October 2010. Endang. Species Res. 26(3):271–280.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 2:51-61.

Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. Gulf of Mexico Science 1996(1):39-44.

Braun-McNeill, J., and S.P. Epperly. 2002. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4):50-56.

Braun-McNeill, J., C.R. Sasso, S.P.Epperly, C. Rivero. 2008. Feasibility of using sea surface temperature imagery to mitigate cheloniid sea turtle–fishery interactions off the coast of northeastern USA. Endangered Species Research: Vol. 5: 257–266, 2008.

Brown, M.B., O.C. Nichols, M.K. Marx, and J.N. Ciano. 2002. Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters. Final report to the Division of Marine Fisheries, Commonwealth of Massachusetts. September 2002. 29 pp.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report or the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Can. J. Zool. 71: 440-443.

Cole, T. V. N., P. Hamilton, A. G. Henry, P. Duley, R. M. Pace III, B. N. White, T. Frasier. 2013. Evidence of a North Atlantic right whale *Eubalaena glacialis* mating ground. Endang Species Res 21: 55–64.

Collins, M. R. and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. North American Journal of Fisheries Management. 17: 995-1000.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. Fisheries 31: 218-229.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, Acipenser brevirostrum, LeSuer 1818.

Damon-Randall, K., M. Colligan, and J. Crocker. 2013. Composition of Atlantic Sturgeon in Rivers, Estuaries, and Marine Waters. National Marine Fisheries Service, NERO, Unpublished Report. February 2013. 33 pp.

DePiper GS. 2014. Statistically assessing the precision of self-reported VTR fishing locations. NOAA Tech Memo NMFS NE 229; 16 p. doi: 10.7289/V53F4MJN

Dodge, K.L., B. Galuardi, T. J. Miller, and M. E. Lutcavage. 2014. Leatherback Turtle Movements, Dive Behavior, and Habitat Characteristics in Ecoregions of the Northwest Atlantic Ocean. PLOS ONE 9 (3) e91726: 1-17.

Dovel, W.L. and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River Estuary, New York. New York Fish and Game Journal 30: 140-172.

Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.J. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. Fishery Bulletin 108:450-465.

Dunton, K.J., D. Chapman, A. Jordaan, K. Feldheim, S. J. O'Leary, K. A. McKown, and M. G. Frisk. 2012. Brief Communications: Genetic mixed-stock analysis of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* in a heavily exploited marine habitat indicates the need for routine genetic monitoring. Journal of Fish Biology 80: 207–217.

Dunton, K.J., A. Jordaan, D. O. Conover, K.A. McKown, L. A. Bonacci, and M. G. Frisk. 2015. Marine Distribution and Habitat Use of Atlantic Sturgeon in New York Lead to Fisheries Interactions and Bycatch. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7:18–32.

Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. Chel. Cons. Biol. 5(2): 239-248.

Eldridge, PJ. 1962. Observations on the winter trawl fishery for summer flounder, Paralichthys dentatus.MS thesis, College of William and Mary, Virginia Institute of Marine Science, Gloucester Point, VA.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93:254-261.

Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner, and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bulletin of Marine Science 56(2):547-568.

Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1815. J. Appl. Ichthyol. 27: 356–365.

Gaichas, S., J. Hare, M. Pinksy, G. DePiper, O. Jensen, T. Lederhouse, J. Link, D. Lipton, R. Seagraves, J. Manderson, and M. Clark. 2015. Climate change and variability: a white paper to inform the Mid-Atlantic Fishery Management Council on the impact of climate change on fishery science and management. Second draft. Available at: http://www.mafmc.org/eafm/

Gilbert, CR and JD Williams. 2002. National Audubon Society Field Guide to Fishes: North America. Alfred A. Knopf, New York, NY.

Good, C. 2008. Spatial Ecology of the North Atlantic Right Whale (*Eubalaena glacialis*). Doctoral Dissertation, Duke University. Available at: http://dukespace.lib.duke.edu/dspace/handle/10161/588

Greene, J.K., M.G. Anderson, J. Odell, and N. Steinberg, eds. 2010. The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One. The Nature Conservancy, Eastern U.S. Division, Boston, MA. Available at: www.conservationgateway.org

Griffin, D.B., S. R. Murphy, M. G. Frick, A. C. Broderick, J. W. Coker, M. S. Coyne, M. G. Dodd, M. H. Godfrey, B. J. Godley, L. A. Hawkes, T. M. Murphy, K. L. Williams, and M. J. Witt. 2013. Foraging habitats and migration corridors used by a recovering subpopulation of adult female loggerhead sea turtles: implications for conservation. Mar. Biol. 160: 3071–3086.

Groombridge, B., and R. Luxmoore. 1989. The green turtle and hawksbill (Reptilia: Cheloniidae): world status, exploitation and trade. CITES Secretariat; Lausanne, Switzerland.

Hamazaki, T. 2002. Spatiotemporal prediction models of cetacean habitats in the mid-western North Atlantic Ocean (from Cape Hatteras, No. Carolina, USA to Nova Scotia, Canada). Mar. Mamm. Sci. 18(4): 920-939.

Hamilton, P.K., and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978-1986. Reports of the International Whaling Commission, Special Issue No. 12: 203-208.

Hartley, D., A. Whittingham, J. Kenney, T. Cole, and E. Pomfret. 2003. Large Whale Entanglement Report 2001. Report to the National Marine Fisheries Service, updated February 2003.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hawkes, L.A., M.J. Witt, A.C. Broderick, J.W. Coker, M.S. Coyne, M. Dodd, M.G. Frick, M.H. Godfrey, D.B. Griffin, S.R. Murphy, T.M. Murphy, K.L. Williams, and B.J. Godley. 2011. Home on the range: spatial ecology of loggerhead turtles in Atlantic waters of the USA. Diversity and Distributions 17:624–640.

Henderson EM. 1979. Summer flounder (*Paralichthys dentatus*) in the Northwest Atlantic. Northeast Fisheries Center Laboratory Reference Document No. 79-31. 27 p.

Henry, A.G., T.V.N. Cole, L. Hall , W. Ledwell , D. Morin , and A. Reid. 2016. Serious injury and mortality and determinations for baleen whale stocks along the Gulf of Mexico, United

States east coast and Atlantic Canadian provinces, 2010-2014. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-10; 51 p.

Henry, A.G., T.V.N. Cole, M. Garron, W. Ledwell, D. Morin, and A. Reid. 2017. Serious injury and mortality and determinations for baleen whale stocks along the Gulf of Mexico, United States east coast and Atlantic Canadian provinces, 2011-2015. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-19; 57 p.

Herman, S.S. 1963. Planktonic fish eggs and larvae of Narragansett Bay. Limnol. Oceanogr. 8: 103-109.

Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, Chelonia mydas (Linnaeus 1758). USFWS Biological Report 97(1):1-120.

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. Proc. R. Soc. B, 272: 1547-1555.

James, M.C., S.A. Sherrill-Mix, K. Martin, and R. A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biological Conservation 133: 347-357.

Jefferson, T.A., D. Fertl, J. Bolanos-Jimenez and A.N. Zerbini. 2009. Distribution of common dolphins (*Delphinus spp.*) in the western North Atlantic: a critical re-examination. Mar. Biol. 156:1109-1124.

Johnson, A. J., G. S. Salvador, J. F. Kenney, J. Robbins, S. D. Kraus, S. C. Landry, and P. J. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales, Marine Mammal Science 21(4): 635-645.

Jones WJ, Quattro JM. 1999. Genetic structure of summer flounder (*Paralichthys dentatus*) populations north and south of Cape Hatteras. Mar Bio 133: 129-135.

Kenney, J., and D. Hartley. 2001. Draft Large Whale Entanglement Summary 1997-2001. Report to the National Marine Fisheries Service, updated October.

Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott and H.E. Winn. 1986. Estimation of prey densities required by western North Atlantic right whales. Mar. Mamm. Sci. 2: 1–13.

Kenney, R.D., H.E. Winn and M.C. Macaulay 1995. Cetaceans in the Great South Channel, 1979-1989: right whale (*Eubalaena glacialis*). Cont. Shelf Res. 15: 385–414.

Khan, C., T.V.N. Cole, P. Duley, A. Glass, M. Niemeyer, and C. Christman. 2009. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2008 Results Summary. NEFSC Reference Document 09-05. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2010. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2009 Results Summary. NEFSC Reference Document 10-07. 7 pp.

Khan, C., T. Cole, P. Duley, A. Glass, and J. Gatzke. 2011. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2010 ResultsSummary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-05. 6 pp.

Khan C., T. Cole, P. Duley, A. Glass, and J. Gatzke, J. Corkeron. 2012. North Atlantic Right Whale Sighting Survey (NARWSS) and Right Whale Sighting Advisory System (RWSAS) 2011 Results Summary. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 12-09; 6 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/

Knowlton, A.R., P.K. Hamilton, M.K. Marx, H.M. Pettis, and S.D. Kraus. 2012. Monitoring North Atlantic right whale (*Eubalaena glacialis*) entanglement rates: a 30 yr retrospective. Marine Ecology Progress Series 466:293-302.

Kocik. J.F., S.E. Wigley, and D. Kircheis. 2014. Annual Bycatch Update Atlantic Salmon 2013 U.S. Atlantic Salmon Assessment Committee Working Paper 2014:05. Old Lyme, CT. 6 pp.(cited with permission of authors).

Kraus RT, Musick JA. 2003. A brief interpretation of summer flounder, (*Paralichthys dentatus*), movements and stock structure with new tagging data on juveniles. Mar Fish Rev. 63(3):1-6.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitat used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: A hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988–2006. Pages 167-182. In: J. Munro, D. Hatin, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, (editors), Anadromous sturgeons: Habitats, threats, and management. Am. Fish. Soc. Symp. 56, Bethesda, MD.

Lucey, S. M. and J. A. Nye. 2010. Shifting species assemblages in the northeast US continental shelf large marine ecosystem. Marine Ecology Progress Series. 415: 23-33.

Lux FE, Porter LR. 1966. Length-weight relation of the summer flounder (Paralichthys dentatus (Linneaus). US Bur Comm Fish. Spec Sci Rep Fish. No 531. 5 p.

Lyssikatos MC. 2015. Estimates of cetacean and pinniped bycatch in Northeast and mid-Atlantic bottom trawl fisheries, 2008-2013. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-19.

MAFMC (Mid-Atlantic Fishery Management Council). 1993. Amendment 2 to the Fishery Management Plan for the Summer Flounder Fishery. Dover, DE. Available at: http://www.mafmc.org/s/SFSCBSB_Amend_2.pdf

MAFMC (Mid-Atlantic Fishery Management Council). 1998. Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. Dover, DE. 398 p. + appendices. Available at: http://www.mafmc.org/s/SFSCBSB_Amend_12.pdf.

MAFMC (Mid-Atlantic Fishery Management Council). 2002. Amendment 13 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan. Dover, DE. Available at: https://mafmc.squarespace.com/s/SFSCBSB_Amend_13_Vol_1compressed.pdf

Mansfield, K.L., V.S. Saba, J. Keinath, and J.A. Musick. 2009. Satellite telemetry reveals a dichotomy in migration strategies among juvenile loggerhead sea turtles in the northwest Atlantic. Marine Biology 156:2555-2570.

Mayo, C.A. and M.K. Marx. 1990. Surface foraging behaviour of the North Atlantic right whale, Eubalaena glacialis, and associated zooplankton characteristics. Can. J. Zool. 68: 2214–2220.

McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594

Miller, T. and G. Shepard. 2011. Summary of Discard Estimates for Atlantic Sturgeon. Northeast Fisheries Science Center, Population Dynamics Branch, August 2011.

Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.

Moore, M.J. and J. M. van der Hoop. 2012. The Painful Side of Trap and Fixed Net Fisheries: Chronic Entanglement of Large Whales. Journal of Marine Biology, Volume 2012, Article ID 230653, 4 pages

Morgan, L.E., and R. Chuenpagdee. 2003. Shifting gears: addressing the collateral impacts of fishing methods in U.S. waters. Pew science series on conservation and the environment.

Morreale, S.J. and E.A. Standora. 2005. Western North Atlantic waters: Crucial developmental habitat for Kemp's ridley and loggerhead sea turtles. Chel. Conserv. Biol. 4(4):872-882.

Morse, W.W. 1981. Reproduction of the summer flounder, *Paralichthys dentatus* (L.). J. Fish Biol. 19: 189-203.

Murawski, W.S. (1970) Results of tagging experiments of summer flounder, (*Paralichthys dentatus*), conducted in New Jersey waters from 1960–1967. New Jersey Division of Fish, Game, and Shellfisheries, Nacote Research Station. Miscellaneous Report No. 5M, 72 pp.

Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial Distribution, and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. Chel. Cons. Biol. 5(2): 216-224.

Murray, K.T. 2009. Characteristics and magnitude of sea turtle bycatch in U.S. mid-Atlantic gillnet gear. Endang Species Res 8:211-224.

Murray, K.T. 2011. Interactions between sea turtles and dredge gear in the U.S. sea scallop (*Placopecten magellanicus*) fishery, 2001-2008. Fisheries Research 107:137-146.

Murray, K.T. 2013. Estimated loggerhead and unidentified hard-shelled turtle interactions in mid-Atlantic gillnet gear, 2007-2011. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NM-225. 20 pp. Available at http://www.nefsc.noaa.gov/publications/tm/.

Murray, K.T. 2015a. Estimated loggerhead (*Caretta caretta*) interactions in the Mid-Atlantic scallop dredge fishery, 2009-2014. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-20; 15 p. doi: 10.7289/V5GT5K5W.

Murray, K.T. 2015b. The importance of location and operational fishing factors in estimating and reducing loggerhead turtle (*Caretta caretta*) interactions in U.S. bottom trawl gear. Fisheries Research 172: 440–451.

NEFMC (New England Fishery Management Council). 2018. Framework Adjustment 5 to the Northeast Skate Complex FMP. Newburyport, MA.

NEFSC (Northeast Fisheries Science Center). 1996a. Report of the 20th Northeast Regional Stock Assessment Workshop (20th SAW). Northeast Fisheries Science Center Ref Doc. 95-19. 52 p.

NEFSC (Northeast Fisheries Science Center). 1996b. Report of the 22nd Northeast Regional Stock Assessment Workshop (22nd SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. Northeast Fisheries Science Center Ref Doc. 96-13. 242 p.

NEFSC (Northeast Fisheries Science Center). 2007. 44th Northeast Regional Stock Assessment Workshop (44th SAW) assessment summary report. US Dep Commer, Northeast Fish Sci Cent Ref Doc. 07-03; 58 p.

NEFSC (Northeast Fisheries Science Center). 2008. 47th Northeast Regional Stock Assessment Workshop (47th SAW) Assessment Report. US Dept Commerce, Northeast Fish Sci Cent Ref Doc. 08-12a, 335 p.

NEFSC (Northeast Fisheries Science Center). 2013. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-16; 967 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/.

NEFSC (Northeast Fisheries Science Center). 2017. 62nd Northeast Regional Stock Assessment Workshop (62nd SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 17-03; 822 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://nefsc.noaa.gov/publications/.

NMFS NEFSC FSB (National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB)). 2015. Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2014 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

NMFS NEFSC FSB (National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center Fisheries Statistics Branch (NEFSC FSB)). 2016. Northeast Fisheries Observer Program: Incidental Take Reports. Omnibus data request + supplemental data for 2015 from http://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

NMFS (National Marine Fisheries Service). 1991. Final recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

NMFS (National Marine Fisheries Service). 2001. Endangered Species Act Section 7 consultation on the golden tilefish fishery management plan. Gloucester, MA. 78pp.

NMFS (National Marine Fisheries Service). 2005. Revision- recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 137 pp.

NMFS (National Marine Fisheries Service). 2010a. Biological Assessment of Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Status Review Team for the National Marine Fisheries Service, Gloucester MA. 417pp.

NMFS (National Marine Fisheries Service). 2010b. Final recovery plan for the fin whale (*Balaenoptera physalus*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 121 pp.

NMFS (National Marine Fisheries Service). 2011a. Final recovery plan for the sei whale (*Balaenoptera borealis*). Prepared by the Office of Protected Resources National Marine Fisheries Service, Silver Spring, MD. 108 pp.

NMFS (National Marine Fisheries Service). 2011b. Bycatch Working Group Discussion Notes.NMFS Sturgeon Workshop, Alexandria, VA. February 11, 2011.

NMFS (National Marine Fisheries Service). 2012. North Atlantic Right Whale (*Eubalaena glacialis*) five year review: summary and evaluation. NOAA Fisheries Service, Northeast Regional Office, Gloucester, MA. 36pp.

NMFS (National Marine Fisheries Service). 2013. NMFS-Greater Atlantic Region Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries.

NMFS (National Marine Fisheries Service). 2014a. NMFS-Greater Atlantic Region Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the American Lobster Fishery.

NMFS (National Marine Fisheries Service). 2014b. NMFS-Greater Atlantic Region (GARFO) Memo to the record: Determination regarding reinitiation of Endangered Species Act section 7 consultation on 12 GARFO fisheries and two Northeast Fisheries Science Center funded fisheries research surveys due to critical habitat designation for loggerhead sea turtles. Memo issued September 17, 2014.

NMFS (National Marine Fisheries Service). 2014c. Final Environmental Impact Statement for Amending the Atlantic Large Whale Take Reduction Plan: Vertical Line Rule. National Marine Fisheries Service. May 2014.

NMFS (National Marine Fisheries Service). 2015a. Endangered Species Act Section 4(b)(2) Report: Critical Habitat for the North Atlantic Right Whale (*Eubalaena glacialis*). Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, December 2015. http://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16narwchsection4_b__2_report012616.pdf

NMFS (National Marine Fisheries Service). 2015b. North Atlantic Right Whale (*Eubalaena glacialis*). Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat" Prepared by National Marine Fisheries Service Greater Atlantic Regional Fisheries Office and Southeast Regional Office, July 2015.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 1991. Recovery plan for U.S. population of Atlantic green turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, D.C. 58 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service. 139 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 1998a. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*). Silver Spring, Maryland: National Marine Fisheries Service. 65 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 1998b. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). Silver Spring, Maryland: National Marine Fisheries Service. 84 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2005. Recovery plan for the Gulf of Maine distinct population segment of the Atlantic salmon (*Salmo salar*). National Marine Fisheries Service, Silver Spring, MD.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2007a. Kemp's ridley sea turtle *(Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2007b. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2013a. Hawksbill sea turtle (*Eretmochelys imbricata*)5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 89 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2013b. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 91 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2015. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 62 pp.

NMFS and USFWS (National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS)). 2016. Draft Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*). http://www.fisheries.noaa.gov/pr/pdfs/20160329_atlantic_salmon_draft_recovery_plan.pdf

NMFS (National Marine Fisheries Service), U.S. Fish and Wildlife Service, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, MD. 156 pp. + appendices.

NOAA (National Oceanic and Atmospheric Administration). 2008. High numbers of right whales seen in Gulf of Maine: NOAA researchers identify wintering ground and potential breeding ground. NOAA press release. December 31, 2008.

Northeast Region Essential Fish Habitat Steering Committee (NREFHSC). 2002. Workshop on the effects of fishing gear on marine habitat off the northeastern United States. October 23-25, Boston, Massachusetts. NEFSC Ref. Doc. 02-01, 86 pp.

Nye, J. A., T. M. Joyce, Y.O. Kwon, and J.S. Link. 2011. Silver hake tracks changes in Northwest Atlantic circulation. Nature Communications. 2:412.

Olla, B.L., C.E. Samet, and A.L. Studholme. 1972. Activity and feeding behavior of the summer flounder (*Paralichthys dentatus*) under controlled laboratory conditions. Fish. Bull. (U.S.) 70: 1127-1136.

Oliver, M.J., M. W. Breece, D. A. Fox, D. E. Haulsee, J. T. Kohut, J. Manderson, and T. Savoy. 2013. Shrinking the Haystack: Using an AUV in an Integrated Ocean Observatory to Map Atlantic Sturgeon in the Coastal Ocean. Fisheries 38(5): 210-216.

O'Leary, S.J., K. J. Dunton, T. L. King, M. G. Frisk, and D.D. Chapman. 2014. Genetic diversity and effective size of Atlantic sturgeon, *Acipenser oxyrhinchus oxyrhinchus,* river spawning populations estimated from the microsatellite genotypes of marine-captured juveniles. Conserv Genet: DOI 10.1007/s10592-014-0609-9; ISSN 1566-0621.

Pace, R.M. III and R. Merrick. 2008. Northwest Atlantic Ocean Habitats Important to the Conservation of North Atlantic Right Whales (*Eubalaena glacialis*). NEFSC Ref. Doc. 08-07.

Packer, David; Griesbach, Sara; Berrien, Peter; Zetlin, Christine; Johnson, Donna; Morse, Wallace. 1999. "Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics." Highlands, NJ. Available at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm151/tm151.pdf.

Palka, D. L. 2006. Summer abundance estimates of cetaceans in US North Atlantic Navy Operating Areas. Northeast Fish. Sci. Cent. Ref. Doc. 06-03. 41 pp. http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0603/crd0603.pdf

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala sp*.) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int. Whal. Comm. (Special Issue) 14: 51- 68.

Payne, P.M., L. A**.** Selzer, and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980 - December 1983, based on shipboard observations. National Marine Fisheries Service-NEFSC, Woods Hole, MA. 294pp.

Payne, P.M., J.R. Nicholas, L. O'Brien and K.D. Powers 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fish. Bull. 84: 271-277.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham and J.W. Jossi 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88: 687-696.

Peters, D.S. and J.W. Angelovic. 1971. Effect of temperature, salinity, and food availability on growth and energy utilization of juvenile summer flounder, *Paralichthys dentatus*. *In* D.J. Nelson ed. Proc. 3rd Natl. Symp. Radioecology USAEC Conf.,-710501-PI. p. 545-554. National Technical Information Service, Springfield, VA.

Pinsky, M.L., B. Worm, M.J. Fogarty, J.L. Sarmiento, and S.A. Levin. 2013. Marine taxa track local climate velocities. Science. 341(6151): 1239-1242.

Plotkin, P. and A.F. Amos. 1988. Entanglement in and ingestion of marine turtles stranded along the south Texas coast. Pages 79-82. In: B.A. Schroeder, compiler. Proceedings of the eighth annual workshop on sea turtle conservation and biology. NOAA Technical Memorandum NMFS/SEFC-214. On file at U.S. Fish and Wildlife Service, South Florida Ecosystem Office; Vero Beach, FL.

Plotkin, P. and A.F. Amos. 1990. Effects of anthropogenic debris on sea turtles in the northwestern Gulf of Mexico. In: R.S. Shomura and M.L. Godfrey (eds.), Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulu, HI, p. 736-747, NOAA Tech. Mem. NMFS-SWFSC-154. 1274 pp.

Poole, J.C. 1961. Age and growth of the fluke in Great South Bay and their significance to the sport fishery. N.Y. Fish Game J. 8: 1-18.

Powell AB. 1974. Biology of the summer flounder, *Paralichthys dentatus*, in Pamlico Sound and adjacent waters, with comments on *P. lethostigma* and *P. albigutta*. M.S. Thesis. University of North Carolina, Chapel Hill, NC. 145 p.

Read, A.J., P. Drinker, and S. Northridge. 2006. Bycatch of Marine Mammals in the U.S. and Global Fisheries. Conservation Biology 20(1): 163-169.

Reddin, D.G. 1985. Atlantic salmon (*Salmo salar*) on and east of the Grand Bank. J. Northwest Atl. Fish. Soc. 6(2):157-164.

Reddin, D.G and P.B. Short. 1991. Postsmolt Atlantic salmon (*Salmo salar*) in the Labrador Sea. Can. J. Fish Aquat. Sci. 48:2-6.

Reddin, D.G and K.D. Friedland. 1993. Marine environmental factors influencing the movement and survival of Atlantic salmon. 4th Int. Atlantic Salmon Symposium. St. Andrews, N.B. Canada.

Risch, D., C. W. Clark, P. J. Dugan, M. Popescu, U. Siebert, and S. M. Van Parijs. 2013. Minke whale acoustic behavior and multi-year seasonal and diel vocalization patterns in Massachusetts Bay, USA. Mar Ecol Prog Ser 489: 279–295.

Robbins, J. 2009. Scar-based inference into the Gulf of Maine humpback whale entanglement: 2003-2006. Report to National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. NOAA Contract #EA133F04SE0998.

Rudnicky, B.M., and J.A. Sulikowski. 2016. First Observation of YOY *Paralichthys dentatus* (summer flounder) in a Southern Maine estuary. Northeastern Naturalist 23(1):N1-N3.

Sasso, C.R., and S.P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. Fisheries Research 81:86-88.

Savoy, T., and D. Pacileo. 2003. Movements and important habitats of subadult Atlantic sturgeon in Connecticut waters. Transactions of the American Fisheries Society. 132: 1-8.

Schevill, W.E., W.A. Watkins, and K.E. Moore. 1986. Status of *Eubalaena glacialis* off Cape Cod. Report of the International Whaling Commission, Special Issue 10: 79-82.

Schilling, M. R., I. Seipt, M. T. Weinrich, S. E. Frohock, A. E. Kuhlberg, and P. J. Clapham. 1992. Behavior of individually-identified sei whales *Balaenoptera borealis* during an episodic influx into the southern Gulf of Maine in 1986. Fishery Bulletin 90:749–755.

Sears, R. 2002. Blue whale, *Balaenoptera musculus*. Pages 112-116. In: W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. Encyclopedia of Marine Mammals. San Diego: Academic Press.

Seminoff, J.A., C.D. Allen, G.H. Balazs, P.H. Dutton, T. Eguchi, H.L. Hass, S.A. Hargrove, M. Jensen, D.L. Klemm, A.M. Lauritsen, S.L. MacPherson, P. Opay, E.E. Possardt, S. Pultz, E. Seney, K.S. Van Houtan, and R.S. Waples. 2015. Status Review of the Green Turtle (Chelonia mydas) Under the Endangered Species Act. NOAA Technical Memorandum: NOAA-TM-NMFS-SWFSC-539. NMFS Southwest Fisheries Science Center, March 2015.

Sheehan, T.F., D.G. Reddin, G. Chaput and M.D. Renkawitz. 2012. SALSEA North America: A pelagic ecosystem survey targeting Atlantic salmon in the Northwest Atlantic. ICES Journal of Marine Science, doi:10.1093/icesjms/fss052.

Shepherd G. 1980. A comparative study of aging methods for summer flounder (*Paralichthys dentatus*). Northeast Fisheries Center Lab Ref Doc. 80-13. 26 p.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Smith, W.G. 1973. The distribution of summer flounder, *Paralichthys dentatus*, eggs and larvae on the continental shelf between Cape Cod and Cape Lookout, 1965-66. Fish. Bull. (U.S.) 71: 527-548.

Smith, R.W. and F.C. Daiber. 1977. Biology of the summer flounder, *Paralichthys dentatus*, in Delaware Bay. Fish. Bull. (U.S.) 75: 823-830.

STDN (Sea Turtle Disentanglement Network. 2016. Northeast Region Sea Turtle Disentanglement Network Summary of Entanglement/Disentanglement Data from 2002-2016. Unpublished report compiled by NMFS NERO.

Steimle, FW, and CA Zetlin. 2000. Reef habitats in the middle Atlantic bight: abundance, distribution, associated biological communities, and fishery resource use. Marine Fisheries Review. 62: 24-42. 62: 24-42.

Stenseth, N.C, Mysterud, A., Otterson, G., Hurrell, J.W., Chan, K., and M. Lima. 2002 Ecological Effects of Climate Fluctuations. Science 297(5585); 1292-1296.

Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Wilhelm, J. McCarthy, M. Pentony. 2004. Characterization of the fishing practices and marine benthic ecosystems of the Northeast U.S. Shelf, and an evaluation of the potential effects of fishing on Essential Fish Habitat. NOAA Technical Memorandum NMFS-NE-181; 179 p.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004a. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transactions of the American Fisheries Society 133: 527-537.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004b. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management 24: 171-183.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

Terceiro, M. 2001. “The summer flounder chronicles: Science, politics, and litigation, 1975–2000.” Reviews in Fish Biology and Fisheries,11: p. 125-168. Available at: https://www.nefsc.noaa.gov/saw/2006FlukeReview/chronicles.pdf.

Terceiro, M. 2011. “The summer flounder chronicles II: new science, new controversy, 2001-2010.” Reviews in Fish Biology and Fisheries, 21: p. 681-712. Available at: https://www.researchgate.net/publication/251269270_The_summer_flounder_chronicles_II_New_science_new_controversy_2001-2010.

Terceiro M. 2012. Stock assessment of summer flounder for 2012. Northeast Fisheries Science Center Ref Doc. 12-21. 148 p.

Terceiro M. 2015. Stock assessment update of summer flounder for 2015. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-13; 18 p. doi: 10.7289/V57D2S4G

Terceiro M. 2016. Stock Assessment of Summer Flounder for 2016. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-15; 117 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/publications/.

Terceiro, M. 2017a. Summer Flounder Data Update for 2017. US Dept Commer, Northeast Fish Sci Cent. Available at: http://www.mafmc.org/s/5-Summer_flounder_2017_Data_Update-t9ap.pdf

Terceiro, M. 2017b. Stock Assessment of Scup for 2017. US Dept Commer, Northeast Fish Sci Cent. Available at: http://www.mafmc.org/s/5Scup_2017_Assesssment_Update.pdf.

TEWG (Turtle Expert Working Group). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

TEWG (Turtle Expert Working Group). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555:1-116.

TEWG (Turtle Expert Working Group). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

Timmons, M. 1995. Relationships between macroalgae and juvenile fishes in the inland bays of Delaware. Ph.D. dissertation, Univ. Delaware, Newark, DE. 155 p.

Timoshkin, V. P. 1968. Atlantic sturgeon (*Acipenser sturio* L.) caught at sea. Prob. Ichthyol. 8(4):598.

U.S. Atlantic Salmon Assessment Committee (USASAC). 2004.Annual Report of the U.S. Atlantic Salmon Assessment Committee.

Vu, E., D. Risch, C. Clark, S. Gaylord, L. Hatch, M. Thompson, D. Wiley, and S. Van Parijs. 2012. Humpback whale song occurs extensively on feeding grounds in the western North Atlantic Ocean. Aq. Biol.14(2):175–183.

Waldman, J.R., T. King, T. Savoy, L. Maceda, C. Grunwald, and I. Wirgin. 2013. Stock Origins of Subadult and Adult Atlantic Sturgeon, *Acipenser oxyrinchus*, in a Non-natal Estuary, Long Island Sound. Estuaries and Coasts 36:257–267.

Warden, M.L. 2011a. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005–2008. Biological Conservation 144: 2202–2212.

Warden, M.L. 2011b. Proration of loggerhead sea turtle (*Caretta caretta*) interactions in US Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. NEFSC Reference Document 11-04; 8 pp. http://www.nefsc.noaa.gov/publications/crd/.

Waring G.T., E. Josephson, C.P. Fairfield-Walsh , K. Maze-Foley K, editors. 2007. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2007. NOAA Tech Memo NMFS-NE- 205. 415 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2010. NOAA Tech Memo NMFS-NE-219. 606 pp.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2014a. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments—2013. NOAA Tech Memo NMFS- NE-228. 475 pp.

Waring, G.T, F. Wenzel, E. Josephson, M.C. Lyssikatos. 2014b. Serious Injury Determinations for Small Cetaceans and Pinnipeds Caught in Commercial Fisheries off the Northeast U.S. Coast, 2007-2011. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 14-13; 26 p. doi: 10.7289/V5QN64QH

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2015. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2014. http://www.nmfs.noaa.gov/pr/sars/pdf/atl2014_final.pdf

Waring, G.T. , E. Josephson , K. Maze-Foley , and P. E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments 2015. NOAA Technical Memorandum NMFS-NE-238. http://www.nmfs.noaa.gov/pr/sars/pdf/atlantic2015_final.pdf

Watkins, W.A., and W.E. Schevill. 1982. Observations of right whales (*Eubalaena glacialis*) in Cape Cod waters. Fish. Bull. 80(4):875-880.

Weinberg, J. R. 2005. Bathymetric shift in the distribution of Atlantic surfclams: response to warmer ocean temperature. ICES Journal of Marine Science. 62(7): 1444-1453.

Whitehead, H. 2002. Estimates of the Current Global Population Size and Historical Trajectory for Sperm Whales. Mar. Ecol. Prog. Ser. 242: 295-304.

Whittingham, A., D. Hartley, J. Kenney, T. Cole, and E. Pomfret. 2005a. Large Whale Entanglement Report 2002. Report to the National Marine Fisheries Service, updated March 2005.

Whittingham, A., M. Garron, J. Kenney, and D. Hartley. 2005b. Large Whale Entanglement Report 2003. Report to the National Marine Fisheries Service, updated June 2005.

Wigley SE, McBride HM, McHugh NJ. 2003. Length-weight relationships for 74 fish species collected during NEFSC research vessel bottom trawl surveys, 1992-99. NOAA Technical Memorandum NMFS-NE-171.

Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. Reports of the International Whaling Commission (Special issue). 10: 129-138.

Wilk SJ, Smith WG, Ralph DE, Sibunka J. 1980. The population structure of summer flounder between New York and Florida based on linear discriminant analysis. Trans Am Fish Soc. 109: 65-271.

Wirgin, I., L. Maceda, J.R. Waldman, S. Wehrell, M. Dadswell, and T. King. 2012. Stock origin of migratory Atlantic sturgeon in the Minas Basin, Inner Bay of Fundy, Canada, determined by microsatellite and mitochondrial DNA analyses.

Wirgin, I., M. W. Breece , D. A. Fox , L. Maceda , K. W. Wark, and T. King. 2015a. Origin of Atlantic Sturgeon Collected off the Delaware Coast during Spring Months. North American Journal of Fisheries Management 35: 20–30.

Wirgin, I., L. Maceda, C. Grunwald, and T. L. King. 2015b. Population origin of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus* by-catch in U.S. Atlantic coast fisheries. Journal of Fish Biology 86(4):1251–1270.

9.0 APPENDIX I. IMPACTS OF THE ALTERNATIVES

This section analyzes the impacts to the affected environment of the alternatives described in section 4.2. These alternatives contain options that could 1) implement requalifying criteria for federal commercial moratorium permits, 2) modify the allocation of commercial summer flounder quota, and 3) add framework provisions to the FMP that would allow for commercial landings flexibility policies for summer flounder to be developed through later framework actions.

Environmental impacts are analyzed with respect to five valued ecosystem components (VECs):

1. The **managed resources,** i.e., summer flounder, the managed species potentially affected by the measures under consideration (sections 9.1.1 and 9.2.1);
2. **Non-target species**, including the primary species or species groups that interact with summer flounder, summer flounder habitat, and/or commercial summer flounder fishing gear (sections 9.1.2 and 9.2.2);
3. The **physical environment and habitat**, including Essential Fish Habitat (EFH; sections 9.1.3 and 9.2.3);
4. **Protected resources**, including ESA-listed and MMPA-protected large and small cetaceans, pinnipeds, sea turtles, fish, and critical habitat occurring in the affected area (sections 9.1.4 and 9.2.4);
5. The **human environment**, including socioeconomic aspects of the fisheries (especially commercial fisheries) targeting summer flounder and the communities associated with those fisheries, as well as other human communities with an interest in summer flounder conservation and management (sections 9.1.5 and 9.2.5).

In sections 9.1 and 9.2, the impacts are described both in terms of their direction (negative, positive, or no impact) and their magnitude (slight, moderate, or high). Table 34 summarizes the main guidelines used for each VEC to determine the magnitude and direction of the impacts described in this section. As described in section 9.3., the framework provision alternatives for landing flexibility are primarily administrative and are not expected to have direct impacts on any of the VECs.

When considering impacts on each VEC, the impact of each alternative on the current, or baseline, condition of the VEC is described. The impacts of each alternative on each VEC are also compared to each other. The no action alternative describes what would happen if no action were taken. For all options considered in this document, the "no action" alternative would have the same outcome as *status quo* management, therefore, these alternatives are at times described as "no action/*status quo*." Where an alternative is said to "maintain the current condition of a VEC," this means that while the alternative may have some effect on the VEC, overall they are not likely to change its current baseline condition.

The recent conditions of the VECs include the biological conditions of the target stock, non-target stocks, and protected species over the most recent five years (section 1.2). They also include the fishing practices and levels of effort and landings in the commercial summer flounder fishery over the most recent five years, as well as the economic characteristics of the fisheries over the most recent three to five years (depending on the dataset; section 1.3.2). The recent conditions of the VECs also include recent levels of habitat availability and quality (section 1.3). The current condition of each VEC is described in Table 34.

The alternatives are not compared to a theoretical condition where the fisheries are not operating. These fisheries have occurred for many decades and are expected to continue into the foreseeable future. The nature and extent of the management programs for these fisheries have been examined in detail in past EAs and EISs prepared for previously implemented management actions under the Summer Flounder, Scup, and Black Sea Bass FMP, and are further described in this document.

When considering overall impacts on each VEC, impacts resulting from management changes in the commercial sector of the summer flounder fishery are the focus of the discussion, given that no recreational management modifications are proposed in this action. There may be indirect impacts to recreational communities within the human environment that could occur from changes in commercial management, and those are also described where relevant.

In general, alternatives which may result in overfishing or an overfished status for target and non-target species may have negative biological impacts for those species. Conversely, alternatives which may result in a decrease in fishing effort, resulting in ending overfishing or rebuilding to the biomass target, may result in positive impacts for those species by resulting in a decrease in fishing mortality (Table 34).

For the physical environment and habitat, alternatives that improve the quality or quantity of habitat or allow for recovery are expected to have positive impacts. Alternatives that degrade the quality or quantity, or increase disturbance of habitat are expected to have negative impacts (Table 34). The proposed actions in this document only impact the commercial summer flounder fishery; thus, the evaluation of habitat impacts is focused on how the interaction of commercial gear types and vessels may change with each alternative. Bottom trawls are the predominant commercial gear type used to harvest summer flounder and typically account for 90-97% of all landings (see section 1.3). Alternatives that may result in a reduction in fishing effort or fleet capacity may decrease the time that fishing gear is in the water, thus reducing the potential for interactions between fishing gear and habitat; however, most habitat areas where summer flounder are fished have been heavily fished by multiple fishing fleets over many decades and may not see a measurable improvement in their condition in response to shifts in effort in a single fishery (Table 34).

For protected species, consideration is given to both ESA-listed species and MMPA-protected species. ESA-listed species include populations of fish, marine mammals, or turtles at risk of extinction (endangered) or endangerment (threatened). For endangered or threatened species, any action that results in interactions with or take of ESA-listed resources is expected to have negative impacts, including actions that reduce interactions. Actions expected to result in positive impacts on ESA-listed species include only those that contain specific measures to ensure no interactions with protected species (i.e., no take). By definition, all species listed under the

ESA are in poor condition and any take has the potential to negatively impact that species' recovery. Under the MMPA, the stock condition of each protected species varies, but all are in need of protection.

For marine mammal stocks/species that have their potential biological removal (PBR) level reached or exceeded, negative impacts would be expected from any alternative that has the potential to interact with these species or stocks. For species that are at more sustainable levels (i.e., PBR levels have not been exceeded), actions not expected to change fishing behavior or effort such that interaction risks increase relative to what has been in the fishery previously, may have positive impacts by maintaining takes below the PBR level and approaching the Zero Mortality Rate Goal (Table 34). Thus, the overall impacts on the protected resources VEC for each alternative take into account impacts on ESA-listed species, impacts on marine mammal stocks in good condition (i.e., PBR level has not been exceeded), and marine mammal stocks that have exceeded or are in danger of exceeding their PBR level (Table 34).

Socioeconomic impacts are considered primarily in relation to potential changes in landings and prices, and by extension, revenues, compared to the current fishery conditions. Alternatives which could lead to increased availability of target species and/or an increase in catch per unit effort (CPUE) could lead to increased landings for particular communities or for the fishery as a whole. Alternatives which could result in an increase in landings are generally considered to have positive socioeconomic impacts because they could result in increased revenues (for fishing businesses as well as shoreside businesses); however, if an increase in landings leads to a decrease in price or a decrease in SSB for any of the landed species, then negative socioeconomic impacts could occur (Table 34). In addition, socioeconomic impacts can be considered in terms of other economic metrics and effects on the social wellbeing of fishery participants and communities, including factors like effect on community resilience, jobs, and employee income.
The expected impacts to each VEC are derived from both consideration of the current condition of the VEC and the expected changes in the characteristics and prosecution of the fishery (including but not limited to changes in overall effort, the spatial and seasonal distribution of effort, and fishing techniques) under each of the alternatives. It is not possible to quantify with confidence how these factors will change under each alternative; therefore, expected changes are estimated and/or described qualitatively.

Table 34 also describes the qualifiers that are used to describe the magnitude and direction of impacts throughout this section. Impacts may range from negligible or no impact to significant impacts, and expected impacts may be positive, negative, or mixed. Impacts that are associated with a higher degree of uncertainty are qualified as "likely" or "uncertain."

Table 34: General definitions for impacts and qualifiers relative to resource condition (i.e., baselines) summarized in Table 35 below.

General Definitions				
VEC	**Resource Condition**	**Impact of Action**		
		Positive (+)	Negative (-)	No Impact (0)
Target and non-target Species	Overfished status defined by the MSA	Alternatives that would maintain or are projected to result in a stock status above an overfished condition*	Alternatives that would maintain or are projected to result in a stock status below an overfished condition*	Alternatives that do not impact stock / populations
ESA-listed protected species (endangered or threatened)	Populations at risk of extinction (endangered) or endangerment (threatened)	Alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take)	Alternatives that result in interactions/take of listed species, including actions that reduce interactions	Alternatives that do not impact ESA listed species
MMPA protected species (not also ESA listed)	Stock health may vary but populations remain impacted	Alternatives that maintain takes below PBR and approaching the Zero Mortality Rate Goal	Alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	Alternatives that do not impact MMPA protected species
Physical environment / habitat / EFH	Many habitats degraded from historical effort and slow recovery time (see condition of the resources table for details)	Alternatives that improve the quality or quantity of habitat or allow for recovery	Alternatives that degrade the quality/quantity or increase disturbance of habitat	Alternatives that do not impact habitat quality
Human communities (socioeconomic)	Highly variable but generally stable in recent years (see condition of the resources table for details)	Alternatives that increase revenue and social well-being of fishermen and/or communities	Alternatives that decrease revenue and social well-being of fishermen and/or communities	Alternatives that do not impact revenue and social well-being of fishermen and/or communities
	Impact Qualifiers			
A range of impact qualifiers is used to indicate any existing uncertainty	Negligible	To such a small degree to be indistinguishable from no impact		
	Slight (sl), as in slight positive or slight negative	To a lesser degree / minor		
	Moderate (M) positive or negative	To an average degree (i.e., more than “slight”, but not “high”)		
	High (H), as in high positive or high negative	To a substantial degree (not significant unless stated)		
	Significant (in the case of an EIS)	Affecting the resource condition to a great degree, see 40 CFR 1508.27.		
	Likely	Some degree of uncertainty associated with the impact		

*Actions that will substantially increase or decrease stock size, but do not change a stock status may have different impacts depending on the particular action and stock. Meaningful differences between alternatives may be illustrated by using another resource attribute aside from the MSA status, but this must be justified within the impact analysis.

Table 35: Baseline conditions of VECs considered in this action.

VEC		Baseline Condition	
		Status/Trends, Overfishing?	**Status/Trends, Overfished?**
Target stock (section 1.3)	**Summer flounder**	Yes	No
Non-target species (principal species listed in section 1.3)	**Black Sea Bass**	No	No
	Scup	No	No
	Northeast skate complex	No	No, except thorny skate
	Spiny dogfish	No	No
	Northern sea robin	Unknown	Unknown
Habitat (section 1.4)		Commercial fishing impacts are complex and variable and typically adverse; Non-fishing activities had historically negative but site-specific effects on habitat quality.	
Protected resources (section 7.0)	**Sea turtles**	Leatherback and Kemp's ridley sea turtles are classified as endangered under the ESA; loggerhead (NW Atlantic DPS) and green (North Atlantic DPS) sea turtles are classified as threatened.	
	Fish	Atlantic salmon (Gulf of Maine DPS), shortnose sturgeon, and the New York Bight, Chesapeake, Carolina, and South Atlantic DPSs of Atlantic sturgeon are classified as endangered under the ESA; the Atlantic sturgeon Gulf of Maine DPS is listed as threatened; cusk are a candidate species	
	Large whales	All large whales in the Northwest Atlantic are protected under the MMPA. North Atlantic right, fin, blue, sei, and sperm whales are also listed as endangered under the ESA. Pursuant to section 118 of the MMPA, the Large Whale Take Reduction Plan was implemented to reduce humpback, North Atlantic right, and fin whale entanglement in vertical lines associated with fixed fishing gear (sink gillnet and trap/pot) and sinking groundlines.	
	Small cetaceans	Pilot whales, dolphins, and harbor porpoise are all protected under the MMPA. Pursuant to section 118 of the MMPA, the HPTRP and BDTRP were implemented to reduce bycatch of harbor porpoise and bottlenose dolphin stocks, respectively, in gillnet gear.	
	Pinnipeds	Gray, harbor, hooded, and harp seals are protected under the MMPA.	
Human communities (section 1.3)		Summer flounder supports large commercial and recreational fisheries; human communities impacted by the commercial fishery are relevant in this action. Over the past five years (2012-2016), the commercial fishery has averaged $28 million ex-vessel value per year (in 2016 dollars). Approximately 789 commercial moratorium permits for summer flounder were issued in 2016, with 344 reporting summer flounder landings. 19 ports from MA through NC have averaged over 100,000 lb of summer flounder landings annually from 2012-2016. Over 200 federally-permitted dealers from Maine through North Carolina purchased summer flounder in 2016.	

IMPACTS OF ALTERNATIVE SET 1: FEDERAL MORATORIUM PERMIT REQUALIFICATION

This alternative set contains options for requalification criteria for federal commercial moratorium permits for summer flounder, in the form of various combinations of landings thresholds and time periods over which those landings thresholds must have been achieved. The permit requalification alternatives are fully described in section 4.2 and briefly summarized here.

Alternative 1A (no action/*status quo*) would make no changes to the current commercial moratorium permit eligibility requirements established in 1993. To be eligible for a moratorium permit, a vessel must have been issued a moratorium permit in the previous year, or be replacing a vessel that was issued a moratorium permit after the owner retires the vessel from the fishery. All moratorium permits must be reissued on an annual basis by the last day of the fishing year for which the permit is required, unless the permit is in CPH.

Alternative 1B and sub-options (requalification of existing federal moratorium permits) presents various options for revising the qualifying criteria for summer flounder moratorium permits. All sub-options under this alternative, as described below, would evaluate requalification only from the existing pool of summer flounder moratorium permit holders and would not allow new entrants to obtain a permit based on the qualifying criteria. The qualifying criteria are associated with the summer flounder moratorium right ID (MRI) number maintained by GARFO.

Under all alternatives and sub-alternatives, overall annual summer flounder landings will still be constrained by the annual commercial quotas, which should remain the primary driving factor for overall fishery effort in a given year. As described below, requalification of moratorium permits theoretically could result in a redistribution of effort among a different pool of vessels. However, it appears that most MRIs that would be eliminated under each sub-alternative of 1B are associated with little to no activity for summer flounder in recent years; therefore, the impacts of reducing permit capacity under alternative 1B may be minimal, as described below.
Because this alternative set would not substantially modify overall effort, but considers how fishery effort will be distributed among participants, the impacts of this alternative set are primarily socioeconomic, both on individual permit holders and more broadly on fishing communities, as described below in section 9.1.5.

9.1.1 Impacts to the Target Stock (Summer Flounder)

9.1.1.1 Alternative 1A: No Action/Status Quo

This alternative would take no action to revise federal permit qualifications and would result in moderate positive impacts to the summer flounder stock, since the fishery would continue to be managed to prevent overfishing and to prevent the stock from becoming overfished. The summer flounder stock will continue to be managed under ACLs and AMs as required by the MSA, with the commercial fishery managed under an annual commercial quota derived from the commercial ACL and based on the best scientific information available.

When compared to alternative 1B and its sub-alternatives, alternative 1A is expected to have a similar magnitude of positive impacts. Neither of these alternatives are expected to change the overall level of effort in the fishery, which will continue to be constrained by ACLs and the annual commercial quota. The slight changes in vessel permit access under any 1B sub-alternative is expected to result in very minor practical impacts to the fishery, as described below. Therefore, the positive impacts to summer flounder from both alternatives are not expected to meaningfully differ in their magnitude.

9.1.1.2 Alternative 1B: Requalification of Existing Federal Moratorium Permits

Similar to alternative 1A, all-sub-alternatives under alternative 1B would not be expected to result in overall changes in fishing effort for summer flounder. The fishery will still be constrained by annual catch and landings limits, therefore, overall fishery effort in a given year will remain driven by these limits. Summer flounder is a high demand species and it is likely that utilization rates will remain high and annual quotas will continue to be reached every year. Therefore, a reduction in permit capacity under alternative 1B is not likely to impact overall effort each year but will impact the pool of vessels participating in the fishery.

Summer flounder removals will continue to be limited by annual catch limits, which will have positive impacts on the stock as the annual catch limits are based on the best available science and are intended to prevent overfishing.

Changes in the distribution of effort by vessel are not expected to have a meaningful impact on the summer flounder stock, especially given that most eliminated permits under all sub-alternatives are associated with little to no summer flounder landings in recent years. Between August 2009 and July 2014, summer flounder commercial landings associated with each group of eliminated MRIs were minimal for most sub-alternatives and non-existent for alternatives 1B-2 and 1B-4. These landings represented between 0% and 0.32% of coastwide summer flounder landings over the same time period (Table 36). Given this information, it is likely that most eliminated permits under each sub-alternative are not actively participating in the summer flounder fishery. Thus, changes in distribution of effort amongst participants under any of the sub-alternatives is likely to have minimal or no impacts on summer flounder landings, and would not be expected to influence stock status.

Overall incidental catch levels of summer flounder catch for vessels targeting other species are likely to be unaffected. While in theory, a slight increase in summer flounder discards from non-requalifying vessels is possible if they are no longer permitted to land summer flounder, it does not appear that most of the eliminated vessels under various sub-alternatives are landing much, if any, summer flounder in recent years. Thus, there should not be a substantial conversion from landings into discards, since landings among these vessels are currently very low to non-existent. In addition, the total dead catch (i.e., total removals from the fishery) will still be accounted for and constrained by the annual catch limit.

In theory, a reduction in the number of moratorium permits for summer flounder could result in a reduction in management uncertainty (in the near-term or long-term) based on a reduction in the potential for an influx of latent effort into the fishery. Such an influx is difficult to predict, but if it occurred could cause managers difficulty in constraining catch to the ACL. By reducing the total permit capacity in the summer flounder fishery, some of this management uncertainty is reduced, resulting in possible indirect slight positive impacts to the resource due to a better ability to control catch and landings

Table 36: Recent landings for eliminated MRIs associated with sub-alternatives under Alternative 1B, between August 1, 2009 and July 31, 2014. Landings thresholds under each sub-alternative refer to commercial landings of summer flounder associated with each MRI.

Sub-alternative under 1B	Time Period	Landings Threshold	# MRIs Eliminated (%)	Combined landings (lb) from eliminated MRIs, 8/1/09-7/31/14	% of coastwide summer flounder landings, 8/1/09-7/31/14
1B-1	8/1/09-7/31/14 (5 yrs)	≥1,000 lbs cumulative	516 (55%)	24,529	0.04%
1B-2	8/1/09-7/31/14 (5 yrs)	At least 1 pound in any year	448 (48%)	0	0.00%
1B-3	8/1/04-7/31/14 (10 yrs)	≥1,000 lbs cumulative	389 (41%)	5,713	0.01%
1B-4	8/1/04-7/31/14 (10 yrs)	At least 1 pound in any year	306 (33%)	0	0.00%
1B-5	8/1/99-7/31/14 (15 yrs)	≥1,000 lbs cumulative	295 (31%)	2,896	0.01%
1B-6	8/1/94-7/31/14 (20 yrs)	At least 1 pound in 20% of years (i.e., in at least 4 years over this 20-year period)	271 (29%)	181,302	0.32%
1B-7	8/1/94-7/31/14 (20 yrs)	≥1,000 lbs cumulative	233 (25%)	2,414	0.00%

Compared to alternative 1A, all of the sub-alternatives under 1B are likely to have a similar magnitude of moderate positive impacts to the summer flounder stock. All alternatives maintain the current management to the annual catch and landings limits, which is designed to prevent overfishing and prevent the stock from becoming overfished. Maintaining the current pool of participants (alternative 1A) and reducing the number of current permits to eliminate those that are inactive or very low activity will not meaningfully change the status of the summer flounder resource. Similarly, differences among sub-alternatives for alternative 1B are unlikely to vary in their magnitude of positive impacts to the summer flounder resource. While the number of MRIs eliminated under these sub-options varies (ranging from 25% to 55% of existing MRIs), landings from these MRIs in recent years consist of less than a third of one percent of coastwide landings at most.

9.1.2 Impacts to Non-Target Species

Primary non-target species identified for the commercial summer flounder trawl fishery, as described in section 1.3, are several species of skate, spiny dogfish, Northern sea robin, black sea bass, and scup. Non-target species could be affected by the alternatives for moratorium permit requalification if these alternatives were expected to change the level of effort or the prosecution of the fishery in a manner that would impact the interaction rates with non-target species. However, this is unlikely to be the case for alternatives 1A and 1B in this document. As described above in section 9.1.1, the permit requalification alternatives are not expected to change the overall level of effort for summer flounder. In addition, the alternatives in this document are not expected to change how the fishery is currently prosecuted, including the timing, areas fished, or gear types used. Impacts to non-target species from all federal permit alternatives are thus expected to be minimal and will contribute to maintaining the current stock status of non-target species, as described below.

9.1.2.1 Alternative 1A: No Action/Status Quo

As described in section 9.1.1, alternative 1A would make no changes to the current pool of commercial moratorium rights for summer flounder. As with impacts to summer flounder, this alternative would result in moderate positive impacts to non-target species that currently have a positive stock condition, since this alternative would contribute to maintaining that positive stock status.

The stock conditions of non-target species relevant to this action are described in Table 35. With the exception of thorny skate (overfished status) and Northern sea robin (status unknown), none of the non-target species are experiencing overfishing or are currently overfished. Most of these fisheries (with the exception of sea robin) are currently managed by the MAFMC or NEFMC. These fisheries would continue to be managed to prevent overfishing and to prevent the stock from becoming overfished under the requirements of the MSA, based on the best scientific information available. Incidental dead catch of MSA managed species is accounted for through the setting and monitoring of ACLs and AMs.

Alternative 1A would result in no changes in effort, and no changes in the prosecution of the fishery. Thus, impacts to non-target species from this alternative are expected to be overall moderate positive as they would maintain the positive stock status of most relevant non-target species. For species with unknown or overfished (thorny skate) stock status, alternative 1A would be expected to slight negative to no impacts, as it would be expected to maintain the current overfished or unknown stock status for these species. Given the condition of most non-target species, overall, alternative 1A would result in moderate positive impacts for non-target species. Compared to alternative 1B and sub-alternatives, alternative 1A is likely to have very similar magnitude of moderate positive impacts, because the overall fishing effort and the prosecution of the fishery are not expected to vary in a meaningful way between these alternatives.

9.1.2.2 Alternative 1B: Requalification of Existing Federal Moratorium Permits

As described in section 9.1 for impacts to summer flounder, alternative 1B and its sub-alternatives would not be expected to affect the overall amount of effort for summer flounder since catch and landings will still be constrained by annual catch and landings limits. In addition, most of the eliminated MRIs under all 1B sub-alternatives are landing little or no summer flounder in recent years (Table 36), meaning that actual changes in the distribution of effort as the result of alternative 1B are expected to be negligible.

Thus, the impacts of all sub-alternatives under alternative 1B are expected to be similar to each other and to impacts of alternative 1A. Moderate positive impacts are expected overall, since alternative 1B and sub-options would maintain the positive stock status of most non-target species relevant to this action. For overfished or unknown status species (thorny skate and Northern sea robin, respectively), this action is not expected to meaningfully contribute to a change in stock status.

9.1.3 Impacts to Physical Habitat and EFH

9.1.3.1 Alternative 1A: No Action/Status Quo

Alternative 1A is not expected to alter the prosecution of the fishery in any way that would directly either improve or degrade the quality of habitat. The summer flounder fisheries operate in areas that have been fished for many years, not only for summer flounder but for a variety of species, with a variety of gear types, and this is not expected to change under this alternative, which simply maintains the number of eligible moratorium permits at their current level and is not expected to alter overall effort levels, times and areas fished, or gear types used in the fishery. However, this alternative does allow continued permitting of summer flounder trawl vessels which are known to interact with habitat through their operation. As described in Table 34, alternatives that allow for recovery of habitat quality would result in positive impacts to the physical environment and habitat, meaning that actions that prevent recovery may result in indirect negative impacts to habitat.

As such, while alternative 1A is not expected to directly alter the level of habitat quality either positively or negatively, this alternative may have slight negative indirect impacts to habitat and EFH by continuing to prevent degraded habitats from recovering (i.e., this alternative will continue the current operating conditions which do not allow for recovery of degraded habitats due to continued fishing in those areas).

Alternative 1A is expected to have the same impacts (indirect slight negative impacts) as alternative 1B, as described below.

9.1.3.2 Alternative 1B: Requalification of Existing Federal Moratorium Permits

As described in the sections above, as with alternative 1A, none of the sub-alternatives under 1B are expected to result in changes in overall effort in the fishery. In addition, these sub-alternatives are not expected to have meaningful impacts on the distribution of effort in time and space due to the very low summer flounder effort observed in recent years for eliminated MRIs under each sub-alternative (Table 36). The current footprint of the fishery will continue to be fished by remaining summer flounder vessels and other fishing vessels. Like alternative 1A, sub-alternatives under 1B would result in indirect slight negative impacts to habitat, as they contribute to maintaining fishery impacts that prevent the recovery of degraded habitats.

Alternative 1B is expected to result in the same magnitude of indirect slight negative impacts to habitat as alternative 1A, as none of the alternatives for federal permit requalification are expected to change the overall degree of effort or the prosecution of the fishery in terms of areas fished or gear types used. Both alternatives 1A and 1B will result in a similar or identical footprint of fishing, and overall effort will remain tied to annual catch and landings limits.

9.1.4 Impacts to Protected Resources

As described above in the introduction to section 7, the impacts on protected resources may vary between ESA-listed and MMPA-protected species. For ESA-listed species, any action that could result in take of ESA-listed species is expected to have negative impacts, including actions that reduce interactions. Under the MMPA, the impacts of the proposed alternatives would vary based on the stock condition of each protected species and the potential for each alternative to impact fishing effort. For marine mammal stocks/species that have their PBR level reached or exceeded, negative impacts would be expected from any alternative that has the potential to interact with these species or stocks. For species that are at more sustainable levels (i.e., PBR levels have not been exceeded), any action not expected to change fishing behavior or effort such that interaction risks increase relative to what has been seen in the fishery previously, may have positive impacts by maintaining takes below the PBR level and approaching the Zero Mortality Rate Goal (Table 34). Taking the latter into consideration, the overall impacts on the protected resources VEC for each alternative take into account impacts on ESA-listed species, impacts on marine mammal stocks in good condition (i.e., PBR level has not been exceeded), and marine mammal stocks that have reached or exceeded their PBR level.

Overall, the federal permit requalification alternatives could have potential impacts on protected resources ranging from slight positive to slight negative, with slight positive to slight negative impacts likely on non-ESA listed marine mammals, and slight negative impacts likely for ESA-listed species. Because overall effort and the timing and location of fishery operation is not expected to vary between any of these alternatives, alternative 1A and all sub-alternatives under alternative 1B would have similar magnitudes of slight positive to slight negative impacts on protected resources.

9.1.4.1 Alternative 1A: No Action/Status Quo

MMPA (Non-ESA Listed) Species Impacts

The summer flounder fishery overlaps with the distribution of non-ESA listed species of marine mammals (cetaceans and pinnipeds). As a result, marine mammal interactions with fishing gear used to prosecute the commercial fishery are possible (i.e., otter trawls, see section 7.3). Ascertaining the risk of an interaction and the resultant potential impacts on marine mammals is uncertain because quantitative analyses have not been performed and data are limited (section 6.4). However, we have considered, the most recent (2010-2014) information on marine mammal interactions with commercial fisheries (Hayes *et al*. 2017; https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html).

Aside from pilot whales and several stocks of bottlenose dolphin, there has been no indication that takes of non-ESA listed species of marine mammals in commercial fisheries have gone beyond levels which would result in the inability of each species population to sustain itself. Specifically, aside from pilot whales and several stocks of bottlenose dolphin, the PBR level has not been exceeded for any of the non-ESA listed marine mammal species identified in section 7.0 (Hayes *et al*. 2017). Although pilot whales and several stocks of bottlenose dolphin have experienced levels of take that resulted in the exceedance of each species PBR level, take reduction strategies and/or plans have been implemented to reduce bycatch in the fisheries affecting these species (Atlantic Trawl Gear Take Reduction Strategy, Pelagic Longline Take Reduction Plan effective May 19, 2009 (74 FR 23349); Bottlenose Dolphin Take Reduction Plan, effective April 26, 2006 (71 FR 24776)). These efforts are still in place and are continuing to assist in decreasing bycatch levels for these species. Although NEFOP observer reports[33] and the most recent five years of information presented in Hayes et al. (2017) are a collective representation of commercial fisheries interactions with non-ESA listed species of marine mammals, and do not address the effects of the summer flounder fishery specifically, the information does demonstrate that thus far, operation of any fishery has not resulted in a collective level of take that threatens the continued existence of non-ESA listed marine mammal populations, aside from those species (pilot whales and bottlenose dolphin stocks) noted above.

Taking into consideration the above information, and the fact that there are non-listed marine mammal stocks/species whose populations may or may not be at optimum sustainable levels, impacts of alternative 1A on non-ESA listed marine mammal species are likely to range from slight negative to slight positive. As noted above, there are some marine mammal stocks/species that are experiencing levels of interactions that have resulted in exceedance of their PBR levels. These stocks/populations are not at an optimum sustainable level and therefore, the continued existence of these stocks/species is at risk. As a result, any potential for an interaction is a detriment to the species/stocks ability to recover from this condition. As interactions with non-ESA listed marine mammals are possible under alternative 1A, for these species/stocks with a current sub-optimal stock condition, alternative 1A is likely to result in slight negative impacts to these species.

Alternatively, there are also many non-ESA listed marine mammals that, even with continued fishery interactions, are maintaining an optimum sustainable level (i.e., PBR levels have not been exceeded) over the last several years. For these stocks/species, it appears that the fishery management measures that have been in place over this timeframe have resulted in levels of effort that equate to interaction levels that are not expected to impair the stocks/species ability to remain at an optimum sustainable level. These fishery management measures, therefore, have resulted in indirect slight positive impacts to these non-ESA listed marine mammal species/stocks. Should future fishery management actions maintain similar operating condition as they have over the past several years, it is expected that these slight positive impacts would remain. Thus, given that alternative 1A is not expected to change fishing effort relative to the *status quo*, the impacts of alternative 1A on these non-ESA listed species of marine mammals

[33] https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

with positive stock conditions are expected to be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level).

Based on this information, overall alternative 1A is expected to have slight negative to slight positive impacts on non-ESA listed species of marine mammals.

ESA Listed Species Impacts

The summer flounder commercial fishery is prosecuted primarily with bottom trawl gear. As provided in section 7.0, ESA listed species of sea turtles, Atlantic sturgeon, large whales, and Atlantic salmon are vulnerable to interactions with bottom trawl, sink gillnet, and/or hook and line gear , with interactions often resulting in the serious injury or mortality to the species. Based on this, the summer flounder fishery has the potential to interact with these species and therefore, result in some level of negative impacts to ESA listed species. Interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species (with risk of an interaction increasing with increases in of any or all of these factors). Because alternative 1A simply maintains the current total number of possible moratorium permits in the fishery and will not impact overall effort in a given year, this alternative is not expected to increase or decrease interaction rates with ESA listed species. However, because alternative 1A would maintain access to the fishery and maintain the possibility of interactions with ESA listed species, slight negative impacts are expected to result from this alternative.

Overall Impacts

Overall, alternative 1A is expected to have slight negative to slight positive impacts on protected resources, with slight negative to slight positive impacts likely on non-ESA listed marine mammals and slight negative impacts likely for ESA-listed species.

Compared to alternative 1B, alternative 1A is likely to have similar magnitude and direction of impacts, assuming that other conditions impacting participation in the fishery remain similar to current conditions. Because all sub-alternatives under 1B would eliminate mostly vessels with low or no activity for summer flounder, the near-term differences between alternatives in terms of the prosecution of the summer flounder fishery are expected to be negligible. However, sub-alternatives under 1B, as described below, do have the possibility of preventing future latent effort from re-entering the fishery. Relative to alternative 1A, this could result in slightly more positive impacts to protected resources, as this could reduce the possibility of increased interactions with marine mammals and ESA listed species resulting from a re-entry of latent effort to the fishery.

9.1.4.2 Alternative 1B: Requalification of Existing Federal Moratorium Permits

Impacts of alternative 1B, and all of its sub-alternatives, are expected to be similar in direction and magnitude to the impacts of alternative 1A, given that overall effort and the manner in which the fishery is prosecuted are not expected to change under any of these alternatives. As described above, the MRIs that would be eliminated under each sub-alternative under 1B are associated with little to no landings of summer flounder in recent years, meaning that any of the sub-alternatives under 1B would have little or no practical impact as far as modifying the distribution of participation and effort in the fishery. As with alternative 1A, slight negative to slight positive impacts are possible for non-ESA listed species of marine mammals. Slight positive impacts are expected for those species where takes have not exceeded that stock's PBR, and slight negative impacts are expected for those species with less positive stock conditions. For ESA listed species, any action resulting in takes is likely to have negative impacts; however, given that this action is not expected to substantially change the prosecution of the fishery, these negative impacts are expected to be minor relative to the current conditions.

As mentioned above, it's possible that alternative 1B and its sub-alternatives would result in a reduced risk of latent effort re-entering the fishery in future years, which could possibly increase the rates of interactions with protected species. However, the re-entry of latent effort is difficult to predict, and the sub-alternatives under 1B may result in different combinations of vessels being eliminated. Because all 1B sub-alternatives eliminate vessels with little or no recent summer flounder activity, and because conditions that would theoretically cause latent permits to re-enter the fishery are highly uncertain and are likely to vary based on individual businesses considerations, it is difficult to draw meaningful conclusions about the differences in the magnitude of impacts of each sub-alternative on protected resources. For example, it is impossible to demonstrate that alternative 1B-1 (eliminating 516 MRIs) will have meaningfully different impacts from alternative 1B-3 (eliminating 389 MRIs; Table 36). However, in general, sub-alternatives eliminating more MRIs will theoretically have a greater impact on reductions in permit capacity, meaning a greater reduction in the potential for future re-entry of latent effort. In that sense, relative to alternative 1A, the sub-alternatives under alternative 1B may afford vary levels of positive impacts to protected species, with the level of positive impacts be greatest for alternative 1B-1 (eliminates the most permits), followed by alternative 1B-2, and so on in numerical order through alternative 1B-7 (which eliminates the least amount of permits). Based on this and the information provided above, relative Alternative 1A, the impacts of Alternative 1B and its sub-alternative on protected species are likely to range from neutral to moderately positive.

9.1.5 Impacts to Human Communities

Alternatives for federal moratorium permit qualifications may have an impact on human communities by impacting permit holders (both those who requalify and those who do not under various alternatives), as well as their fishing communities and ports, including associated fishing businesses.

As described above, overall summer flounder landings will still be constrained by the annual commercial quotas, which should remain the primary driving factor for overall fishery effort in a given year. Requalification of moratorium permits under alternative 1B would result in a smaller pool of vessels eligible to participate in the fishery. However, most eliminated MRIs under each sub-alternative under 1B are associated with little (or no) activity for summer flounder in recent years; therefore, the overall near-term impacts of reducing permit capacity under alternative 1B are likely to be small, as described below.

9.1.5.1 Alternative 1A: No Action/Status Quo

The no action/*status quo* alternative 1A would make no changes to the current pool of eligible vessels or permitting requirements. This alternative is associated with the highest number of summer flounder permits remaining eligible (940 MRIs currently exist for summer flounder, meaning 940 summer flounder moratorium permits are currently eligible to be issued). The magnitude and direction of impacts of alternative 1A to individual vessels depends on the potential for latent effort to re-enter the fishery, which is difficult to predict; thus, the impacts are presented as a range of possible outcomes.

If conditions remain similar to the past few years in terms of fishery participation (which can be influenced by factors such as overall quota levels, market factors, restrictions in other fisheries, or broader economic factors, among other things) then the distribution of effort among vessels will remain similar to the current distribution. In this case, alternative 1A would have minimal impacts (positive or negative) to human communities, as this alternative would not change revenues or other socioeconomic metrics for fishery participants and their communities.

If conditions change and inactive or low activity permits increase their landings of summer flounder (as the result of constraints in other fisheries, quota reallocation through this action, market factors, etc.), some permit holders that are currently active in the fishery may experience negative socioeconomic impacts as the result of limited quotas being further spread among participants. The fishing communities associated with these permit holders also could experience negative impacts. The magnitude of these effects would depend on the degree of re-entry to the fishery and how active the formerly latent vessels become, which is difficult to predict.

If many latent vessels re-enter the fishery and/or these vessels begin landing substantial amounts of summer flounder, more restrictive management measures would likely be necessary for all summer flounder vessels to ensure that quotas are not exceeded. Because there are several hundred inactive or mostly inactive federal permits (Table 37; Table 38), the capacity for summer flounder landings from these vessels is theoretically large, however, the likelihood of a large proportion of these vessels becoming active in the fishery is uncertain and probably low.

Slight positive socioeconomic impacts are possible under alternative 1A for those current permit holders with low or no activity, as these vessels would retain the flexibility to target summer flounder in the future and may increase their revenues from summer flounder if that flexibility was utilized. Some of these benefits may be limited if an influx of effort results in tighter management measures. Under a scenario where latent effort does re-enter the fishery, socioeconomic impacts at the vessel level would likely range from slight positive (for inactive/low activity permit holders who choose to re-enter the fishery) to slight negative (to all currently active summer flounder permit holders and communities if there is a notable influx of latent effort).

Quota reallocation options under alternative set 2 may influence the degree of re-entry to the fishery and associated distributional impacts. Under a revised state-by-state allocation system, whether latent permit holders re-enter the fishery may be driven by how their state allocation and resulting measures change. Participants in some states that have been inactive in recent years may be incentivized to target summer flounder if their state's quota is increased. Under a scup model system (alternative 2D-1 or 2D-2), the winter quota periods would have no state-level measures or quotas. Under this scenario, latent permits (especially those associated with vessels capable of fishing offshore in the winter) may re-enter the fishery if coast-wide winter period measures are appealing enough compared to their particular state measures in recent years.

Overall, the impacts of alternative 1A to the fishery as a whole are likely to be negligible, but for individual participants and communities could range from slight negative to slight positive. An influx of effort is theoretically possible under alternative 1A, resulting in an increase in revenue for some vessels and a decrease in revenue for others. The efficiency of the vessels entering the fishery would have to be compared against those already active in the fishery to quantify the precise economic impacts. Under alternative 1A there may be no changes to current conditions (and therefore no impacts to human communities). Alternatively, there could be slight positive impacts (for permit holders exercising flexibility to fish for summer flounder) and slight negative socioeconomic impacts (due to effort being spread among more participants).

Compared to alternative 1B, alternative 1A is expected to have slightly less negative socioeconomic impacts on low/no activity permit holders and their associated fishing businesses (although the impacts of all alternatives are expected to be small). Similarly, alternative 1A would have less positive impacts to active participants in the fishery compared to 1B, since alternative 1A would not prevent federal latent effort from re-entering the fishery.

9.1.5.2 Alternative 1B: Requalification of Existing Federal Moratorium Permits

Alternative 1B would reduce the number of eligible federal summer flounder moratorium permits, to varying degrees depending on the sub-alternative selected. Under each sub-alternative for permit requalification, impacts to human communities will depend primarily on how many permits are eliminated and how active these permits have been in recent years.

The fishery will still be constrained by annual catch and landings limits, therefore, overall fishery effort in a given year would not be expected to be heavily impacted by any of the 1B sub-alternatives. Summer flounder is a high demand species and it is likely that utilization rates will remain high. Therefore, a reduction in permit capacity is not likely to drive landings each year but will impact the pool of vessels that are eligible to participate in the fishery. Alternative 1B may impact the distribution of effort depending on how active eliminated permits have been or would be in the future.

Impacts to human communities from alternative 1B could include near-term economic impacts through elimination of current effort and opportunity, as well as longer-term economic impacts resulting from reduced potential for latent effort to re-enter the fishery.

Direct near-term, and possibly long-term, negative economic impacts may occur to non-requalifying permit holders that have landed some summer flounder in recent years, and their associated communities. Near-term negative economic impacts would not be expected for permits that are completely inactive, as these vessels are not currently generating any revenue from summer flounder. For permit holders that requalify, near-term and long-term positive economic impacts are possible since overall effort may be spread among a smaller pool of vessels, possibly leading to higher revenues for some vessels.

The magnitude of economic impacts to vessels that requalify and those that do not would depend on a) how many permits are eliminated and b) how active those eliminated permits have been in recent years (i.e., how much landings and revenue they have generated). The more summer flounder landings and revenues that are associated with each group of eliminated permits under each sub-alternative, the larger the distributional impacts will be. Impacts will also depend on what other species eliminated vessels are able to fish for and how dependent are they on summer flounder, with vessels that are more dependent on summer flounder experiencing more negative impacts. Due to the low landings evident in recent years across many eliminated MRIs, it is likely that most eliminated vessels are not heavily dependent on summer flounder.

Table 37 describes the number of eliminated MRIs under each sub-alternative along with their associated landings and revenues over the 5-year time period of August 1, 2009 through July 31, 2014.[34] Over this time period, all eliminated MRIs under these alternatives are associated with very little or no summer flounder landings in recent years (ranging from 0 to 131,302 total lbs for all eliminated permit holders over this time period, or 0% to 0.32% of coastwide landings).

Table 38 shows the same analysis over the fishing years 2013-2017. Over these years, eliminated MRIs under these alternatives are associated with slightly higher summer flounder landings and revenues, though they are still a relatively small portion of coastwide landings and revenues (ranging from 0.14% to 3.04% of landings and from 0.18% to 3.19% of revenues). This appears to indicate that there was a small influx of effort for summer flounder after the publication of the control date on August 1, 2014.

According to this analysis, even though a substantial portion of summer flounder permits may be eliminated under some alternatives (ranging from 25% to 55% of current MRIs), the overall portion of summer flounder landings and revenues that would be eliminated under any 1B sub-alternative is relatively low and is spread among a few hundred vessels. This indicates that the magnitude of overall impacts is likely to be low, although impacts may vary at the vessel level based on each vessel's recent activity. Near-term positive (for remaining permit holders) or negative economic impacts (for eliminated permit holders) are in general likely to be small or negligible, though some vessels eliminated from the fishery may experience moderate negative impacts if they have recently invested in this fishery or increased effort for summer flounder.

[34] Although this period is the requalification time frame for only alternatives 1B-1 and 1B-2, it was used in evaluating all sub-alternatives in order to allow comparison between each option.

Most vessels with eliminated permits would not see a substantial reduction in revenues given that most vessels are landing very small amounts of summer flounder on average and are very unlikely to be highly dependent on the summer flounder fishery. Remaining vessels are unlikely to see a substantial near-term economic benefit from reduced permit capacity in the fishery.

Table 37: Comparison of impacts of sub-alternatives under Alternative 1B, in terms of associated number of moratorium rights eliminated, with associated landings and revenues between August 1, 2009 and July 31, 2014. Landings thresholds under each sub-alternative refer to commercial landings of summer flounder associated with each MRI.

Sub-alternative under 1B	Time Period	Landings Threshold	# MRIs Eliminated (%)	Combined landings (lb) from eliminated MRIs, 8/1/09-7/31/14	% of coastwide summer flounder landings, 8/1/09-7/31/14	Combined ex-vessel revenue 8/1/09-7/31/14	% of coastwide summer flounder revenue, 8/1/09-7/31/14
1B-1	8/1/09-7/31/14 (5 yrs)	≥1,000 pounds cumulative	516 (55%)	24,529	0.04%	$54,395	0.05%
1B-2	8/1/09-7/31/14 (5 yrs)	At least 1 pound in any year	448 (48%)	0	0.00%	$0	0.00%
1B-3	8/1/04-7/31/14 (10 yrs)	≥1,000 pounds cumulative	389 (41%)	5,713	0.01%	$10,980	0.01%
1B-4	8/1/04-7/31/14 (10 yrs)	At least 1 pound in any year	306 (33%)	0	0.00%	$0	0%
1B-5	8/1/99-7/31/14 (15 yrs)	≥1,000 pounds cumulative	295 (31%)	2,896	0.01%	$7,016	0.01%
1B-6	8/1/94-7/31/14 (20 yrs)	At least 1 pound in 20% of years (i.e., in at least 4 years over this 20-year period)	271 (29%)	181,302	0.32%	$326,034	0.28%
1B-7	8/1/94-7/31/14 (20 yrs)	≥1,000 pounds cumulative	233 (25%)	2,414	0.00%	$5,619	0.00%

Table 38: Comparison of impacts of sub-alternatives under Alternative 1B, in terms of associated number of moratorium rights eliminated, with associated landings and revenues between January 1, 2013 and December 31, 2017. Landings thresholds under each sub-alternative refer to commercial landings of summer flounder associated with each MRI.

Sub-alternative under 1B	Time Period	Landings Threshold	# MRIs Eliminated (%)	Combined landings (lb) from eliminated MRIs, 1/1/13-12/31/17	% of coastwide summer flounder landings, 1/1/13-12/31/17	Combined ex-vessel revenue 1/1/13-12/31/17	% of coastwide summer flounder revenue, 1/1/13-12/31/17
1B-1	8/1/09-7/31/14 (5 yrs)	≥1,000 pounds cumulative	516 (55%)	1,083,694	3.04%	$3,540,052	3.19%
1B-2	8/1/09-7/31/14 (5 yrs)	At least 1 pound in any year	448 (48%)	663,985	1.86%	$2,326,859	2.1%
1B-3	8/1/04-7/31/14 (10 yrs)	≥1,000 pounds cumulative	389 (41%)	503,356	1.41%	$1,613,440	1.46%
1B-4	8/1/04-7/31/14 (10 yrs)	At least 1 pound in any year	306 (33%)	334,151	0.94%	$1,117,053	1.01%
1B-5	8/1/99-7/31/14 (15 yrs)	≥1,000 pounds cumulative	295 (31%)	109,573	0.31%	$393,944	0.36%
1B-6	8/1/94-7/31/14 (20 yrs)	At least 1 pound in 20% of years (i.e., in at least 4 years over this 20-year period)	271 (29%)	290,894	0.81%	$946,917	0.85%
1B-7	8/1/94-7/31/14 (20 yrs)	≥1,000 pounds cumulative	233 (25%)	48,464	0.14%	$204,436	0.18%

In addition to the near-term impacts of a reduced pool of participants, sub-alternatives under alternative 1B would also lead to reduced potential for future expansion of latent effort. As described above under alternative 1A, broader management or economic conditions could drive latent permit holders to re-enter the fishery for summer flounder (e.g., restrictions in other fisheries, quota reallocation, market conditions, etc.) if they are still permitted. The sub-alternatives under alternative 1B would prevent re-entry to a degree, and/or would reverse some of the re-entry that appears to have occurred since publication of the control date. The reduced potential for latent effort would have positive economic impacts on remaining vessels, and possibly on their communities depending on the community's characteristics, by reducing the likelihood of needing to spread quota between a larger number of vessels, and reducing uncertainty about whether measures would need to be restricted due to an influx of latent effort. Permit holders with eliminated summer flounder permits could experience negative economic impacts due to not having the opportunity to target summer flounder in the future. Some fishing communities may experience mixed impacts from these alternatives, depending on their associated permit holders and how many requalify.

It is worth noting that this alternative has no impact on state level permits. Re-entry of latent effort would still be possible in state waters under this alternative (in some states, depending on current and future state-level restrictions), confounding the impacts of reductions in federal permit capacity.

Analysis of the number of MRIs eliminated (including permits in CPH) by state was also conducted for each sub-alternative (Table 39). The "home port" of a vessel as indicated by the owner on the official U.S. Coast Guard documentation was used to associate an approximate number of MRIs with each state, to describe general possible impacts by state. However, home port does not necessarily reveal where these vessels typically land, as some vessels are permitted to land in multiple states. A small number of permits that would be eliminated under alternative 1B identify their home port in states that are outside the management unit (i.e., Texas and Florida).

Among the states with affected permits, some states have more eliminated permits than others. In terms of home port states that stand to lose the most summer flounder MRIs under Alternative 1B, Massachusetts ranks highest for all sub-alternatives. For Massachusetts, the percentage of their MRIs eliminated under each sub-alternative ranges from 38% to 77%, indicating that there are many inactive federal permits associated with a Massachusetts home port. New Jersey ranks second highest in terms of eliminated MRIs under most sub-alternatives. All states stand to lose significantly more MRIs with a shorter qualification period (sub-alternatives 1B-1 and 1B-2), and when looking at a longer qualification period (sub-alternatives 1B-6 and 1B-7), the clear majority of MRIs not requalifying are in the northern region of the fishery (Table 39). Although some states would have a high proportion of permits eliminated under some sub-alternatives, it is important to remember that the previously described analysis of recent effort indicates that individual eliminated permits are mostly associated with little or no summer flounder landings in recent years, with cumulative landings over several hundred vessels under all options making up a small percentage of coastwide landings. Thus, despite having a high number or proportion of eliminated permits on paper for some states, the actual socioeconomic impact on those states is expected to be fairly small.

Table 39: Number of MRIs requalifying (REQ.) and eliminated (ELIM.) under each 1B sub-alternative by state of home port. C= Confidential.

	1B-1		1B-2		1B-3		1B-4		1B-5		1B-6		1B-7	
Home port state	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**	**REQ.**	**ELIM.**
ME	3	39	3	39	9	33	14	28	19	23	22	20	23	19
NH	C	14	C	13	C	13	6	C	4	11	6	C	5	10
MA	83	276	106	253	142	217	180	179	187	172	203	156	223	136
RI	76	12	76	12	81	C	83	5	83	C	81	7	83	C
CT	15	C	17	7	16	8	18	6	17	C	14	10	19	C
NY	55	35	62	28	62	28	66	24	67	23	69	21	68	22
NJ	94	74	117	51	122	46	142	26	139	29	141	27	146	22
PA	C	C	3	C	C	C	C	C	C	C	C	C	C	C
DE	0	C	0	C	0	C	0	C	0	C	0	C	0	C
MD	C	C	C	C	4	C	5	0	4	C	4	C	4	C
VA	23	32	30	25	33	22	38	C	41	14	45	10	48	C
NC	69	17	72	14	78	8	79	7	81	5	80	6	84	C
FL	0	C	0	C	0	C	0	C	0	C	C	C	C	C
TX	C	0	C	0	C	0	C	0	C	0	C	0	C	0

Overall, impacts from the sub-alternatives under 1B are expected to vary by individual permit holder and by fishing community, depending on the degree of activity of eliminated vessels and the extent to which each sub-alternative prevents re-entry of latent effort into the fishery. The socioeconomic impacts of each sub-alternative under 1B at the vessel level is likely to range from slight positive (for remaining permit holders and their communities due to the reduced potential for re-entry of latent effort) to moderate negative (for eliminated permit holders, due to likely small to moderate losses in revenues as well as lost flexibility to fish for summer flounder in the future).

Among the sub-alternatives considered, the magnitude of expected impacts at the vessel level is likely to vary slightly between each sub-alternative in the short-term based on the analysis of 2013-2017 landings and revenues shown in Table 38. As a percentage of overall coastwide landings and revenues, the highest magnitude of negative impacts (to eliminated permit holders) and positive impacts (to remaining permit holders) are likely to occur from alternative 1B-1 due to having the highest associated landings and revenues for summer flounder, followed in order by alternative 1B-2, 1B-3, 1B-4, 1B-6, 1B-5, and 1B-7 (Table 38). Again, these impacts are likely to be overall small, but would be expected to vary more at the individual vessel level.

Compared to alternative 1A, alternative 1B and its sub-alternatives are expected to have moderately more adverse socioeconomic impacts on eliminated individual permit holders and their associated fishing businesses (although the impacts of all alternatives are expected to be small). Similarly, alternative 1A would have fewer positive impacts to active participants in the fishery compared to 1B, since alternative 1A would not prevent federal latent effort from re-entering the fishery.

Summary of Impacts of Alternative Set 1

Because overall fishery effort is not expected to be heavily influenced by these alternatives, and catch and landings will remain driven by annual limits, each alternative should have no impacts to minor impacts on the summer flounder stock, non-target species, habitat, or protected resources compared to their current condition as described in the sections above. This results in moderate positive impacts to the summer flounder stock and non-target species, indirect slight negative impacts to habitat, and slight negative to slight positive impacts to protected resources under all alternatives. Impacts of sub-alternatives under 1B will be primarily socioeconomic impacts to individual permit holders and fishing communities However, given the small magnitude of recent summer flounder landings and revenues from eliminated permits under requalification alternatives, the short-term impacts of these alternatives are likely to be small overall. There is some uncertainty associated with the long-term socioeconomic impacts depending on the realistic potential for latent effort to re-enter the fishery, as described above. A summary of impacts to each VEC is provided in Table 40.

Table 40: Summary of impacts of Alternative Set 1: requalification of existing commercial moratorium permits.

Alt.	Description	Expected Impacts				
		Summer flounder	*Non-target species*	*Habitat*	*Protected Resources*	*Human communities*[a]
1A	No action/*status quo*	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact if conditions remain similar; slight - if incentives to re-enter fishery change; slight + to latent permit holders due to flexibility
1B-1	Requalify at ≥1,000 pounds cumulatively over 8/1/09-7/31/14 (5 yrs)	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-2	Requalify at ≥1 pound in any year from 8/1/09-7/31/14 (5 yrs)	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-3	Requalify at ≥1,000 pounds cumulatively over 8/1/04-7/31/14 (10 yrs)	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-4	Requalify at ≥1 pound of summer flounder in any one year from 8/1/04-7/31/14 (10 yrs).	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-5	Requalify at ≥1,000 pounds cumulatively over 8/1/99-7/31/14 (15 yrs)	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-6	Requalify at ≥1 lb in 20% of years 8/1/94-7/31/14 (20 yrs; i.e., at least 1 lb of landings is required in any 4 years over this time period).	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)
1B-7	Requalify at ≥1,000 pounds cumulatively over 8/1/94-7/31/14 (20 yrs).	Moderate +	Moderate +	Indirect slight negative	Slight - to slight +	No impact to moderate - (for eliminated permit holders), no impact to slight + (for remaining permit holders)

[a] All impacts to human communities are uncertain and likely mixed depending on the stakeholder/community affected, as described above

9.2 IMPACTS OF ALTERNATIVE SET 2: COMMERCIAL QUOTA ALLOCATION

This alternative set contains options for reallocation of the annual commercial quota for summer flounder. The allocation alternatives are fully described in section 4.2.2 and briefly recapped here.

Alternative 2A (no action/*status quo*) would make no changes to the current commercial allocations established on the basis of 1980-1989 landings history (section 4.2.2).

Alternative 2B (Adjust State Quotas Based on Recent Biomass Distribution) would modify state-by-state allocations by accounting for a shift in relative exploitable biomass by region between 1980-1989 and 2007-2016. There are two sub-options for calculating the change in relative exploitable biomass and applying this change to revised allocations. Both options would shift allocation from the Southern region (states of New Jersey through North Carolina) to the Northern region (states of New York through Maine).

Alternative 2C (Revise State Allocations above a Commercial Quota Trigger Point) would create state allocations that vary with overall stock abundance and resulting commercial quotas. For all years when the annual commercial quota is at or below a specified annual commercial quota trigger level, the state allocations would remain *status quo*. In years when the annual coastwide quota exceeded the specified trigger, the trigger amount would be distributed according to *status quo* allocations, and the additional quota beyond that trigger would be distributed by equal shares (with the exception of Maine, New Hampshire, and Delaware, which would split 1% of the additional quota). Alternative 2C has two sub-alternatives for different annual coastwide quota triggers.

Alternative 2D ("Scup Model" Quota System for Summer Flounder) would allocate quota into three unequal seasonal periods, as is done for scup. During the two winter periods, January-April ("Winter I") and November-December ("Winter II"), a coastwide quota system would be implemented in conjunction with a system of coastwide possession limits and other measures. In a "Summer" period, May-October, a state-by-state quota system would be implemented by the Commission, and state-specific measures would be set to constrain landings to the summer period state quotas. Alternative 2D has two sub-alternatives for exempting or not exempting the state of Maryland from this allocation system.

The quota reallocation alternatives under alternative set 2 are not expected to impact overall fishing effort in terms of annual catch and landings (i.e., total removals of summer flounder from the commercial fishery), which will remain driven by annual catch and landings limits. The allocation alternatives will primarily affect access to the resource at the state/and or individual fishing vessel level within the management unit, depending on the allocation option selected. This could result in a somewhat modified distribution of fishing effort in space and time, as described below, and is expected to modify the distribution of landings (and thus revenues) by state and port. Changes in access to summer flounder quota could also impact effort in terms of the total number and duration of trips and hauls for summer flounder if modified allocations result in a change in participation in the fishery terms of vessel sizes or gear types; however, in general the fishery is expected to remain dominated by trawl gear.

Changes in the distribution of effort as the result of reallocation are generally difficult to predict, as effort is influenced by many factors. Characteristics of the commercial fishery, including seasonal effort, spatial effort, gear types used, and landings by state are described in section 1.3 of the Affected Environment in this document. From these descriptions, some general patterns of fishing effort can be described to provide a basis for predicting the general range of impacts of each reallocation alternative. In general, the commercial fishery for summer flounder varies seasonally and by region, with larger trawl vessels generally fishing offshore on the continental shelf in the winter months (approximately late October through April) and with summer effort (approximately May through early October) taking place primarily in state waters (0-3 miles from shore), corresponding with the seasonal inshore-offshore migrations of summer flounder (see section 1.2.6.) As described in section 1.3, during November-April, over 75% of the landings are estimated to originate from federal waters. May, September, and October see a more balanced mix of federal and state waters harvest, while June-August harvest occurs mostly in state waters. In the summer, more of the fishery is prosecuted in state waters with smaller vessels using a wider variety of gear types. While bottom trawls are still the dominant gear type in the summer, other gear types, such as hand lines, gill nets, and other gear types are more commonly used compared to the winter fishery. Larger vessels (classified as vessels 51 tons or larger) are dominant in the winter offshore fishery, while during the spring and early fall, more of a mix of small and larger vessels participate. By state, the commercial fisheries in Virginia and North Carolina are clearly dominated by large trawl vessels fishing offshore in the winter. Other states have more of a mix of gear types, vessel sizes, and dominant months of commercial summer flounder effort (see section 1.3).

As the result of reallocation alternatives in this document, some location and/or timing of commercial summer flounder effort could change, which could affect each VEC, although the magnitude and direction of impacts are difficult to predict. Offshore winter fishing effort is not expected to change substantially in terms of location, as the larger vessels that typically participate in this season have historically been more mobile vessels that target prime summer flounder fishing locations offshore even when long steam times are required to do so. For this fleet, footprints of fishing effort do not necessarily closely correlate with distance from state of landing. The locations of offshore fishing effort are thus unlikely to change substantially under reallocation alternatives.

Nearshore effort observed mainly in the summer months (prosecuted by a variety of vessel types with more representation from smaller day boats) may see a small to moderate shift in location under some reallocation alternatives, as discussed below; however, the extent to which this may occur is difficult to predict and would depend on other factors such as management response to increased or decreased quotas. It is also possible that there could be a shift in the balance of offshore winter vs. inshore summer effort under some reallocation alternatives, due to changes in the allocation for states that are dominant in the winter fishery. These possibilities are explored further below.

Because the overall catch will remain driven by annual catch limits, reallocation alternatives in general are not expected to affect the stock status of summer flounder, leading to positive overall impacts on the target resource. For non-target species and protected resources, the possible changes in distribution of fishing effort could lead to changes in interaction rates that may influence stock status, although these effects are highly uncertain, as discussed below. For habitat, any effort shifts resulting from reallocation are not expected to change the overall footprint of fishing effort for summer flounder, over which fishing effort for many species has taken place for many years. However, continued fishing effort within this footprint will prevent recovery of any degraded habitats within this area. For human communities, this action is expected to have socioeconomic impacts that would vary by state and by individual participants and their communities, based on changes in the distribution of access and revenues from the resource.

9.2.1 Impacts to the Target Stock

9.2.1.1 Alternative 2A: No Action/Status Quo

Alternative 2A would maintain current quota allocations described in Table 18 (section 4.2.2). This is expected to result in moderate positive impacts to the summer flounder stock, since the fishery would continue to be managed to prevent overfishing and to prevent the stock from becoming overfished. The summer flounder stock will continue to be managed under ACLs and AMs as required by the MSA, with the commercial fishery managed under an annual commercial quota derived from the commercial ACL and based on the best scientific information available. Alternative 2A does not modify the current allocation and thus would not be expected to cause changes in the distribution of effort or participation in the fishery.

When compared to alternatives 2B-2C and its sub-alternatives, alternative 2A is expected to result in a similar magnitude of moderate positive impacts. None of these alternatives are expected to change the overall level of effort in the fishery, which will continue to be constrained by ACLs and the annual commercial quota. The changes in commercial allocation under alternatives 2B, 2C, and 2D are expected to result in changes in the distribution of effort and participation by state and individual fishing vessels, however, these changes are not expected to result in biological effects on the summer flounder stock that would modify stock status, as described below. Therefore, the positive impacts to summer flounder from both alternatives are not expected to meaningfully differ in their magnitude.

9.2.1.2 Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution

Alternative 2B, under either of its sub-alternatives 2B-1 and 2B-2, would shift quota allocation from the Southern region of the management unit (North Carolina through New Jersey) to the Northern region (New York through Maine). Under alternative 2B-1, the total amount of allocation shifted from the South to the North would be 6% (with Northern states increasing their relative allocations by 19% and southern states decreasing their relative allocations by 9%), while under 2B-2, allocation shifted to the North from the South would 13% of the coastwide allocation (with the Northern states increasing their allocations by 40% and the Southern states decreasing theirs by 19%). This alternative would thus increase access to the fishery for vessels in Northern states, possibly leading to changes in effort distribution. Any changes in fishery effort would depend on the characteristics of each state's fishery and how management responded to increased or decreased quotas, as well as additional external factors that may drive regional effort fluctuations, like local market conditions.

Although changes in the distribution of fishing effort by state and by fishing vessel may occur under alternatives 2B-1 and 2B-2, this is not expected to affect the biological characteristics of the summer flounder stock in a way that would impact overall stock status. Summer flounder is managed and assessed as a single unit stock, and there is currently no evidence to suggest that relatively small to moderate scale changes in the location of fishing effort would impact stock status, if overall effort in the fishery remains constrained. As described above, it is possible that under both alternatives 2B-1 and 2B-2 that effort may shift toward Northern states, especially nearshore effort. It is likely that the location of offshore effort will remain similar to current condition, for reasons described in the beginning of section 9.2. It is possible that a slight shift in the balance between winter offshore fishing and summer inshore fishing may occur, with slightly more effort possibly shifting to nearshore areas, although this is difficult to predict and depends on each state's future management measures. Any such shift is likely to be small in magnitude. Virginia and North Carolina (which mostly participate in the winter fishery) will still remain dominant players during the winter months under alternatives 2B-1 and 2B-2. In addition, increased allocation in the North may result in larger Northern vessels increasing their offshore fishery participation to counter any decreases in North Carolina and Virginia offshore effort. Any shifts in fishing effort as the result of reallocation are unlikely to have a meaningful biological impact on the stock.

Shifts in timing of fishing effort are also difficult to predict. Most states spread their fishing effort throughout the year using open and closed seasons along with other management measures. Shifts in timing of fishing effort under alternatives 2B-1 and 2B-2 could occur, but would depend on management responses to modified allocations and would vary by state. The timing of fishing effort can also vary based on market factors such as price, and may vary from year to year, so the effect of these alternatives on timing is highly uncertain.

Overall, alternatives 2B-1 and 2B-2 are expected to have moderate positive impacts on the summer flounder resource, as they will work within the existing management framework that aims to prevent negative biological impacts to the stock. All states, regardless of an allocation increase or decrease, will still be required to set management measures to control effort and landings within their revised allocation. Accountability measures will still be in place, including a landings-based accountability system at the state level, and overall catch-based accountability evaluated annually.

Compared to other alternatives in alternative set 2, alternatives 2B-1 and 2B-2 are likely to have a similar magnitude of moderate positive impacts to the summer flounder stock. All alternatives maintain the current management to the annual catch and landings limits, which is designed to prevent overfishing and prevent the stock from becoming overfished. There is not expected to be a notable difference in the biological outcomes between alternative 2B-1 and 2B-2.

9.2.1.3 Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

Similar to alternatives 2A and 2B, alternative 2C is not expected to impact the overall removals of summer flounder from the commercial fishery, but would impact the distribution of effort among states in years when the annual commercial quota is above a certain trigger. The effects of this redistribution would differ from those of alternative 2B, in that there is not a broader North/South pattern of increased/decreased allocation. Instead, some states receive increased allocations under increasing quotas, and some states lose a portion of their allocation under increasing quotas.

As summarized in section 4.2.2, the state allocations would vary as the annual commercial quota grows beyond the specified trigger. For quotas up to the trigger point, allocations remain *status quo*. As the annual commercial quota level grows beyond the quota trigger, the state quota allocation percentages get closer together, i.e., with increasing quotas above the trigger, quota is distributed more evenly among the states (see Figure 34 and Figure 35; section 4.2.2).

The only difference between alternative 2C-1 and 2C-2 is that alternative 2C-1 specifies an 8.40 million pound trigger, while 2C-2 specifies a 10.71 million pound trigger, which impacts how often future quotas would exceed the trigger. Table 21 and Figure 33 in section 4.2.2 indicate that for alternative 2C-1, historically between 1993-2018, the 8.40 million pound trigger has been exceeded in 22 of 26 of these years, while for alternative 2C-2, the trigger has been exceeded in 17 of 26 of these years. It would thus be expected that in at least some future years, the quota would be redistributed slightly compared to *status quo* allocations.

In years where the quota was at or below the trigger amount, there would be no allocation changes and impacts would be identical to those described under alternative 2A (no action/*status* quo). As annual quotas grow beyond the quota trigger, the allocation for the states of Rhode Island, New Jersey, Virginia, and North Carolina (states that currently have less than 12.375% of the coastwide allocation) decreases, and the allocation for all other states increases. As with alternative 2B, the small to moderate shifts in allocation under annual quotas exceeding the trigger are not expected to affect the biological characteristics of the summer flounder stock in a way that would impact overall stock status, since summer flounder is managed and assessed as a single unit stock and overall catch in the fishery will remain constrained by the ACL. Any shifts in allocation away from the states of Rhode Island, New Jersey, Virginia and North Carolina are small to moderate and would likely not occur every year, and would not have a substantial impact on the health of the overall summer flounder population.

Overall, as with alternative 2B, alternatives 2C-1 and 2C-2 are expected to have moderate positive impacts on the summer flounder resource, as they will work within the existing management framework that aims to prevent negative biological impacts to the stock. All states will still be required to control effort and landings within their revised allocation. Accountability measures will still be in place, including a landings-based accountability system at the state level, and overall catch-based accountability evaluated annually.

Compared to other alternatives in alternative set 2, alternatives 2C-1 and 2C-2 are likely to have a similar magnitude of moderate positive impacts to the summer flounder stock. All alternatives maintain the current management to the annual catch and landings limits, which is designed to prevent overfishing and prevent the stock from becoming overfished. Although alternative 2C-1 would result in modified allocations more often than alternative 2C-2, there is not expected to be a notable difference in the biological outcomes between these sub-alternatives.

9.2.1.4 Alternative 2D: Implement "Scup Model" Quota System for Summer Flounder

Under alternative 2D, the same annual catch and landings limits and accountability measures as discussed above would remain in place to constrain summer flounder removals. This is expected to result in the same impacts as described for alternatives 2A-2C; moderate positive impacts on the stock, for similar reasons as described above. Alternatives 2D-1 and 2D-2 are not expected to result in the summer flounder stock becoming overfished.

The difference between alternatives 2D-1 and 2D-2 is that 2D-1 exempts the state of Maryland, while 2D-2 does not. This very slightly modifies the seasonal quota period allocations and the state summer quota periods as described in section 4.2.3. Because Maryland has a relatively small fishery (about seven vessels directing on summer flounder) and a relatively small percent of the current quota allocation (about 2%), the practical differences between these alternatives with regard to their impact on the summer flounder resource is expected to be negligible. In either case, the state of Maryland, like other states, will still be required to implement measures that constrain effort and harvest to the appropriate levels. Thus, alternatives 2D-1 and 2D-2 are expected to have the same magnitude of moderate positive impacts on the summer flounder resource.

While overall catch and landings will still be driven by annual catch and landings limits and associated measures, among all commercial allocation alternatives, the effects of alternative 2D on effort and participation are the most difficult to predict. Alternatives 2D-1 and 2D-2 would open the winter months (January-April and November-December) to any properly permitted summer flounder vessel, under consistent coastwide management measures. While possession limits, fishery closures triggers, and other mechanisms would be put in place to control harvest throughout the winter periods and constrain landings to the period quotas, there is some management uncertainty associated with the expected level of participation in these seasonal fisheries and with what specific management restrictions would be necessary to effectively manage commercial harvest during these periods.

It is difficult to predict whether and how latent effort may re-enter the fishery if there were fewer constraints on participation in the winter. Depending on current state level restrictions that may be preventing some vessels from targeting summer flounder, the scup model allocation system may result in increased participation. In addition, under current state management, not every vessel is able to fish at the same times of the year due to state level seasonal restrictions, but under alternative 2D, there is more likely to be many vessels participating at once. Depending on the coastwide management measures selected (possession limits, closure triggers, etc.), managers may experience some difficulty in constraining effort and landings, especially in the first few years of implementation. It is uncertain how this alternative would impact summer flounder discards, but if winter open seasons for summer flounder close quickly due to a high volume of activity, it is possible that this alternative could lead to increased discarding relative to the other allocation alternatives. Thus, while overall, alternatives 2D-1 and 2D-2 are expected to have moderate positive impacts on summer flounder, these alternatives are likely to have slightly less positive impacts compared to alternatives 2A, 2B-1, 2B-2, 2C-1, and 2C-2 due to the introduction of additional management uncertainty and the possible increased difficulty in controlling catch and landings under this alternative.

9.2.2 Impacts to Non-Target Species

Primary non-target species identified for the commercial summer flounder trawl fishery, as described in section 1.3.4, are several species of skate, spiny dogfish, Northern sea robin, black sea bass, and scup. Non-target species could be affected by the alternatives for reallocation if these alternatives were expected to change rates of interaction with the summer flounder fishery in a manner that would influence the stock status or the biological sustainability of non-target species, although the likelihood of this occurring is highly uncertain.

Commercial allocation alternatives, as described above, are not expected to influence overall coastwide effort, however, there is the possibility that alternatives 2B, 2C, and 2D could affect spatial and temporal effort trends within this overall effort. Changes in participation resulting from reallocation could also influence the number of total annual trips and hauls for summer flounder, if the composition of gear types and/or vessel sizes changed substantially, although it is highly uncertain to what extent this would occur, if at all. Overall, the fishery is highly likely to remain dominated by trawl vessels, with mesh size restrictions that are unlikely to change substantially. The potential impacts of each alternative depend on each non-target species' existing stock status and how likely reallocation alternatives are to change that status. Impacts to non-target species from commercial allocation alternatives are expected to range from slight negative to moderate positive, depending on the alternative and the non-target species, as described below.

9.2.2.1 Alternative 2A: No Action/Status Quo

As described in section 9.2.1, alternative 2A would make no changes to the current allocations. As with impacts to summer flounder, this alternative would result in moderate positive impacts to non-target species that currently have a positive stock condition, since this alternative would contribute to maintaining that positive stock status.

The stock conditions of non-target species relevant to this action are described in Table 35. With the exception of thorny skate (overfished status) and Northern sea robin (status unknown), none of the non-target species are experiencing overfishing or are currently overfished. Most of these fisheries (with the exception of sea robin) are currently managed by the MAFMC or NEFMC. These fisheries would continue to be managed to prevent overfishing and to prevent the stock from becoming overfished under the requirements of the MSA, based on the best scientific information available. Incidental dead catch of MSA managed species is accounted for through the setting and monitoring of ACLs and AMs.

Alternative 2A would result in no reallocation and therefore no resulting changes in effort or changes in the prosecution of the fishery. Thus, impacts to non-target species from this alternative are expected to be overall moderate positive as they would maintain the positive stock status of most relevant non-target species. For species with unknown or overfished (thorny skate) stock status, alternative 2A would be expected to slight negative to no impacts, as it would be expected to maintain the current overfished or unknown stock status for these species. Given the condition of most non-target species, overall, alternative 1A would result in moderate positive impacts for non-target species.

As described below, the impacts of alternatives 2B-1, 2B-2, 2C-1, 2C-2, 2D-1, and 2D-2, are more uncertain relative to non-target species. As such, there is some uncertainty when comparing alternative 2A to other allocation alternatives. If the other allocation alternatives did not shift effort or change the prosecution of the fishery, alternative 2A would have the same magnitude of moderate positive impacts on non-target species. If the other allocation alternatives modified effort in a manner that negatively impacted non-target species, as discussed below, then alternative 2A would have more positive impacts on non-target species compared to other alternatives.

9.2.2.2 Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution

As described in section 9.2.1.2, alternative 2B, under either of its sub-alternatives 2B-1 and 2B-2, would shift quota allocation from the Southern region of the management unit (North Carolina through New Jersey) to the Northern region (New York through Maine). Under alternative 2B-1, the total amount of allocation shifted from the South to the North would be 6% (with Northern states increasing their relative allocations by 19% and southern states decreasing their relative allocations by 9%), while under 2B-2, allocation shifted to the North from the South would 13% of the coastwide allocation (with the Northern states increasing their allocations by 40% and the Southern states decreasing theirs by 19%).

It is possible that alternatives 2B-1 and 2B-2 could lead to regional effort changes or other changes in the prosecution of the fishery (e.g., changes in gear type composition or number of total hauls) that could affect interaction rates with non-target species. It is unclear to what extent this may occur, and if interaction rates did change, if it would have a meaningful impact on the stock status of non-target species. Small to moderate scale changes in the locations of fishing effort could increase or decrease localized interaction rates with non-target species. Depending on the distribution of non-target species, the effects of effort redistribution on non-target species are likely to range from slight negative to slight positive. Most non-target species relevant to this action are distributed throughout the range of summer flounder, however, any non-target species that may have higher densities in more northerly areas may experience increased interactions under alternative 2B. Likewise, non-target species that have lower densities toward the southern end of the management unit may see decreased interactions that could have slight positive impacts on the stock. These effects are highly uncertain, especially given that the overlap in habitat preferences for summer flounder and non-target species may vary by region.

Interaction rates with non-target species are also influenced by factors like seasonality of effort, which as previously mentioned, is difficult to predict under various reallocation alternatives. Because overall current conditions for non-target species are positive (with the exception of thorny skate, which is overfished, and Northern sea robin, which is unknown), if no changes or relatively minor changes in the distribution of effort occurred, the result would likely be moderate positive impacts on non-target species due to the maintenance of current stock conditions (the same impacts as alternative 2A). As described above, if effort or other fishery patterns change, slight negative to slight positive impacts are possible.

Thus, the overall impacts of alternatives 2B-1 and 2B-2 could range from slight negative (if interaction rates changed enough to negatively impact the biological characteristics of non-target stocks) to moderate positive (if little change in interaction rates occurred, or if reallocation reduced interaction rates enough to positively impact stock condition).

As described above, alternatives 2B-1 and 2B-2 would both likely result in some effort shift toward Northern states, especially nearshore effort. Alternative 2B-2 results in a more substantial shift compared to 2B-1, and thus between the two alternatives, alternative 2B-2 has a higher potential for slight negative impacts (if effort distribution changes negatively influence non-target interactions).

As described under alternative 2A, there is some uncertainty when comparing alternative 2B-1 and 2B-2 to other allocation alternatives. Alternatives 2B-1 and 2B-2 could have the same magnitude of moderate positive impacts on non-target species as alternative 2A, if non-target species interactions did not notably change under these alternatives. If fishing effort distribution did change in a manner influencing non-target species interactions, it is possible that alternatives 2B-1 and 2B-2 could have either slightly more negative impacts or slightly more positive impacts compared to alternative 2A, due to the possibility of increased or decreased interactions with non-target species as the result of shifts in fishing effort. Because alternatives 2C and 2D have similar uncertainties regarding the range of impacts as alternative 2B, these three alternatives are likely to have a similar range of the magnitude of impacts.

9.2.2.3 Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

Similar to alternative 2B, the impacts of alternative 2C are uncertain, and specifically for alternative 2C, would vary by year depending on the annual quota and how it influenced the final state allocations.

In years where the quota was at or below the trigger amount, there would be no allocation changes and non-target species impacts would be identical to those described under alternative 2A (no action/*status* quo).

Alternative 2C in some years would result in higher allocations to most states except for Rhode Island, New Jersey, Virginia, and North Carolina, which would see decreased allocations. Thus, there is not as clear of a north/south shift in allocation, although there may be some northerly shift in effort since Virginia and North Carolina currently have the highest percentages of the allocation. Overall changes in effort or fishery prosecution under this alternative are difficult to predict, and thus a range of possible impacts are possible in years when the quota exceeds the reallocation trigger.

As with alternative 2B, because overall current conditions for non-target species are positive (with the exception of thorny skate, which is overfished, and Northern sea robin, which is unknown), if no changes or relatively minor changes in the distribution of effort occurred, the result would likely be moderate positive impacts on non-target species due to the maintenance of current stock conditions (the same impacts as alternative 2A). As described above, if effort or other fishery patterns change, slight negative to slight positive impacts are possible.

Thus, the overall impacts of alternatives 2C-1 and 2C-2 could range from slight negative (if interaction rates changed enough to negatively impact the biological characteristics of non-target stocks) to moderate positive (if little change in interaction rates occurred, or if reallocation reduced interaction rates enough to positively impact stock condition). The difference between alternative 2C-1 and 2C-2 is the annual quota trigger, which would impact in how many future years the allocation is modified. Alternative 2C-1 is likely to have a higher magnitude of impacts (positive or negative depending on the state) in the long-term compared to alternative 2C-2 given that the trigger is lower and thus allocations would be modified more frequently under this alternative compared to 2C-2.

As described under alternative 2A, there is some uncertainty when comparing alternative 2C-1 and 2C-2 to other allocation alternatives. Alternatives 2C-1 and 2C-2 could have the same magnitude of moderate positive impacts on non-target species as alternative 2A, if non-target species interactions did not notably change under these alternatives. If fishing effort distribution did change in a manner influencing non-target species interactions, it is possible that alternatives 2C-1 and 2C-2 could have either slightly more negative impacts or slightly more positive impacts compared to alternative 2A, due to the possibility of increased or decreased interactions with non-target species as the result of shifts in fishing effort. Because alternatives 2B and 2D have similar uncertainties regarding the range of impacts as alternative 2C, these three alternatives are likely to have a similar range of the magnitude of impacts. However, alternative 2C is also variable by year and in some years would have impacts that are identical to or close to *status quo* (alternative 2A).

9.2.2.4 Alternative 2D: Implement "Scup Model" Quota System for Summer Flounder

The impacts to non-target species from alternative 2D are highly uncertain given that effort changes, and general changes in the prosecution of the fishery under this alternative, are very difficult to predict. Overall catch and landings of summer flounder will still remain driven by annual catch and landings limits and associated measures, however there may be regional shifts or inshore/offshore shifts in effort that occur, but it is not possible to predict to what extent this would occur without knowing which vessels would likely participate and what management measures may be put in place to constrain harvest during the coastwide winter quota periods.
Alternative 2D-1 (Maryland exemption) and alternative 2D-2 (no Maryland exemption) are very unlikely to have meaningful differences in terms of impacts to non-target species. Maryland has

a small summer flounder fishery (about seven vessels directing on summer flounder) and a relatively small percent of the current quota allocation (about 2%). The Maryland fishery is thus unlikely to have substantially different non-target species or interaction rates compared to comparable vessels in other states. Thus, alternatives 2D-1 and 2D-2 are expected to have the same magnitude of impacts ranging from slight negative to moderate positive on non-target species.

Compared to alternative 2A, if major changes in the distribution of effort and prosecution of the fishery do not occur, then alternative 2D would have similar moderate positive impacts as alternative 2A. If fishing effort distribution did change in a manner influencing non-target species interactions, it is possible that alternatives 2D-1 and 2D-2 could have either slightly more negative impacts or slightly more positive impacts compared to alternative 2A, due to the possibility of increased or decreased interactions with non-target species as the result of shifts in fishing effort. Because alternatives 2B and 2C have similar uncertainties regarding the range of impacts as alternative 2D, these three alternatives are likely to have a similar range of the magnitude of impacts.

9.2.3 Impacts to Physical Habitat and EFH

9.2.3.1 Alternative 2A: No Action/Status Quo

Alternative 2A is not expected to alter the prosecution of the fishery in any way that would directly either improve or degrade the quality of habitat. The summer flounder fisheries operate in areas that have been fished for many years, not only for summer flounder but for a variety of species, with a variety of gear types, and this is not expected to change under this alternative, which simply maintains the current allocations and is not expected to alter overall effort levels, times and areas fished, or gear types used in the fishery. However, this alternative does allow continued access to the fishery for summer flounder vessels which are known to interact with habitat through their operation, especially trawl vessels that account for most landings. As described in Table 34, alternatives that allow for recovery of habitat quality would result in positive impacts to the physical environment and habitat, meaning that actions that prevent recovery may result in indirect negative impacts to habitat.

As such, while alternative 2A is not expected to directly alter the level of habitat quality either positively or negatively, this alternative may have slight negative indirect impacts to habitat and EFH by continuing to prevent degraded habitats from recovering (i.e., this alternative will continue the current operating conditions which do not allow for recovery of degraded habitats due to continued fishing in those areas).

Alternative 2A is expected to have the same impacts (indirect slight negative impacts) as all sub-alternatives under alternatives 2B, 2C, and 2D, as described below.

9.2.3.2 Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution

As described in the sections above, as with alternative 2A, the two sub-alternatives under 2B are not expected to result in changes in overall catch and landings in the fishery. While these alternatives may alter the distribution of effort by region, as described above, these changes are not expected to negatively impact habitat beyond its current condition. The summer flounder fishery has been prosecuted for many years, and the overall footprint of the fishery is unlikely to change. Alternatives 2B-1 and 2B-2 are unlikely to drive effort into places that are not currently impacted by the summer flounder fishery or by trawl effort for the many other species targeted in the Greater Atlantic region.

Like alternative 2A, sub-alternatives under 2B would result in indirect slight negative impacts to habitat, as they contribute to maintaining fishery impacts that prevent the recovery of degraded habitats. Compared to other allocation alternatives, alternative 2B is likely to result in the same magnitude of indirect slight negative impacts.

9.2.3.3 Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

Like alternatives 2A and 2B, alternative 2C is not expected to result in a modified overall footprint of fishing effort for summer flounder and it not expected to increase the level of habitat impacts in any areas within that footprint. The areas fished have been fished for many years by a variety of gear types and fisheries. Alternatives 2C-1 and 2C-2 would result in the same magnitude of slight negative indirect impacts on habitat, resulting from continued fishing preventing recovery of any degraded habitats. Compared to other allocation alternatives, alternative 2C is likely to result in the same magnitude of indirect slight negative impacts.

9.2.3.4 Alternative 2D: Implement "Scup Model" Quota System for Summer Flounder

Like other allocation alternatives, alternative 2D is not expected to result in a modified overall footprint of fishing effort for summer flounder and it not expected to increase the level of habitat impacts in any areas within that footprint. The areas fished have been fished for many years by a variety of gear types and fisheries. Alternatives 2D-1 and 2D-2 would result in the same magnitude of slight negative indirect impacts on habitat, resulting from continued fishing preventing recovery of any degraded habitats. Compared to other allocation alternatives, alternative 2D is likely to result in the same magnitude of indirect slight negative impacts.

9.2.4 Impacts to Protected Resources

As described above in the introduction to section 7, the impacts on protected resources may vary between ESA-listed and MMPA-protected species. For ESA-listed species, any action that could result in take of ESA-listed species is expected to have negative impacts, including actions that reduce interactions. Under the MMPA, the impacts of the proposed alternatives would vary based on the stock condition of each protected species and the potential for each alternative to impact fishing effort. For marine mammal stocks/species that have their PBR level reached or exceeded, negative impacts would be expected from any alternative that has the potential to interact with these species or stocks. For species that are at more sustainable levels (i.e., PBR levels have not been exceeded), any action not expected to change fishing behavior or effort such that interaction risks increase relative to what has been seen in the fishery previously, may have positive impacts by maintaining takes below the PBR level and approaching the Zero Mortality Rate Goal (Table 34). Taking the latter into consideration, the overall impacts on the protected resources VEC for each alternative take into account impacts on ESA-listed species, impacts on marine mammal stocks in good condition (i.e., PBR level has not been exceeded), and marine mammal stocks that have reached or exceeded their PBR level.

The quota reallocation alternatives are not expected to heavily influence overall effort for summer flounder, which will remain driven by annual catch and landings limits. The primarily effect of the allocation alternatives under alternative set 2 will be on fishery access and effort among states in the management unit, which may or may not have notable effects on where the bulk of fishing effort occurs. As described above, offshore fishing effort (which mostly occurs in the winter by larger trawl vessels) may not change substantially, as more mobile vessels will continue to fish in prime summer flounder fishing locations offshore. Inshore effort (prosecuted by a mix of vessels with more small day boats participating) may see a small to moderate shift under reallocation alternatives, as discussed below; however, the extent to which this may occur is difficult to predict and would depend on other factors such as management response to increased or decreased quotas. It is possible that under some options there could be a shift in the proportion of offshore vs. inshore effort.

Interactions with protected resources (ESA listed and MMPA protected species) are difficult to predict as they depend on many factors, including local environmental factors. Combined with the uncertainty of exactly how effort or the prosecution of the fishery may change under reallocation options, any resulting changes in interaction rates with ESA-listed or MMPA-protected species is highly uncertain; therefore, a range of possible impacts is provided.

Overall, the commercial quota reallocation alternatives could have potential impacts on protected resources ranging from moderate positive to moderate negative, with moderate positive to moderate negative impacts likely on non-ESA listed marine mammals, and slight to moderate negative impacts likely for ESA-listed species.

9.2.4.1 Alternative 2A: No Action/Status Quo

MMPA (Non-ESA Listed) Species Impacts

As described in section 9.1.4, the summer flounder fishery overlaps with the distribution of non-ESA listed species of marine mammals (cetaceans and pinnipeds). As a result, marine mammal interactions with fishing gear used to prosecute the commercial fishery are possible (i.e., otter trawls, see section 7.0). Ascertaining the risk of an interaction and the resultant potential impacts on marine mammals is uncertain because quantitative analyses have not been performed and data are limited (section 7.0). However, we have considered, the most recent (2010-2014) information on marine mammal interactions with commercial fisheries (Hayes *et al*. 2017; https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html).

Aside from pilot whales and several stocks of bottlenose dolphin, there has been no indication that takes of non-ESA listed species of marine mammals in commercial fisheries have gone beyond levels which would result in the inability of each species population to sustain itself. Specifically, aside from pilot whales and several stocks of bottlenose dolphin, the PBR level has not been exceeded for any of the non-ESA listed marine mammal species identified in section 6.4 (Hayes *et al*. 2017). Although pilot whales and several stocks of bottlenose dolphin have experienced levels of take that resulted in the exceedance of each species PBR level, take reduction strategies and/or plans have been implemented to reduce bycatch in the fisheries affecting these species (Atlantic Trawl Gear Take Reduction Strategy, Pelagic Longline Take Reduction Plan effective May 19, 2009 (74 FR 23349); Bottlenose Dolphin Take Reduction Plan, effective April 26, 2006 (71 FR 24776)). These efforts are still in place and are continuing to assist in decreasing bycatch levels for these species. Although NEFOP observer reports[35] and the most recent five years of information presented in Hayes et al. (2017) are a collective representation of commercial fisheries interactions with non-ESA listed species of marine mammals, and do not address the effects of the summer flounder fishery specifically, the information does demonstrate that thus far, operation of any fishery has not resulted in a collective level of take that threatens the continued existence of non-ESA listed marine mammal populations, aside from those species (pilot whales and bottlenose dolphin stocks) noted above.

Taking into consideration the above information, and the fact that there are non-listed marine mammal stocks/species whose populations may or may not be at optimum sustainable levels, impacts of alternative 2A on non-ESA listed marine mammal species are likely to range from slight negative to slight positive. As noted above, there are some marine mammal stocks/species that are experiencing levels of interactions that have resulted in exceedance of their PBR levels. These stocks/populations are not at an optimum sustainable level and therefore, the continued existence of these stocks/species is at risk. As a result, any potential for an interaction is a detriment to the species/stocks ability to recover from this condition. As interactions with non-ESA listed marine mammals are possible under alternative 2A, for these species/stocks with a current sub-optimal stock condition, alternative 2A is likely to result in negative impacts to these species; however, given that effort and interaction rates are not expected to change under alternative 2A, the magnitude of negative impacts is expected to be small.

Alternatively, there are also many non-ESA listed marine mammals that, even with continued fishery interactions, are maintaining an optimum sustainable level (i.e., PBR levels have not been exceeded) over the last several years. For these stocks/species, it appears that the fishery management measures that have been in place over this timeframe have resulted in levels of effort that equate to interaction levels that are not expected to impair the stocks/species ability to remain at an optimum sustainable level. These fishery management measures, therefore, have resulted in indirect slight positive impacts to these non-ESA listed marine mammal species/stocks. Should future fishery management actions maintain similar operating condition as they have over the past several years, it is expected that these slight positive impacts would remain. Thus, given that alternative 2A is not expected to change fishing effort relative to the *status quo*, the impacts of alternative 2A on these non-ESA listed species of marine mammals with positive stock conditions are expected to be slight positive (i.e., continuation of current operating conditions is not expected to result in exceedance of any of these stocks/species PBR level).

[35] https://www.nefsc.noaa.gov/fsb/take_reports/nefop.html.

Based on this information, overall alternative 2A is expected to have slight negative to slight positive impacts on non-ESA listed species of marine mammals.

ESA Listed Species Impacts

The summer flounder commercial fishery is prosecuted primarily with bottom trawl gear. As provided in section 7.0, ESA listed species of sea turtles, Atlantic sturgeon, large whales, and Atlantic salmon are vulnerable to interactions with bottom trawls, with interactions often resulting in the serious injury or mortality to the species. Based on this, the summer flounder fishery has the potential to interact with these species and therefore, result in some level of negative impacts to ESA listed species. Interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species (with risk of an interaction increasing with increases in of any or all of these factors). Because alternative 2A simply maintains the current commercial allocation and will not impact overall effort in a given year, this alternative is not expected to increase or decrease interaction rates with ESA listed species. However, because alternative 2A would maintain current state-level access to the fishery and maintain the possibility of interactions with ESA listed species, slight negative impacts are expected to result from this alternative.

Overall Impacts

Overall, alternative 2A is expected to have slight negative to slight positive impacts on protected resources, with slight negative to slight positive impacts likely on non-ESA listed marine mammals and slight negative impacts likely for ESA-listed species.

Compared to alternatives 2B-2D, alternative 2A is likely to have a slightly narrow range of possible negative or positive impacts, given that under this alternative, interactions with protected resources are slightly more predictable and should remain at close to *status quo* levels. The other commercial allocation alternatives introduce additional uncertainties regarding how fishery effort may change that could theoretically result in higher negative or higher positive impacts to protected resources.

9.2.4.2 Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution

As described above, alternative 2B, under either of its sub-alternatives, would shift quota allocation from the Southern region of the management unit (North Carolina through New Jersey) to the Northern region (New York through Maine). Under alternative 2B-1, the total amount of allocation shifted from the South to the North would be 6%, while under 2B-2, allocation shifted to the North from the South would be 13% of the coastwide allocation. This increased quota for vessels in Northern states may result in small to moderate changes in the spatial or temporal patterns of fishery effort that may impact protected resources. However, the extent to which this may occur is uncertain, and interaction rates between this fishery and specific protected resources as the result of small to moderate effort shifts are difficult to predict.

MMPA (Non-ESA Listed) Species Impacts

As described above, alternatives 2B-1 and 2B-2 could lead to regional effort changes or other changes in the prosecution of the fishery (e.g., changes in gear type composition or number of total hauls) that could affect interaction rates with protected resources. It is unclear to what extent this may occur, and if interaction rates did change, if it would have a meaningful impact on the stock status of protected resources. Small to moderate scale changes in the locations of fishing effort could increase or decrease localized interaction rates. Depending on the redistribution of effort, and how that redistribution changes the area of overlap, either in space or time, between the gear and marine mammal species, impacts to non-ESA listed marine mammals may be similar to or greater than those under current operating conditions.

Specifically, should the allocation to the northern region result in the redistribution of effort to an area with high overlap with non-ESA listed species of marine mammals, the potential for interactions may increase. Under this scenario, impacts to non-ESA listed species of marine mammals are likely to range from slight negative (i.e., for non-ESA listed species of marine mammals with positive stock condition) to moderate negative (i.e., for non-ESA listed species of marine mammals with sub-optimal stock condition). Alternatively, should the redistribution of effort result in the movement of vessels from an area of high, to an area of low overlap with non-ESA listed marine mammal species, then interactions with non-ESA listed species of marine mammals have the potential to decrease. Under this scenario, impacts to non-ESA listed species of marine mammals are likely to range from moderately positive (i.e., for non-ESA listed species of marine mammals with positive stock condition) to slight negative (i.e., for non-ESA listed species of marine mammals with sub-optimal stock condition). These effects are highly uncertain, especially given that the overlap in habitat preferences for summer flounder and non-ESA listed species of marine mammals may vary by region. Interaction rates are also influenced by factors like seasonality of effort, which as previously mentioned, is difficult to predict under various reallocation alternatives.

Thus, the overall impacts of alternatives 2B-1 and 2B-2 on MMPA-protected species could have a broad range from slight to moderate negative (if redistribution of effort results in high overlap with non-ESA listed marine mammal species) or from moderate positive to slight negative (if redistribution of effort results in a reduced overlap with non-ESA listed marine mammal species).

ESA Listed Species Impacts

The summer flounder commercial fishery is primarily prosecuted with bottom trawl gear. As provided in section 7.0, ESA listed species of sea turtles, minke whales, Atlantic sturgeon, and Atlantic salmon are vulnerable to interactions with bottom trawls, with interactions often resulting in the serious injury or mortality to the species. Based on this, the summer flounder fishery has the potential to interact with these species and therefore, result in some level of negative impacts to ESA listed species. Interaction risks with protected species are strongly associated with the amount of gear in the water, gear soak or tow time, as well as the area of overlap, either in space or time, of the gear and a protected species (with risk of an interaction increasing with increases in of any or all of these factors).

Because alternative 2B may shift effort and could possibly impact the composition of gear types used and/or the number of hauls/trips taken (for example, if the balance of large vs. small vessels or inshore vs. offshore effort changed), the allocation under alternative 2B could lead to increased or decreased interactions with ESA listed species. As described above, any action that results in continued takes of ESA-listed species is expected to have negative impacts on those species. Therefore, alternatives 2B-1 and 2B-2 are expected to result in slight to moderate negative impacts on ESA-listed species.

Overall Impacts

Overall, the impacts to protected species from alternatives 2B-1 and 2B-2 are highly uncertain and depend on exactly how effort and the prosecution of the fishery may change as the result of allocation. Impacts also vary with the stock status of impacted species. Overall, the impacts of alternatives 2B-1 and 2B-2 range from moderate negative to moderate positive.

As described above, alternatives 2B-1 and 2B-2 would both likely result in some effort shift toward Northern states, especially nearshore effort. Alternative 2B-2 results in a more substantial shift compared to 2B-1, and thus between the two alternatives, alternative 2B-2 has a higher potential for impacts of higher magnitude (positive or negative) within the previously described range.

As described under alternative 2A, there is some uncertainty when comparing alternative 2B-1 and 2B-2 to other allocation alternatives. Alternatives 2B-1 and 2B-2 could have the same magnitude of impacts on protected species as alternative 2A, if protected species interactions did not notably change under these alternatives. If interaction rates did change, it is possible that alternatives 2B-1 and 2B-2 would have slightly more negative impacts, or slightly more positive impacts, compared to alternative 2A, depending on how exactly changes in the fishery influenced interaction rates with protected species. As Alternative 2B is likely to have the same magnitude of possible impacts to protected species compared to alternatives 2C and 2D, relative to Alternatives 2C and 2D, Alternative 2B is expected to have neutral impacts to protected species (see below for rationale to support this determination).

9.2.4.3 Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

As described above, alternative 2C, under either of its sub-alternatives, would distribute additional quota above a certain trigger point differently than *status quo* allocations. In years where the quota was at or below this trigger point, allocations would remain *status quo*. In years where the quota trigger is exceeded, the states of Rhode Island, New Jersey, Virginia, and North Carolina would see a reduction in allocation while other states would have their allocations increased. The scale of these changes would be small to moderate for annual quotas near the trigger and would grow larger as the quotas approached the time series high (17.9 million lbs). A moderate to large redistribution of quota could result in small to moderate changes in the spatial or temporal patterns of fishery effort that may impact protected resources. However, the extent to which this may occur is uncertain, and interaction rates between this fishery and specific protected resources as the result of small to moderate effort shifts are difficult to predict.

The range of possible impacts to protected resources from alternative 2C are very similar to that of alternative 2B, given that both alternatives are associated with high uncertainty regarding characteristics of possible effort changes and changes in the prosecution of the fishery. Overall catch and landings of summer flounder will remain driven by annual catch and landings limits and associated measures.

For alternative 2C, in years when the quota is at or below the reallocation trigger, impacts to protected resources would be expected to be identical to those described for alternative 2A, as the allocations would not change. In this case, impacts on protected resources are expected to range from slight negative to slight positive impacts on protected resources, with slight negative to slight positive impacts likely on non-ESA listed marine mammals and slight negative impacts likely for ESA-listed species.

In years where the quota is above the reallocation trigger, there may be regional shifts or inshore/offshore shifts in effort that occur due to some states receiving increased allocation and other states decreased allocation, but it is not possible to predict to what extent this would occur. In addition, if shifts did occur, it is not clear to what extent this would affect non-ESA listed marine mammals and ESA-listed species given that interactions can be highly variable and dependent on a number of factors (e.g., amount of gear in the water, gear soak or tow time, area of overlap of the gear and a protected species).

Overall, as with alternatives 2B and 2D, it is unclear how alternatives 2C-1 and 2C-2 may or may not change interaction risks to protected species relative to status quo conditions. Taking the latter into consideration, depending on the actual changes in the fishery, either sub-alternative could lead to impacts to protected species that range from slight negative to slight positive (similar to Alternative 2A), to impacts that range from moderate negative to moderate positive (similar to Alternatives 2B and 2D). These effects are highly uncertain, especially given that the overlap in habitat preferences for summer flounder and protected species may vary by region. Interaction are also influenced by factors like seasonality of effort, which as previously mentioned, is difficult to predict under various reallocation alternatives.

As described under alternative 2A (No Action/Status Quo), there is some uncertainty when comparing alternative 2C-1 and 2C-2 to other allocation alternatives. In years where the quota was at or below the trigger point set under 2C-1 or 2C-2, allocations would remain *status quo* and therefore, fishing effort would be expected to remain similar to status quo operations. Under this scenario, Alternatives 2C-1 and 2C-2 could have the same magnitude of impacts to protected species as alternative 2A, and therefore, under either of 2C's sub-alternatives, relative to Alternative 2A, impacts to protected species would be neutral. However, if the trigger point set under Alternative 2C-1 or 2C-2 is met, interaction rates may change due to changes in fishing effort. Under this scenario, it is possible that alternatives 2C-1 and 2C-2 would have slightly more negative impacts, or slightly more positive impacts, compared to alternative 2A, depending on how exactly changes in the fishery influenced interaction rates with protected species. As Alternative 2C is likely to have the same magnitude of possible impacts to protected species compared to alternatives 2B and 2D, relative to Alternatives 2B and 2D, Alternative 2C is expected to have neutral impacts to protected species (see below for rationale to support this determination).

9.2.4.4 Alternative 2D: Implement "Scup Model" Quota System for Summer Flounder

The impacts to protected resources from alternative 2D are highly uncertain given that effort changes, and general changes in the prosecution of the fishery under this alternative, are very difficult to predict. Overall catch and landings of summer flounder will still remain driven by annual catch and landings limits and associated measures, however there may be regional shifts or inshore/offshore shifts in effort that occur, but it is not possible to predict to what extent this would occur without knowing which vessels would likely participate and what management measures may be put in place to constrain harvest during the coastwide winter quota periods. In addition, if shifts did occur, it is not clear to what extent this would affect non-ESA listed marine mammals and ESA-listed species given that interactions can be highly variable and dependent on a number of factors (e.g., amount of gear in the water, gear soak or tow time, area of overlap of the gear and a protected species).

Based on the above, alternatives 2D-1 and 2D-2 could lead to modifications in the prosecution of the fishery, such as regional inshore effort shifts, a shift between inshore/offshore effort, changes in gear use, changes in total number of hauls, etc. However, it is unclear how the fishery will respond to either alternative and therefore, to what extent these potential changes in the fishery, relative to status quo, may occur and change effort. As a result, it is unclear how alternatives 2D-1 and 2D-2 may or may not change interaction risks to protected species relative to status quo conditions. Taking the latter into consideration, depending on the actual changes in the fishery, either sub-alternative could lead to impacts to protected species that range from slight negative to slight positive (similar to Alternative 2A), to impacts that range from moderate negative to moderate positive (similar to Alternatives 2B and 2C). These effects are highly uncertain, especially given that the overlap in habitat preferences for summer flounder and protected species may vary by region. Interaction are also influenced by factors like seasonality of effort, which as previously mentioned, is difficult to predict under various reallocation alternatives.

Alternatives 2D-1 and 2D-2 only differ in their exemption of Maryland, which will continue to fish regardless of which allocation scheme is selected. Because of the small size of Maryland's fleet, whether or not this fishery is exempt is likely to have negligible impacts on protected resources.

As described under alternative 2A, there is some uncertainty when comparing alternative 2D-1 and 2D-2 to other allocation alternatives. Alternatives 2D-1 and 2D-2 could have the same magnitude of impacts on protected species as alternative 2A; under this scenario, impacts to protected species from either of 2D's sub-alternatives, relative to Alternative 2A, would be neutral. However, if fishing effort, relative to status quo conditions, does change in response to either sub-alternative 2D-1 or 2D-2, it is possible that alternatives 2D-1 or 2D-2 could have slightly more negative impacts, or slightly more positive impacts, compared to alternative 2A, depending on how exactly changes in the fishery influenced interaction rates with protected species. Under this scenario, relative to Alternatives 2B and 2C, Alternative 2D is likely to have the same magnitude of possible impacts to protected species and therefore, relative to Alternatives 2B and 2C, Alternative 2D would be expected to have neutral impacts to protected species.

9.2.5 Impacts to Human Communities

The impacts of this alternative set are primarily socioeconomic impacts on states and their fishing communities, including revenues and jobs for vessel owners and crew, shoreside operations, and other associated businesses. Alternatives 2A, 2B, and 2C can be generally described in terms of impacts to states, since they either maintain the *status quo* (2A) or propose modified state-by-state quotas (2B and 2C). Alternative 2D (the "scup model" allocation) is the most extreme departure from current management given that it opens the winter fishery to any permitted vessel and allows those vessels to land in any port provided they are licensed to land in that state. The impacts of this alternative are the most uncertain, as described below.

9.2.5.1 Alternative 2A: No Action/Status Quo

Under alternative 2A, no changes to the commercial allocation would be made. Summer flounder catch and effort would continue to be constrained by annual catch limits and associated management measures. States would continue to be constrained to their existing state allocation, and the distribution of landings by state would remain similar to the generally stable levels observed since allocations were implemented in 1993 (see Figure 14 and Table 4 in section 1.3). Typically, landings by state as a percentage of the coastwide landings do not fluctuate much from year to year, since allocations are constant and most states land or come close to landing their quota. Exceptions can occur under special circumstances, such as 2012-2013 when a high amount of North Carolina landings were landed in Virginia by mutual agreement due to shoaling at Oregon Inlet, NC.

The socioeconomic impacts of the existing allocations have varied depending on the state, although as the allocations have been in place for 25 years, conditions in each state resulting from state allocations have been relatively stable in recent years. Generally, states with more allocation currently experience more positive socioeconomic benefits; however, socioeconomic benefits also vary depending on the management approaches used to achieve each allocation, and with external economic and community factors. Each state manages their fishery differently in terms of total number of participants, possession limits, seasons, and other measures; these measures are a large driver of the social and economic impacts of the current quotas. Socioeconomic consequences of the current state allocations are also dependent on factors such as local or regional market conditions, dependence of the state's fishing industry on summer flounder, and community resilience characteristics of ports and communities in each state. Overall, the *status quo* socioeconomic condition relative to commercial allocations is mixed.

Throughout the development of this amendment, states have reported varied socioeconomic impacts resulting from their current allocation share. Some Northern states have reported negative socioeconomic impacts due to a perceived mismatch between their current allocation and summer flounder availability in their waters, especially in recent years as the stock distribution and center of biomass have appeared to shift northward. New York in particular has reported negative socioeconomic impacts of their current allocation as the result of a) perceived problems with the original 1980-1989 landings data used to set current allocations, b) relatively higher availability in waters off of New York relative to their current allocation shares, and c) a disparity in their allocation compared to two nearby states, Rhode Island and New Jersey. Other states have experienced long-term positive socioeconomic impacts from the existing quota allocations, in particular Rhode Island, New Jersey, Virginia, and North Carolina, which have the highest allocation shares and the highest resulting revenues.

Recent socioeconomic information for the commercial summer flounder fishery is provided in section 6.5. Overall, alternative 2A is expected to maintain the current socioeconomic conditions by state, resulting in mixed and variable impacts by state ranging from moderate negative to moderate positive.

9.2.5.2 Alternative 2B: Adjust State Quotas Based on Recent Biomass Distribution

As described above, alternative 2B, under either of its sub-alternatives 2B-1 and 2B-2, would shift quota allocation from the Southern region of the management unit (North Carolina through New Jersey) to the Northern region (New York through Maine). Both sub-alternatives are expected to result in mixed socioeconomic impacts that vary by state, with increased revenues in states New York and north and decreased revenues in states New Jersey and south.

Under alternative 2B-1, the total amount of allocation shifted from the South to the North would be 6% (with Northern states increasing their relative allocations by 19% and southern states decreasing their relative allocations by 9%), while under 2B-2, allocation shifted to the North from the South would be 13% of the coastwide allocation (with the Northern states increasing their allocations by 40% and the Southern states decreasing theirs by 19%). Each state's change in revenues is expected to be heavily influenced by the percentage change in that state's allocation, relative to their existing allocation. It is impossible to precisely predict the impacts to revenue and employment from changes in allocation, since the distribution of socioeconomic benefits will vary based on a number of factors. Among these factors are: state/port level interest in and dependence on the summer flounder fishery, current or future state level restrictions on the number of participants, other state management measures to constrain harvest to the allocation, and broader economic resilience of each state and port. The distribution of economic benefits will depend on price and other market conditions that vary by location and over time.

Alternative 2B-2 would be expected to have greater positive socioeconomic benefits to the Northern states compared to alternative 2B-1, as this sub-alternative presents a more substantial shift in allocation from the southern states to the northern states. Likewise, alternative 2B-2 would have more negative socioeconomic impacts on southern states. Under alternative 2B-1, the total amount of allocation shifted from the South to the North would be 6% (with Northern states increasing their relative allocations by 19% and southern states decreasing their relative allocations by 9%), while under alternative 2B-2, allocation shifted to the North from the South would 13% of the coastwide allocation (with the Northern states increasing their allocations by 40% and the Southern states decreasing theirs by 19%). In both cases, allocation shifts of this magnitude could have substantial impacts on some states.

Specifically, alternatives 2B-1 and 2B-2 are likely to have high positive impacts for the states of New York through Massachusetts, all of which have important directed fisheries for summer flounder. Slight positive impacts are possible for Maine and New Hampshire given that these northern states do not currently have a directed fishery for summer flounder and currently have a very small portion of the coastwide allocation. The increase in allocation under alternatives 2B-1 and 2B-2 would result in Maine and New Hampshire maintaining a very low percentage of the coastwide quota (less than 0.07%) and is unlikely to encourage these states to develop directed fisheries for summer flounder. However, increased allocation could result in increased flexibility for fishermen in these states to land and sell a slightly higher total amount of any incidentally caught summer flounder if desired. These states could also transfer their small poundage amounts of allocation to other states.

Alternatives 2B-1 and 2B-2 are expected to have a range of impacts on southern states ranging from slight negative to high negative. For most states New Jersey through North Carolina, summer flounder is an important target species, and a loss of 9% or 19% of their current allocation (under alternatives 2B-1 and 2B-2, respectively) is likely to result in moderate to high negative impacts in states with directed fisheries. The state of Delaware does not have a directed fishery for summer flounder, but could experience slight negative socioeconomic impacts due to a reduced allocation for summer flounder bycatch. Delaware typically is allocated zero quota at the beginning of each fishing year due to a substantial overage many years ago. A reduced allocation for Delaware would likely ensure that this pattern continues and that summer flounder incidental landings would continue to be restricted in that state.

The general expected impacts of alternatives 2B-1 and 2B-2 is summarized in Table 41. Overall, alternative 2B is likely to result in a range of impacts from high negative to high positive depending on the state, with alternative 2B-2 having distributional impacts of higher magnitude.

Table 41: Expected impacts by state of alternatives 2B-1 and 2B-2.

State	2B-1 % increase/decrease relative to current allocation	2B-1 likely impacts	2B-2 % increase/decrease relative to current allocation	2B-2 likely impacts
ME	+19%	No impact to slight positive	+40%	No impact to slight positive
NH	+19%	No impact to slight positive	+40%	No impact to slight positive
MA	+19%	Moderate to high positive	+40%	High positive
RI	+19%	Moderate to high positive	+40%	High positive
CT	+19%	Moderate to high positive	+40%	High positive
NY	+19%	Moderate to high positive	+40%	High positive
NJ	-9%	Moderate to high negative	-19%	High negative
DE	-9%	No impact to slight negative	-19%	No impact to slight negative
MD	-9%	Moderate to high negative	-19%	High negative
VA	-9%	Moderate to high negative	-19%	High negative
NC	-9%	Moderate to high negative	-19%	High negative

9.2.5.3 Alternative 2C: Revise State Allocations Above a Commercial Quota Trigger Point

Under alternative 2C, final state percentage allocations would vary in each year depending on the overall coastwide quota, because the overall allocation percentages vary depending on how much additional quota there is to be distributed. For quotas up to the trigger point, allocations remain *status quo*. In years when the allocation is below the trigger, allocations would be *status quo* and would result in the same socioeconomic impacts as described under alternative 2A (variable by state ranging from moderate negative to moderate positive).

As the annual commercial quota level grows beyond the quota trigger, the state quota allocation percentages get closer together, i.e., with increasing quotas above the trigger, quota is distributed more evenly among the states. Under both sub-alternatives, states with current allocations above 12.375% of the coastwide quota (NC, VA, RI, and NJ) will lose allocation percentage as the quota grows beyond the trigger point, likely leading to negative economic impacts for these states relative to the *status quo*. In years when the annual quota was above the trigger, the impacts to each state would vary depending on the final quota and thus the final allocation, with more extreme changes to allocation occurring in years where the quota is well above average. Under annual quotas that are marginally higher than the trigger amount, slight negative impacts (to NC, VA, RI, and NJ) and slight positive impacts (to all other states) are possible; in years where the annual quota is well above the trigger, the impacts have the potential to be high in magnitude due to substantial modifications to the coastwide allocation.

As described in section 9.2.1.3, the fact that the state allocations vary with the annual coastwide quota makes the impacts of alternatives 2C-1 and 2C-2 somewhat difficult to predict; however, general conclusions can be reached by evaluating what is reasonably expected in terms of commercial quotas in future years. During the period of 1993-2018, annual commercial quotas have ranged from a low of 5.66 million lbs (2017) to a high of 17.9 million lbs (2005). If quotas were to shift out of this range substantially based on new stock information, it is likely that the quota trigger would need to be re-evaluated.

As described in section 4.2.2, the triggers under both sub-alternatives would have been exceeded in the majority of years from 1993-2018. Under 2C-1, historical quotas would have been exceeded in 22 out of 26 years, and under 2C-2, the trigger would have been exceeded in 19 out of 26 years. In the past few years (particularly since 2016), quotas have been below the time series average, meaning that from 2016-2018, the quota trigger would not have been exceeded under either option. However, in most years, if annual quotas remain generally within their historical range, allocations would be modified in most years, to varying degrees (see section 5.2.3, Figure 33 and Table 21).

States that currently have allocations between 2% and 12.5% (MD, CT, NY, and MA) are likely to strongly benefit from these alternatives in years where the annual quota is moderately to substantially above the trigger, whereas the states of North Carolina and Virginia may lose a substantial portion of their quota in years where the annual quota is relatively high. The potential negative economic impacts associated with states that lose share of the overall quota could be somewhat mitigated by the fact that this loss would only happen in relatively higher quota years, meaning revenues for these states may be more stable than what would be expected under a permanent reallocation. For all states, the annual variability in allocation under this alternative may lead to reduced predictability in revenues and a reduced ability to plan for business and infrastructure needs.

The impacts to the states of Maine, New Hampshire, and Delaware are likely to be minimal given that these states currently have only incidental fisheries; there is little to no directed fishing effort. In addition, the alternatives as proposed, while increasing these states allocations by a large percentage relative to their current allocation, still result in very small allocations (less than 0.2%) given that their starting allocations are very small. Thus, both alternatives are likely to have small magnitudes of positive impacts on these states.

The difference between alternative 2C-1 and 2C-2 is the annual quota trigger, which would impact in how many future years the allocation is modified. Alternative 2C-1 is likely to have a higher magnitude of impacts (positive or negative depending on the state) in the long-term compared to alternative 2C-2 given that the trigger is lower and thus allocations would be modified more frequently under this alternative compared to 2C-2.

The general expected impacts of alternatives 2C-1 and 2C-2 is summarized in Table 42. Because the percentage change for each state would vary by year, a range is shown based on historic quotas from 1993-2018. It is important to note that in recent years the annual quotas have been relatively lower and therefore the percentage change for each state would be on the lower end of this range if quotas remained similar to the last few years.

Overall, alternatives 2C-1 and 2C-2 are expected to result in a range of socioeconomic impacts from high negative to high positive, depending on the state and the annual quota in each year. Again, see section 4.2.2 for a range of annual quotas relative to the proposed triggers and the range of state allocations that result.

Table 42: Expected impacts by state of alternatives 2C-1 and 2C-2, under historic range of commercial quotas.

State	2C-1 % increase/decrease relative to current allocation[a,b]	2C-1 likely impacts	2C-2 % increase/decrease relative to current allocation[a,c]	2C-2 likely impacts
ME	0 % to +319%	No impact to slight positive	0 % to +241%	No impact to slight positive
NH	0 % to +38,404%	No impact to slight positive	0 % to +29,067%	No impact to slight positive
MA	0 % to +43%	No impact to high positive	0 % to +33%	No impact to high positive
RI	0 % to -11%	No impact to high negative	0 % to -8%	No impact to high negative
CT	0 % to +238%	No impact to high positive	0 % to +180%	No impact to high positive
NY	0 % to +33%	No impact to high positive	0 % to +25%	No impact to high negative
NJ	0 % to -14%	No impact to high negative	0 % to -10%	No impact to high negative
DE	0 % to +941%	No impact to slight positive	0 % to +712%	No impact to slight positive
MD	0 % to +269%	No impact to high positive	0 % to +204%	No impact to high positive
VA	0 % to -22%	No impact to high negative	0 % to -17%	No impact to high negative
NC	0 % to -29%	No impact to high negative	0 % to -22%	No impact to high negative

[a] Variable annually as allocation varies with annual quota; range provided covers historic commercial quotas, 1993-2018. Percent increases/decreases may vary from this range if future coastwide quotas exceed historic high quota of 17.9 million lb. Annual quotas below the historic low would result in *status quo* allocations.
[b] Annual quotas would have exceeded the 2C-1 trigger in 22 out of 26 years from 1993-2018; see section 5.2.3.
[c] Annual quotas would have exceeded the 2C-2 trigger in 17 out of 26 years from 1993-2018; see section 5.2.3.

9.2.5.4 Alternative 2D: Implement "Scup Model" Quota System for Summer Flounder

Alternative 2D (the "scup model" allocation) is the most extreme departure from current management given that it opens the winter fishery to any permitted vessel. Because this quota system eliminates the historical year-round state-by-state quota system, the expected impacts of this alternative are highly uncertain, more so than the impacts of the other allocation options. It is very difficult to predict the socioeconomic impacts of this alternative on any given state due to uncertainty regarding how many vessels would participate in the winter fishery, and what specific management measures would be implemented under each quota period. In addition, this alternative could have a relatively higher impact on market conditions for summer flounder, which would influence the distribution of socioeconomic benefits. Alternative 2D could lead to high fishing effort toward the beginning of each winter period, which could lead to increased competition for fishing grounds and market share. One possible scenario is that an influx of effort at the start of the winter coastwide periods may result in an increase in overall landings during those time periods, resulting in possible price declines. As discussed in section 7.1, there are currently a large number of latent federal permits for summer flounder, although most of the permits discussed for elimination from the fishery under alternative set 1 have not been active or have been minimally active in recent years.

The overall impacts of alternative 2D are highly uncertain, but are likely to be more variable at the vessel and shoreside business level compared to the other allocation alternatives, as different businesses would be expected to have varying levels of success under coastwide quota periods implemented for half the year. Some vessels would likely be unsuccessful in maintaining stable revenues under this management system, if they are unable to remain competitive during coastwide fishing periods, particularly if an influx of effort under coastwide management increased competition. However, some vessels are highly likely to benefit from a scup model management system. Larger vessels that are capable of remaining competitive in the offshore winter fishery, as well as smaller vessels that participate primarily in the summer fishery in states with moderate to high summer allocations are likely to benefit.

Shoreside communities would also be impacted by alternative 2D. Many states have invested heavily in shoreside infrastructure to support their state's fleet. Under alternative 2D, the distribution of landings in the winter would be driven more by vessel preference and market factors, which would positively impact some shoreside businesses and negatively impact others. It is difficult to predict how the distribution of landings by state and port would change, and therefore difficult to reach conclusions regarding distributional impacts. Stakeholders and managers have asserted that under alternative 2D, southern shoreside businesses in Virginia and North Carolina would be negatively impacted. Under coastwide measures and allocation, vessels are more likely to opt to land in states that are closer to the center of distribution of the resource and/or in ports where market conditions may be more favorable. Some ports will likely see increased landings during coastwide management periods. Thus, the impacts on shoreside infrastructure and associated jobs are likely to range from high negative to high positive, however these impacts are uncertain and depend on market factors and fishermen behavior.

Similar to alternatives 2B and 2C, the states of Maine, New Hampshire, and Delaware will have smaller expected impacts compared to other states given that these states do not currently participate in a directed fishery for summer flounder. Under alternative 2D, it is possible that some directed effort from vessels in these states would enter the fishery, although the extent to which this would occur is unknown.

The difference between alternative 2D-1 and 2D-2 is whether or not the state of Maryland is exempt from the three-period quota system. Under alternative 2D-1, Maryland will maintain their existing state allocation and continue managing under their IFQ system. In this case, for Maryland, the socioeconomic impacts are likely to be moderate to high positive. Maryland has reported relative success in managing their fishery under this IFQ system for many years, due to relatively high stability and predictability for IFQ vessels. Under alternative 2D-2, the state of Maryland has indicated that high negative socioeconomic impacts are possible given that the "scup model" system is incompatible with their IFQ management. IFQ holders would be unable to maintain their individual quotas, except for possibly in the summer months. For all other states, there would likely be a negligible difference between these two sub-alternatives. The general expected impacts of alternatives 2D-1 and 2D-2 is summarized in Table 42. Overall, alternative 2D is likely to have impacts to human communities ranging from high negative to high positive, and would vary by individual vessel and shoreside community.

Table 43: Expected impacts by state of alternatives 2D-1 and 2D-2.

State	2D-1 % increase/ decrease relative to current allocation	2D-1 likely impacts	2D-2 % increase/ decrease relative to current allocation	2D-2 likely impacts
ME	Unknown/ variable	No impact to slight positive	Unknown/ variable	No impact to slight positive
NH		No impact to slight positive		No impact to slight positive
MA		Uncertain/variable, high negative to high positive, depending on vessel and port level outcomes		Uncertain/variable, high negative to high positive, depending on vessel and port level outcomes
RI				
CT				
NY				
NJ				
DE		No impact to slight positive		No impact to slight positive
MD		Moderate to high positive given exemption and maintenance of current allocation		Moderate to high negative given resulting incompatibility with current IFQ system
VA		Variable, high negative to high positive, depending on vessel and port level outcomes; more likely to result in negative impacts due to loss of higher allocation and impacts to shoreside infrastructure		Variable, high negative to high positive, depending on vessel and port level outcomes; more likely to result in negative impacts due to loss of higher allocation and impacts to shoreside infrastructure
NC		Variable, high negative to high positive, depending on vessel and port level outcomes; more likely to result in negative impacts due to loss of higher allocation and impacts to shoreside infrastructure		Variable, high negative to high positive, depending on vessel and port level outcomes; more likely to result in negative impacts due to loss of higher allocation and impacts to shoreside infrastructure

9.2.6 Summary of Impacts of Alternative Set 2

The quota reallocation alternatives under alternative set 2 are not expected to impact overall fishing effort in terms of annual catch and landings (i.e., total removals of summer flounder from the commercial fishery), which will remain driven by annual catch and landings limits. The allocation alternatives will primarily affect access to the resource at the state/and or individual fishing vessel level within the management unit, depending on the allocation option selected. This could result in a somewhat modified distribution of fishing effort in space and time, although the extent to which this would occur is difficult to predict. In general, the commercial fishery for summer flounder is typically prosecuted by larger trawl vessels fishing offshore in federal waters in the winter months (approximately late October through April), while summer effort (approximately May through early October) takes place primarily in state waters from a mix of gear types and vessels sizes. These patterns correspond with the seasonal inshore-offshore migrations of summer flounder (see section 1.2.6)

Under reallocation alternatives, offshore winter fishing effort is not expected to change substantially in terms of location, as the larger vessels that typically participate in this season have historically been more mobile vessels that target prime summer flounder fishing locations offshore even when long travel distances are required to do so. For this fleet, footprints of fishing effort do not necessarily closely correlate with distance from state of landing. However, it is also possible that there could be a shift in the balance of offshore winter vs. inshore summer effort under some reallocation alternatives, due to changes in the allocation for states that are dominant in the winter fishery.

Nearshore effort observed mainly in the summer months (prosecuted by a variety of vessel types with more representation from smaller day boats) may see a small to moderate shift in location under some reallocation alternatives, as discussed below; however, the extent to which this may occur is difficult to predict and would depend on other factors such as management response to increased or decreased quotas.

It is difficult to determine how these possible changes in fishing location will affect fleet-wide costs. Inshore fishing requires less fuel consumption than offshore, but there may be more vessels active in the inshore fishery than offshore. It is possible that a reallocation that will result in more inshore fishing effort will result in lower costs per vessel, but fleet-wide summer flounder fishing related costs could conceivably increase.

The reallocation alternatives are expected to modify the distribution of landings (and thus revenues) by state and port, resulting in impacts to vessels, shoreside businesses, and communities/states. Changes in access to quota could also impact effort changes related to the total number and duration of trips and hauls for summer flounder, if modified allocations resulted in modified participation in terms of vessel types, vessel sizes, or gear types; however, in general these changes are not expected to be substantial. A summary of impacts of Alternative set 2 can be found in Table 44.

Table 44: Summary of impacts of Alternative Set 2: commercial quota allocation.

Alternative	Description	Expected Impacts				
		Summer flounder	***Non-target species***	***Habitat***	***Protected Resources***	***Human communities***
2A	No action/*status quo*	Moderate +	Moderate +	Indirect slight negative	Slight - to Slight +	Mixed; Moderate + to Moderate - depending on state
2B-1	Adjust state quotas based on northern region percent change in exploitable biomass	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	Mixed; High - to High+ depending on state
2B-2	Adjust state quotas based on absolute change in regional proportion of exploitable biomass	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	Mixed; High - to High+ depending on state
2C-1	Revise state allocations above 8.40 million lb commercial quota trigger point	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	High - to High + depending on state, variable with annual quota
2C-2	Revise state allocations above 10.71 million lb commercial quota trigger point	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	High - to High + depending on state, variable with annual quota
2D-1	Scup model with exemption for Maryland	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	Uncertain; High - to High +; variable by state and vessel
2D-2	Scup model with no exemption for Maryland	Moderate +	Uncertain; Slight - to Moderate +	Indirect slight negative	Uncertain; Moderate - to Moderate +	Uncertain; High - to High+; variable by state and vessel

9.3 IMPACTS OF ALTERNATIVE SET 3: LANDINGS FLEXIBILITY FRAMEWORK PROVISIONS

The framework provision alternatives proposed in this action are administrative and intended to simplify and improve the efficiency of future landings flexibility actions to the extent possible. Under this alternative set, the Council and Board would either take no action, or modify the list of framework provisions in the FMP, which would have no effect on summer flounder management until a future framework action was developed and implemented through a separate process. The purpose of modifying the list of “frameworkable items” in the FMP is to demonstrate that the concepts included on the list have previously been considered in an amendment (i.e., they are not novel).

Because these alternatives are administrative, they are expected to have no impacts on any of the VECs. The impacts of any future framework action relevant to landings flexibility would be analyzed through a separate process, including additional opportunities for public comment.
It is not possible to predict the magnitude and direction of impacts of any future landings flexibility framework actions, because impacts will depend on the configuration of landings flexibility. Future actions would need to define how landings flexibility would work, including resolving questions related to who would be allowed to or required to participate in landings flexibility programs, how such policies should be enforced, and how quota would need to be transferred to maintain the underlying state-by-state quota system (if quota remains allocated by state). As previously mentioned, alternatives 3A and 3B themselves will not have direct impacts on any of the VECs, however, some general considerations for future framework actions are briefly described below to provide additional context for decision making on these alternatives.

Alternative 3A: No Action/Status Quo

Alternative 3A would make no changes to the current list of framework provisions in the Council's FMP. Any future proposed landings flexibility policy that required coastwide participation or modification to the federal measures would likely require a full FMP amendment. The timeline and complexity of such an amendment would heavily depend on the nature of options considered and to what extent landings flexibility could work within the existing management program.
States would remain free to develop landings flexibility agreements by state-level agreements, provided that such agreements are consistent with other Council and Commission FMP requirements and would not require modification to the federal management measures.

Alternative 3B: Add Landings Flexibility as a Frameworkable Issue in the FMP

Under this alternative, any future landings flexibility framework action (likely developed in conjunction with a Commission addendum) would be analyzed through a separate process with associated public comment opportunities and a full description of expected impacts.

Landings flexibility policies have been suggested as a means of addressing rising fishing costs, fuel use, increasing adaptability to market conditions, addressing safety concerns, adapting to a changing distribution of fish, and improving efficiency. However, landings flexibility also raises questions and concerns relative to enforcement (e.g., which state's measures are enforced), administrative burdens associated with associated quota transfers and monitoring, and possibly substantial impacts to shoreside operations. Additional concerns have been raised about the potential for flooding markets and rapid swings in market prices if many vessels ultimately chased ports with higher prices at a given time.

Given these issues, depending on how landings flexibility is configured, the social and economic impacts associated with a future framework action may be significant and require substantial analysis. Although the timeline for Magnuson Stevens Act requirements could be shortened by completing a framework instead of an amendment, **an EIS <u>may</u> still be required** for NEPA analysis depending on the expected impacts of future management options, **extending the timeline of a typical framework and possibly eliminating time savings entirely.**

9.4 CUMULATIVE EFFECTS ASSESSMENT

A cumulative effects assessment (CEA) is a required part of an EIS or EA according to the Council on Environmental Quality (CEQ) (40 CFR part 1508.7) and NOAA's agency policy and procedures for NEPA, found in NOAA Administrative Order 216-6. The purpose of the CEA is to integrate into the impact analyses the combined effects of many actions over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective but, rather, the intent is to focus on those effects that are truly meaningful. This section serves to examine the potential direct and indirect effects of the alternatives in the Summer Flounder Commercial Issues Amendment together with past, present, and reasonably foreseeable future actions that affect the summer flounder environment. It should also be noted that the predictions of potential synergistic effects from multiple actions, past, present and/or future will generally be qualitative in nature.

9.4.1 Valued Ecosystem Components

Consistent with the guidelines for CEA, cumulative effects can be more easily identified by analyzing the impacts of the proposed action on valued ecosystem components (VECs). The affected environment is described in this document based on VECs that were identified for consideration relative to the proposed actions. The VECs described in this document and considered in this CEA are listed below.

VECs represent the resources, areas, and human communities that may be affected by a proposed action or alternatives and by other actions that have occurred or will occur outside the proposed action. VECs are generally the "place" where the impacts of management actions are exhibited. An analysis of impacts is performed on each VEC to assess whether the direct/indirect effects of an alternative adds to or subtracts from the effects that are already affecting the VEC from past, present and future actions outside of the proposed action (i.e., cumulative effects).
The Affected Environment is described in this document based on VECs that were identified specifically for this action, including:

1. The **managed resources,** i.e., summer flounder, the managed species potentially affected by the measures under consideration (impacts described in sections 9.1.1 and 9.2.1);
2. **Non-target species**, including the primary species or species groups that interact with summer flounder, summer flounder habitat, and/or commercial summer flounder fishing gear (impacts described in sections 9.1.2 and 9.2.2);
3. The **physical environment and habitat**, including Essential Fish Habitat (EFH; impacts described in sections 9.1.3 and 9.2.3);
4. **Protected resources**, including ESA-listed and MMPA-protected large and small cetaceans, pinnipeds, sea turtles, fish, and critical habitat occurring in the affected area (impacts described in sections 9.1.4 and 9.2.4);
5. The **human environment**, including socioeconomic aspects of the fisheries (especially commercial fisheries) targeting summer flounder and the communities associated with those fisheries, as well as other human communities with an interest in summer flounder conservation and management (impacts described in sections 9.1.5 and 9.2.5).

9.4.2 Spatial and Temporal Boundaries

The geographic area that encompasses the physical, biological and human communities impacts to be considered in the cumulative effects analysis are described in detail in the Description of the Fishery (Section 1.3) of this amendment document. The geographic range for impacts to the target species (summer flounder), non-target species, and protected resources is the total range of each species. The geographic range for impacts to habitat and EFH is the range of the core operation of the summer flounder fishery, which generally corresponds to the management unit, i.e., the U.S. waters in the western Atlantic Ocean from the southern border of North Carolina northward to the U.S.-Canadian border with a core area of operation from Massachusetts through North Carolina. For human communities, the core geographic boundaries are defined as those U.S. fishing communities directly involved in the harvest of summer flounder and associated shore-side operations. These communities were found to occur in coastal states from Maine through North Carolina, with a core range from Massachusetts through North Carolina.
The temporal scope of the past and present actions for the target species, non-target species, habitat, and human communities is primarily focused on actions that have occurred after implementation of the main components of the FMP (Amendment 2; 1993). These actions reflect changes to the resource as a result of Council management. For endangered and other protected species, the scope of the past and present actions is on a species-by-species basis (section 7.0) and is largely focused on the 1980s and 1990s through the present, when NMFS began generating stock assessments and protections for marine mammals and turtles that inhabit the waters of the U.S. EEZ.

The temporal scope of future actions for all five VECs, which includes the measures proposed by this amendment, extends five years into the future following the expected effective date of these measures in 2020 (i.e., ~2020-2024). This period was chosen because the dynamic nature of resource management and lack of information on projects that may occur in the future make it difficult to predict impacts beyond this timeframe with any certainty.

9.4.3 Actions Other Than Those Proposed in This Document

The impacts of each of the alternatives considered in this amendment document are given in Sections 7.1 through 7.3. The text below describes the meaningful past (P), present (Pr), or reasonably foreseeable future (RFF) actions to be considered other than those actions being considered in this amendment document. Table 45 summarizes the possible impacts of these actions on each VEC. These impacts are described in chronological order and qualitatively, as the actual impacts of these actions are too complex to be quantified in a meaningful way. When any of these abbreviations occur together (i.e., P, Pr, RFF), it indicates that some past actions are still relevant to the present and/or future actions. A brief explanation of the rationale for concluding what effect each action has (or will have) had on each VECs is provided in the table and is not repeated here.

Note that most of these *other* actions come from *fishery-related activities* (e.g., Federal fishery management actions). Numerous actions have been taken to manage these fisheries through the establishment of the original FMPs and subsequent amendments and framework adjustment actions. The specifications process for annual catch limits to constrain catch and harvest, as required by the MSA, provides the opportunity for the Councils and NOAA Fisheries to regularly assess the status of the fisheries and to make necessary adjustments to ensure that there is a reasonable expectation of meeting the objectives of the FMPs. The statutory basis for federal fisheries management is the MSA. To the degree that this regulatory regime and National Standards are complied with, the cumulative impacts of past, present, and reasonably foreseeable future federal fishery management actions on the target and non-target species VECs should generally be associated with positive long-term outcomes, which should bring about long-term sustainability of human communities, especially those that are economically dependent upon the managed stocks.

Other FMP Actions

As with the summer flounder actions described in Table 45, there are many other FMPs and associated fishery management actions for other species that have impacted these VECs over the temporal scale described in section 9.4.2. These include FMPs managed by the Mid-Atlantic Fishery Management Council, New England Fishery Management Council, Atlantic States Marine Fisheries Commission, and to a lesser extent the South Atlantic Fishery Management Council and are developed in compliance with the MSA. They have had positive long-term cumulative impacts on managed and non-target species, habitat, and protected resources because they constrain fishing effort and manage stocks at sustainable levels. However, constraining fishing effort through regulatory actions can have negative short-term economic impacts. These impacts are sometimes necessary to bring about long-term sustainability of a resource, and should, in the long-term, promote positive effects on human communities.

In some cases, fishery management plan actions are developed in an omnibus fashion to update many plans at once. Actions associated with other FMPs and omnibus amendments have included measures to regulate fishing effort for other species, measures to protect habitat and forage species, and fishery monitoring and reporting requirements. One special case set of omnibus actions are the Standardized Bycatch Reporting Methodology (SBRM) amendments, which cover Federal waters fisheries managed by the New England and/or Mid-Atlantic Councils. The first SBRM amendment became effective in 2008, and an update to these measures was finalized in June 2015 (Amendment 17 to the Summer Flounder, Scup, and Black Sea Bass FMP; 80 FR 37182). The updated regulations modify the following elements of the monitoring program: new prioritization process for allocation of observers if agency funding is insufficient to achieved target observer coverage level; bycatch reporting and monitoring mechanisms; analytical techniques and allocation of at sea fisheries observers; a precision-based performance standard for discard estimates; a review and reporting process; framework adjustment and annual specifications provisions; and provisions for industry-funded observers and observer set-aside programs. Separate from the SBRM amendment, NMFS, in collaboration with the MAFMC and NEFMC, is currently developing an industry funded monitoring amendment. The Omnibus Observer Coverage Amendment will not necessarily result in immediately increased observer coverage because sufficient funds (from both industry for at-sea coasts and NOAA for shore side costs) may not be available. Rather, this amendment will set a mechanism for increasing observer coverage should sufficient funding become available. The MAFMC also recently developed an Omnibus Unmanaged Forage Amendment (82 FR 40721), to prohibit the development of new, or expansion of existing, directed fisheries on unmanaged forage species until adequate scientific information is available to promote ecosystem sustainability. This action could affect the summer flounder resource, non-target species, and protected resources as it provides some protections for forage species that may prey on or be preyed on by these species at various life stages.

Regarding protected resources, an Atlantic Trawl Gear take reduction strategy for long-finned pilot whales (*Globicephala melas*), short-finned pilot whales (*Globicephala macrorhynchus*), white-sided dolphins (*Lagenorhynchus acutus*), and common dolphins (*Delphinus delphis*) has been developed and is described in Section 7.

Summary of Non-Fishing Effects

In addition to the direct effects on the environment from fishing, the cumulative effects (from past, present, and reasonably foreseeable future actions) to the physical and biological dimensions of the environment may also come from non-fishing activities. Non-fishing activities that have meaningful effects on the VECs include the introduction of chemical pollutants, sewage, changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment. Human-induced non-fishing activities that affect the VECs under consideration in this document are those that tend to be concentrated in nearshore areas. Examples of these activities include, but are not limited to agriculture, port maintenance, beach nourishment, coastal development, marine transportation, marine mining, dredging, and the disposal of dredged material. These activities pose a risk to all of the identified VECs in the long term. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly lower the maximum sustainable yield of the managed resources, and negatively affect non-target species (including deep sea corals) and protected resources.

The overall impact to the affected species and their habitats on a population level is no impact to slight negative, since a large portion of these species have a limited or minor exposure to these local non-fishing perturbations. Decreased habitat suitability would tend to reduce the tolerance of those VECs to the impacts of fishing effort. Impacts from non-fishing activities generally relate to habitat loss from human interaction and alteration or natural disturbances. Mitigation of this outcome through regulations that would reduce fishing effort could then negatively impact human communities.

Non-fishing activities permitted under other federal agencies (e.g. beach nourishment, offshore wind facilities, etc.) require examinations of potential impacts on the VECs. The MSA imposes an obligation on other Federal agencies to consult with the Secretary of Commerce on actions that may adversely affect EFH (50 CFR 600.930). The eight regional fishery management councils engage in this review process by making comments and recommendations on federal or state actions that may affect habitat for their managed species and by commenting on federal actions likely to substantially affect habitat.

In addition to the activities above, in recent years, offshore wind energy and oil and gas exploration have become more relevant activities in the Greater Atlantic region that are expected to impact all VECs, as described below. For potential biological impacts of wind, the turbines and cables may influence water currents and electromagnetic fields, respectively, which can affect patterns of movement for various species (target, non-target, protected). Habitats directly at the turbine and cable sites would be affected and there could be scouring concerns around turbines. Impacts on human communities in the general sense will be mixed – there will be economic benefits in the form of jobs associated with construction and maintenance, and replacement of some electricity generating fossil fuels with renewable resources. But there may be negative effects on fishing activities in terms of effort displacement, or making fishing more difficult or expensive near the turbines or cables.

For oil and gas, this timeframe would include leasing and possible surveys. Seismic surveys impact the acoustic environment within which marine species live, and have uncertain effects on fish behaviors that could cumulatively lead to negative population level impacts. The science on this is fairly uncertain. If marine resources were affected by seismic, then so in turn the fisherman targeting the resources would be affected. However, there would be an economic component in the form of increased jobs where there may be some positive effects on human communities.

While there are currently no operational wind farms in Mid-Atlantic waters, potential offshore wind energy sites have been identified off Virginia, Maryland, New Jersey, Delaware, and New York, and there are several proposals to develop wind farms in both nearshore and offshore waters. In New England, offshore wind project construction south of Massachusetts/Rhode Island may begin as early as 2019 (three projects including Vineyard Wind, Bay State Wind, and South Fork Wind Farm). Additional areas have been leased and will have site assessment activities in the next few years. These projects could have slight negative impacts on EFH, as well as summer flounder, non-target, and fishing communities if there are any negative impacts on those resources. Furthermore, there could be negative impacts on protected species of birds and marine mammals if they interact with the wind farms.

The overall impact of offshore wind energy and oil and gas exploration on the affected species and their habitats on a population level is unknown, but likely to range from no impacts to moderate negative, depending on the number and locations of projects that occur, as well as the effects of mitigation efforts.

Global Climate Change

Global climate change affects all components of marine ecosystems, including human communities. Physical changes that are occurring and will continue to occur to these systems include sea-level rise, changes in sediment deposition; changes in ocean circulation; increased frequency, intensity and duration of extreme climate events; changing ocean chemistry, and warming ocean temperatures. Emerging evidence demonstrates that these physical changes are resulting in direct and indirect ecological responses within marine ecosystems, which may alter the fundamental production characteristics of marine systems (Stenseth et al. 2002). Climate change will potentially exacerbate the stresses imposed by fishing and other non-fishing human activities and stressors (described in this section).

Regarding climate change, all of the species considered in this document are potentially vulnerable to changing climate conditions. NOAA scientists have recently developed an assessment of the climate vulnerability of 82 fish and invertebrate species in the Northeast region, including exploited, forage, and protected species. The results of the assessment were published in Hare et al. (2016). Results from this "Northeast Fisheries Climate Vulnerability Assessment" indicate that climate change could have impacts on Council-managed species that range from negative to positive, depending on the adaptability of these species to the changing environment (Hare et al. 2016).

Based on this assessment, summer flounder was determined to have a moderate vulnerability to climate change. The exposure of summer flounder to the effects of climate change was determined to be “very high” due to the impacts of ocean surface temperature, ocean acidification, and air temperature. Exposure to all three factors occur during all life stages. Summer flounder is an obligate estuarine-dependent species that spawns on the shelf and juveniles develop in estuaries. Adults make seasonal north-south migrations exposing them to changing condition inshore and offshore. The distributional vulnerability of summer flounder was ranked as "high," given that summer flounder spawn in shelf waters and eggs and larvae are broadly dispersed. Adults make regional-scale north-south migrations seasonally. Adults use a range of habitats including estuarine, coastal, and shelf. The life history of the species has a strong potential to enable shifts in distribution. Summer flounder were determined to have low biological sensitivity to climate change (Hare et al. 2016).[36]

[36] The climate vulnerability profile for Summer Flounder is available at:
https://www.st.nmfs.noaa.gov/ecosystems/climate/northeast-fish-and-shellfish-climate-vulnerability/index

Overall climate vulnerability results for additional Greater Atlantic species, including most of the non-target species identified in this action, are shown in Figure 43 from Hare et al. 2016. Overall, climate change is expected to have impacts that range from positive to negative depending on the species. However, future mitigation and adaptation strategies to climate change may mitigate some of these impacts. The science of predicting, evaluating, monitoring and categorizing these changes continues to evolve. The social and economic impacts of climate change on stakeholders will depend on stakeholder and community dependence on the fisheries, and their capacity to adapt to change. Commercial and recreational fisheries may adapt to change in different ways, and methods of adaptation will differ among regions. In addition to added scientific uncertainty, climate change will introduce implementation uncertainty and other challenges to effective conservation and management (MAFMC 2014).

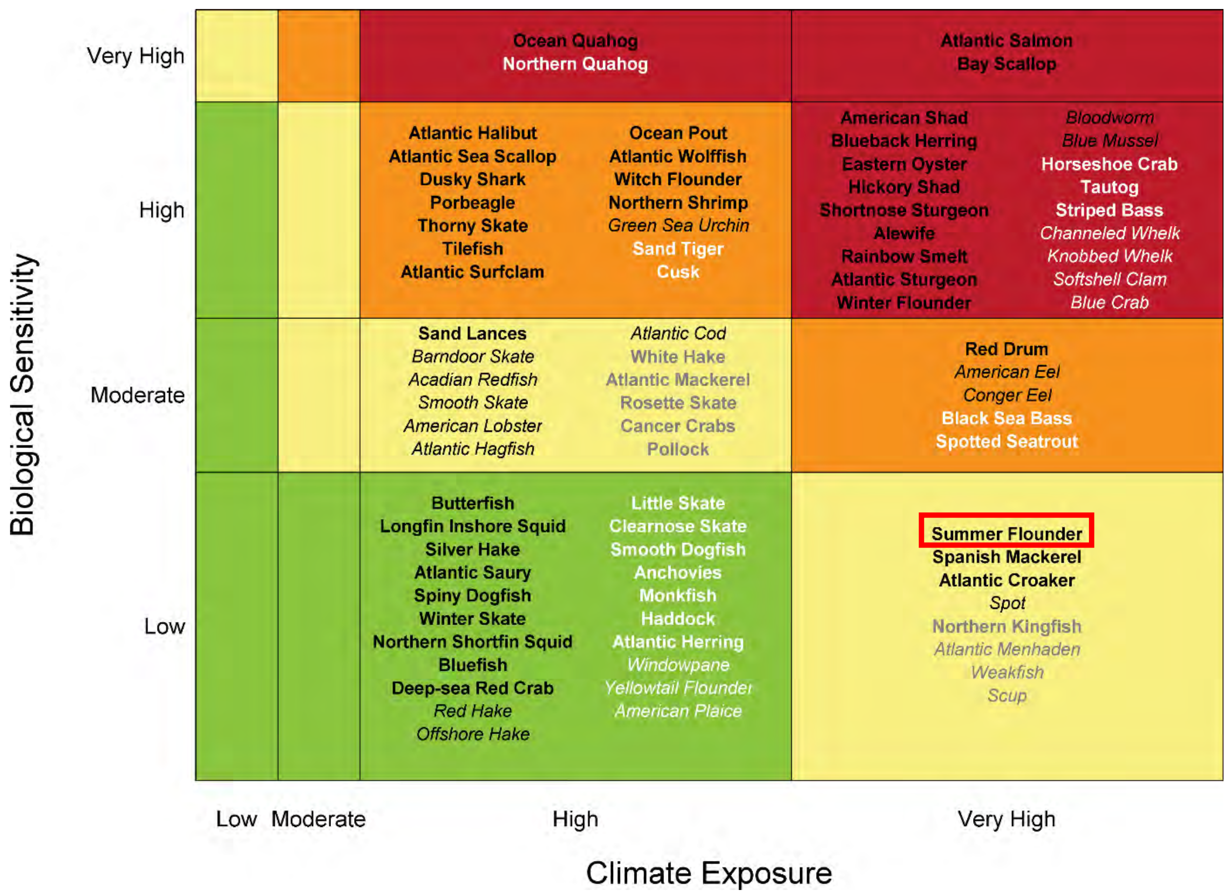


Figure 43: Overall climate vulnerability score for Greater Atlantic species analyzed in Hare et al. 2016, with summer flounder highlighted in red box. Overall climate vulnerability is denoted by color: low (green), moderate (yellow), high (orange), and very high (red). Certainty in score is denoted by text font and text color: very high certainty (>95%, black, bold font), high certainty (90–95%, black, italic font), moderate certainty (66–90%, white or gray, bold font), low certainty (<66%, white or gray, italic font). Figure source: Hare et al. 2016.

The overall impacts of these *other* (past, present, and reasonably foreseeable) actions are summarized in Table 45 and discussed below. These impacts, in addition to the impacts of the management actions being developed in this document (Section 9), comprise the total cumulative effects that will contribute to the significance determination for each of the VECs exhibited later in

Table Table 45.

Table 45: Summary of Past (P), Present (Pr), and Reasonably Foreseeable Future (RFF) actions other than those proposed in this document, and their associated impacts. "The FMP" refers to the Summer Flounder, Scup, and Black Sea Bass FMP except where otherwise specified.

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
P Original FMP	Established management plan for summer flounder.	**Direct Positive** Regulatory tool available to rebuild and manage stocks and to regulate fishing effort	**Indirect Positive** Regulated fishing effort and gear use	**Indirect Positive** Reduced fishing effort; gear requirements	**Indirect Positive** Regulated fishing effort; gear requirements	**Indirect Positive** Benefited domestic businesses
P, Pr, RFF Annual specifications for the FMP species P, Pr, RFF	Establish quotas, recreational harvest limits, and other fishery regulations (commercial and recreational)	**Indirect Positive** Regulatory tool to specify catch limits, and other regulations; allows response to annual stock updates	**Indirect positive** Regulates fishing effort and can include measures to respond to bycatch	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Indirect Positive** Regulated fishing effort; gear requirements	**Indirect Positive** Benefited domestic businesses
P Amendment 2 to the FMP	Established rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements for summer flounder; Created the Summer Flounder Monitoring Committee.	**Direct Positive** Regulatory tool available to rebuild and manage stocks and to regulate fishing effort	**Indirect Positive** Regulated fishing effort and gear use	**Indirect Positive** Reduced fishing effort; gear requirements	**Indirect Positive** Regulated fishing effort; gear requirements	**Indirect Positive** Benefited domestic businesses

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
[P] Frameworks 2 and 6 to the FMP [P]	Established state-specific and region-specific recreational conservation equivalency measures.	**Indirect Positive** Regulatory tool available to constrain recreational harvest	**Indirect Positive** Regulatory tool to constrain recreational harvest and effort impacting non-target species	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Indirect Positive** Allowed state/regional level flexibility in tailoring recreational measures
[P] Amendment 10 to the FMP [P]	Modified commercial minimum mesh requirements; continued commercial vessel moratorium; prohibited transfer of summer flounder at sea; established party/charter permits for summer flounder.	**Direct Positive** Regulatory tool available to rebuild and manage stocks and to regulate fishing effort	**Indirect Positive** Regulated fishing effort and gear use	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Direct slight negative to Indirect slight positive** Imposed some costs and restrictions on fishing industry, but contributed to management of sustainable stock and benefitted some businesses

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
P, Pr, RFF Omnibus ACL/AMs amendment (Amendment 15)	Established Annual Catch Limits (ACLs) and Accountability Measures (AMs)	**Direct Positive** Regulatory tool available to rebuild and manage stocks and to regulate fishing effort	**Direct Positive** Regulatory tool available to rebuild and manage stocks and to regulate fishing effort	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Indirect Negative to Indirect Positive** Decreased fishing effort in some cases, but required sustainable management for long-term sustainable yield
P, Pr, RFF Omnibus Recreational AMs amendment	Modified the accountability measures for the Council's recreational fisheries	**Indirect Slight Positive** Added flexibility in managing stocks and to regulate fishing effort	**Indirect Slight Positive** Added flexibility in managing stocks and to regulate fishing effort	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Indirect Slight Positive** Allowed additional flexibility in responding to recreational overages, lessening required management restrictions

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
P, Pr, RFF Vessel baseline amendment (Amendment 18)	Removed some of the restrictions for upgrading vessels listed on Federal fishing permits	**Indirect Slight Positive** Allows management of fleet to regulate fishing effort	**Indirect Slight Positive** Allows management of fleet to regulate fishing effort	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Indirect Slight Positive** Allowed increased flexibility in vessel modifications
P, Pr, RFF Standardized Bycatch Reporting Methodology	Established acceptable level of precision and accuracy for monitoring of bycatch in fisheries	**Indirect Slight Positive** May improve data quality for monitoring total removals	**Indirect Slight Positive** May improve data quality for monitoring total removals	**No impact** Impacts monitoring of fishery but does not influence effort or level of participation	**Indirect Slight Positive** May increase observer coverage and will not affect distribution of effort	**Uncertain – Likely Indirect Negative** May impose an inconvenience on vessel operations
P, Pr, RFF Unmanaged Forage Omnibus Amendment	Prohibits development of new and expansion of existing directed commercial fisheries on unmanaged forage species in MAFMC waters until the Council can consider available scientific information and potential impacts	**Indirect Positive** Is intended to protect the food source for a variety of species in the Mid-Atlantic	**Indirect Positive** Is intended to protect the food source for a variety of species in the Mid-Atlantic	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Indirect Positive** Intended to protect the food source for a variety of species in the Mid-Atlantic including protected resources	**Mixed** Could have positive impacts by maintaining a food source for several fish stocks. Could have negative impacts for fishermen who already harvest unmanaged forage species.

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
[RFF] Recreational Issues Framework and Addendum	Will consider adding slot limits, transit provisions for Block Island, and conservation equivalency for black sea bass	**Likely Indirect Positive** Will introduce new tools to manage stock to sustainable harvest levels	**Likely Indirect Positive** Will maintain non-target species at sustainable harvest levels	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains effort at current levels; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Likely Indirect Slight Positive** Will introduce management tools that may improve access to the resource and angler satisfactions
[RFF] Omnibus Observer Coverage Amendment	Measures to implement industry-funded monitoring coverage in some FMPs above levels required by SBRM	**Likely Indirect Positive** May improve monitoring and reporting for managed resources	**Likely Indirect Positive** May improve monitoring and reporting for non-target resources	**Uncertain – Likely No Impact** Depending on actions implemented, will not likely result in significant changes to fishing access or effort	**Likely Indirect Positive** May improve monitoring and reporting for protected resources interactions	**Likely Direct Negative** Likely to impose additional costs on fishing operations
[P, Pr, RFF] Convening of Take Reduction Teams (periodically)	Recommend measures to reduce mortality and injury to marine mammals and sea turtles	**Indirect Positive** Will improve data quality for monitoring total removals; Gear requirements could reduce bycatch	**Indirect Positive** Will improve data quality for monitoring total removals; Gear requirements could reduce bycatch	**Indirect Positive** Gear requirements could reduce gear impacts	**Direct Positive** Reducing amount of gear in water could reduce encounters	**Indirect Negative** Gear requirements could reduce revenues

FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
[RFF] Summer flounder recreational issues and sector allocation amendment	Will consider recreational/commercial sector allocation and consider revisions to recreational management strategies	**Likely Indirect Positive** Will allow for continued management to sustainable harvest levels and modernize some management strategies	**Likely Indirect Positive** Likely to maintain or possibly reduce non-target species interactions	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains effort at current levels; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Mixed** Will positively impact some human communities and negatively impact others by modifying access to the resource
[Pr, RFF] Revisions to commercial AMs	Adds additional flexibility in commercial AMs based on stock status	**Indirect Slight Positive** Adds flexibility in managing stocks and to regulate fishing effort	**Indirect Slight Positive** Adds flexibility in managing stocks and to regulate fishing effort	**Indirect Slight Negative** Allows continuation of fishing effort that prevents recovery of degraded habitats	**Likely Indirect Negative to Indirect Positive** Maintains fishing effort; negatively impacting species with poor stock status and positively impacting stocks with positive stock status	**Indirect Positive** Will increase flexibility in response to ACL overages, making responses less burdensome to fishing industry

NON-FISHERY RELATED ACTIONS						
Action	Description	Impacts on Managed Resources	Impacts on Non-target Species	Impacts on Habitat and EFH	Impacts on Protected Species	Impacts on Human Communities
P, Pr, RFF Agriculture runoff	Nutrients applied to agriculture land are introduced into aquatic systems	**Indirect Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area
P, Pr, RFF Port maintenance	Dredging of wetlands, coastal, port and harbor areas for port maintenance	**Indirect Negative** Localized decreases in habitat quality	**Indirect Negative** Localized decreases in habitat quality	**Direct Negative** Reduced habitat quality in the immediate project area	**Direct and Indirect Negative** Potential dredge interactions with protected species ;Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area
P, Pr, RFF Offshore disposal of dredged materials	Disposal of dredged materials	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area

NON-FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
P, Pr, RFF Beach nourishment	Offshore mining of sand for beaches	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Direct and Indirect Negative** Potential dredge interactions with protected species; Localized decreases in habitat quality in the immediate project area	**Mixed** Positive for mining companies, possibly negative for fisheries
	Placement of sand to nourish beach shorelines	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Positive** Beachgoers generally like sand
P, Pr, RFF Marine transportation	Expansion of port facilities, vessel operations and recreational marinas	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Direct and Indirect Negative** potential for interactions (ship strikes) with protected species; Localized decreases in habitat quality in the immediate project area	**Mixed** Positive for some interests, potential displacement for others

NON-FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
[P, Pr, RFF] Installation of pipelines, utility lines and cables	Transportation of oil, gas and energy through pipelines, utility lines and cables	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Reduced habitat quality in the immediate project area	**Direct and Indirect Negative** Reduced habitat quality; Sound Exposure (physical injury or behavioral harassment); Potential interactions with vessels;Dependent on mitigation effects	**Unknown** Dependent on mitigation effects
[RFF] Liquefied Natural Gas (LNG) terminals (w/in 5 years)	Transportation of natural gas via tanker to terminals located offshore and onshore (Several LNG terminals are proposed, including MA, RI, NY, NJ and DE)	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Localized decreases in habitat quality possible in the immediate project area	**Direct and Indirect Negative** Reduced habitat quality; Sound Exposure (physical injury or behavioral harassment); Potential interactions with vessels;Dependent on mitigation effects	**Unknown** Dependent on mitigation effects

NON-FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
[RFF] Offshore Wind Energy Facilities (medium probability w/in 5 years)	Construction of wind turbines to harness electrical power (Several facilities proposed from ME through NC, including off the coast of MA, NY/NJ and VA)	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Localized decreases in habitat quality possible in the immediate project area	**Direct and Indirect Negative** Reduced habitat quality; Sound Exposure (physical injury or behavioral harassment); Potential interactions with vessels**;** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects

Summary Effects of Past and Present Actions

The present conditions of the VECs are empirical indicators of the summary effects of past actions since, independent of natural processes, and these present conditions are largely the product of these past actions. The combined effects of these actions are described in the VEC-by VEC discussion below and are summarized in Table 46.

Managed Species

The cumulative impacts of past and present management actions have resulted in overall positive impacts to the managed resource. Summer flounder stock biomass has trended up over the long term, recovering from population lows in the late 1980s/early 1990s. Although biomass has decreased slightly in recent years, management measures have maintained the population above an overfished condition. The age structure of the population has expanded as the result of minimum size and minimum mesh size requirements and other management measures, contributing to a more sustainable population. Foreseeable future management measures are expected to prevent overfishing and prevent the stock from becoming overfished, and allow for continued stock recovery.

While the negative effects of past and present actions associated with non-fishing activities (Table 45) may have increased negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large.

Therefore, the cumulative impacts of past and present actions should yield positive impacts for managed species in the long term.

Non-target Species

Actions taken by the Council in the Summer Flounder, Scup, and Black Sea Bass FMP in the past and present are mostly positive on non-target species. Specific gear and area restrictions have reduced bycatch of various non-target species. Effort controls and increased efficiency of the fleet have also likely reduced impacts on non-target species. As described in section 1.3, most of the major relevant non-target species in the commercial summer flounder fishery have a positive stock condition, with the exceptions of thorny skate (overfished) and Northern sea robin (unknown). While there are no sub-ACLs for other species in the commercial summer flounder fishery, most of the non-target species are managed by the MAFMC and/or the NEFMC and are managed under their own ACLs and AMs, which will continue to promote the health of each stock. Future actions are anticipated to continue rebuilding and maintaining sustainable stocks. Therefore, the cumulative impacts of the past and present actions should yield positive impacts for non-target species in the long-term.

The summary effects of past and present actions are less certain than for the managed resources. This is because the information needed to quantitatively measure the impacts on these species resulting from summer flounder fishery activities and non-fishing activities is generally lacking. The continued implementation of the Omnibus SBRM Amendment is expected to provide more data to allow management to better manage bycatch. The summary effects of past and present actions on non-target species are considered to be a mixed set of partially offsetting positive effects through fishery effort reduction or gear modifications will, in effect, reduce the magnitude of the negative impacts of fishing in general. This would likely improve with future actions to reduce bycatch. Again, although the negative effects of past and present actions associated with non-fishing activities (Table 45) may have increased negative effects, it is likely that the impacts of those actions have been minor due to the limited scale of the habitat impact compared with the populations at large.

Therefore, the cumulative impacts of past and present actions should yield positive impacts for non-target species in the long term.

Habitat

The summer flounder fishery is dominated by otter trawls, accounting for over 90% of commercial landings. Other minor gear types include gill nets, traps, hook and line, and dredge gear (with dredge gear accounting for mostly incidental landings of summer flounder). Due to the very small percentage of non-trawl gear types used in the commercial summer flounder fishery, and the minimal impacts of hook and line gear on habitat (see section 1.4), the impacts of past, present, and future FMP actions are primarily focused on the bottom trawl fishery rather than on other gear types.

Trawl gear can have negative impacts on habitat by creating furrows in sediments, re-suspending and dispersing sediments, reducing the abundance of benthic prey species. The summer flounder fishery takes place predominantly in dynamic environments with less structured bottom composition, where habitat impacts are more likely to be shorter in duration.

The Mid-Atlantic Council developed some fishery management actions with the sole intent of protecting marine habitats. For example, in Amendment 9 to the Mackerel, Squids, and Butterfish FMP, the Council determined that bottom trawls used in Atlantic mackerel, longfin and *Illex* squid, and butterfish fisheries have the potential to adversely affect EFH for some federally-managed fisheries (MAFMC 2008). As a result of Amendment 9, closures to squid trawling were developed for portions of Lydonia and Oceanographer Canyons. Subsequent closures were implemented in these and Veatch and Norfolk Canyons to protect tilefish EFH by prohibiting all bottom trawling activity. In addition, amendment 16 to the Mackerel, Squid, and Butterfish FMP prohibits the use of all bottom-tending gear in fifteen discrete zones and one broad zone where deep sea corals are known or highly likely to occur (81 Federal Register 90246, December 14, 2016).

Actions implemented in the Summer Flounder, Scup, and Black Sea Bass FMP that affected species with overlapping EFH were considered Amendment 13 (MAFMC 2002). The analysis in Amendment 13 indicated that no management measures were needed to minimize impacts to EFH because the trawl fisheries for summer flounder, scup, and black sea bass in Federal waters are conducted primarily in high energy mobile sand and bottom habitat where gear impacts are minimal and/or temporary in nature. The principal gears used in the recreational fisheries for summer flounder are rod and reel and handline. These gears have minimal adverse impacts on EFH in the region (Stevenson et al. 2004).

Overall, the combination of past and present actions is expected to provide some protection for vulnerable benthic habitats, and continue to promote efficiency in the harvest of fishery resources, thereby reducing adverse effects of fishing on EFH. Such consultations aim to reduce the negative habitat impacts associated with various activities occurring in the marine environment. However, despite these mitigation measures, it is likely that fishing and non-fishing activities will continue to degrade habitat quality and prevent recovery of degraded habitats. Therefore, the cumulative impacts of past and present actions should yield mixed impacts for habitat in the long term.

Protected Species

Those past, present, and reasonably foreseeable future actions which may impact protected species, and the direction of those impacts, are summarized in Table 45. The primary protected species impacted by the fishery include whales (North Atlantic right whale, humpback whale, fin whale, sei whale, minke whale, pilot whale), small cetaceans (Risso's dolphin, Atlantic white-sided dolphin, short beaked common dolphin, bottlenose dolphin, harbor porpoise), sea turtles (leatherback, Kemp's ridley, green, loggerhead), pinnipeds (harbor seal, gray seal, harp seal, hooded seal) and fish (Atlantic salmon, Atlantic sturgeon).

NMFS has several means under which it can review non-fishing actions of other Federal or state agencies that may impact protected species prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts those actions could have on protected species under NMFS' jurisdiction.

Past fishery management actions taken through the respective FMPs and annual specifications process have had a positive cumulative effect on protected species through the reduction of fishing effort (and thus reduction in potential interactions) and implementation of gear requirements. It is anticipated that future management actions, described in Table 45, will result in additional indirect positive effects on protected species. These impacts could be broad in scope. In addition, Take Reduction Teams have been convened to develop measures for certain marine mammal species that have generally reduced interactions over time.

Since modifications to MAFMC management actions will occur through framework adjustments and plan amendments, they will undergo additional review to assess protected species.

Overall, the cumulative impacts of the past and present actions are positive for protected resources, due to reduced gear action with species of concern.

Human Communities

All actions taken under the Summer Flounder, Scup, and Black Sea Bass FMP have had effects on human communities. None have specifically been developed to primarily address elements of fishing related businesses and communities, but many actions have included specific measures designed to improve flexibility and efficiency. In general, actions that prevent overfishing have long-term economic benefits on businesses and communities that depend on those resources; however, many actions may lead to short-term negative economic impacts by reducing effort.

In particular, the development of ACLs and AMs and associated annual specifications have resulted in constraints on effort and revenues in the fishery, but annual catch limits and other measures have resulted in positive impacts on the stock that will positively impact human communities in the future. Amendments 2 and 10 had major implications for human communities, by limiting participation and allocating the resource by state, and imposing other gear and permitting requirements. These major actions resulted in mixed impacts to human communities, by imposing costs and eliminating some participants, but improving management's ability to control harvest and maintain positive biological conditions for the stock. Frameworks 2 and 6 for the recreational fishery provided overall positive benefits to human communities by allowing for increased management flexibility within the constraints of annual catch limits.

While short-term negative impacts may follow an action that reduces effort, past and present actions had positive cumulative impacts on vessel owners, crew, and their families in the summer flounder fishery by increasing their fishing revenues, incomes, and standards of living. The impacts of these past and present actions were also positive for the related sectors including dealers, processors, primary suppliers, to the vessels that sell them gear, engines, boats, etc. The increase in gross profits for summer flounder vessels and in crew incomes have had positive economic benefits on these sectors indirectly through the multiplier impacts. In general, revenues and price have increased over time. Future actions are expected to continue this trend. Therefore, the cumulative impacts of past and present actions are positive for human communities.

The summary effect of past and present actions is complex since the effects have varied among fishery participants, consumers, and communities. Nevertheless, the net effect is considered to be positive in that the fisheries managed under the Summer Flounder, Scup, and Black Sea Bass FMP currently support viable domestic and international market demand. While some short-term economic costs have been associated with effort reductions and gear modifications (Table 45), economic returns have generally been positive and as such, have tended to make a positive contribution to the communities associated with the harvest of these species.

Summary Effects of Future Actions

As with past and present actions, the list of reasonably foreseeable future actions is provided in Table 45. Additionally, the same general trends will be noted with regard to the expected outcomes of fishery related actions and non-fishing actions, the summary effects of fishery related actions tend to be positive with respect to natural resources though short-term negative or mixed effects are expected for human communities. Conversely, for the non-fishing actions listed in Table 45, the general outcome remains negative in the immediate project area, but minor for all VECs again due to the difference in scale of exposure of the habitat perturbation and the population. The directionality of impacts of future actions on the VECs will necessarily be a function of the offsetting negative vs. positive impacts of each of the actions. Since the magnitude and significance of the impacts of these future actions, especially non-fishing impacts, is poorly understood, conclusions as to the summary effects will essentially consist of an educated guess.

Recall that the future temporal boundary for this CEA is five years after full implementation of the amendment (~2024, section 9.4.2). Within that timeframe, the summary effects of future actions on managed resources, non-target species, habitat, and protected resources are all expected to be positive, notwithstanding the localized nearshore negative effects of non-fishing actions. The optimization of the conditions of the resources is the primary objective of the management of these natural resources. Additionally, it is unknown, but expected that technology to allow for mitigation of the negative impacts of non-fishing activities will improve.

For human communities, short-term (i.e., within the temporal scope of this CEA) costs may occur. This negative impact is expected to be the byproduct of an adjustment to the improved management of natural resources. In the longer term, positive impacts on human communities should come about as sustainability of natural resources is attained.

In terms of FMP-specific actions expected to be implemented before 2020, other than the continuation of specifications, the only known FMP modification for summer flounder, scup, and black sea bass expected is a framework action to increase flexibility in recreational fisheries management for summer flounder, scup, and black sea bass. This action is expected to have positive impacts on target and non-target species, would maintain the current conditions of habitat and protected resources, and would have mostly positive impacts on human communities.

For longer-term actions under the FMP for summer flounder, scup, and black sea bass, the MAFMC will begin development of a summer flounder amendment to re-evaluate the commercial/recreational allocation, as well as to consider modifications to recreational management strategies. This action will be initiated following implementation of this Commercial Issues Amendment, and is expected to result in positive impacts on non-target species. Similar to this action, this future amendment is expected to maintain the current condition of habitat, and will have uncertain impacts on protected resources and likely mixed impacts on human communities. It is possible that the MAFMC will develop a black sea bass amendment addressing similar issues, which would have similar impacts on each VEC as those described for the future summer flounder amendment.

A summary of the cumulative impacts of past, present, and reasonably foreseeable future actions on each VEC is provided in Table 46.

Table 46: Summary of expected impacts of combined past, present, and reasonably foreseeable future actions on each VEC.

VEC	Past Actions (P)	Present Actions (Pr)	Reasonably Foreseeable Future Actions (RFFA)	Combined Effects of Past, Present, Future Actions
Managed Resources	**Positive** Combined effects of past actions have decreased effort, improved habitat protection	**Positive** Current regulations continue to manage for a sustainable stock	**Positive** Future actions are anticipated to strive to maintain a sustainable stock	**Positive** Stocks are being managed sustainably
Non-Target Species	**Positive** Combined effects of past actions have decreased effort and reduced bycatch	**Positive** Current regulations continue to decrease effort/increase efficiency and reduce bycatch	**Positive** Future regulations are being developed to improve monitoring and address bycatch issues	**Low positive** Decreased effort/increased efficiency and reduced bycatch continue; most non-target stocks continue to be sustainably managed under ACLs/AMs
Habitat	**Mixed** Combined effects of effort reductions and better control of non-fishing activities have been positive, but fishing activities and non-fishing activities have reduced habitat quality	**Mixed** Effort reductions and better control of non-fishing activities have been positive but fishing activities continue to reduce habitat quality	**Mixed** Future regulations will likely control effort and habitat impacts but as stocks improve, effort may increase along with additional non-fishing activities	**Mixed** Continued fisheries management will likely control effort and thus fishery related habitat impacts but fishery and non-fishery related activities will continue to reduce habitat quality
Protected Resources	**Positive** Combined effects of past fishery actions have reduced effort and thus interactions with protected resources	**Positive** Current regulations continue to control effort, thus reducing opportunities for interactions	**Mixed** Future regulations will likely control effort and thus protected species interactions, but as stocks improve effort will likely increase, possibly increasing interactions	**Positive** Continued effort controls along with past regulations will likely help stabilize protected species interactions

Human Communities	**Mixed** Management actions have imposed requirements that reduced short-term revenues and increased costs, however, stock improvements have led to community benefits and in the long term	**Mixed** Management actions continue to constrain effort, at times reducing short-term revenues, however, stock improvements continue to benefit human communities in the long term; price and revenues are generally increasing	**Mixed** Future regulations will likely control effort and thus reduce revenues at times, but long-term maintenance of sustainable stock will lead to long-term benefits to human communities	**Mixed** Continued fisheries management will impose requirements that may reduce short-term revenues or increase costs; sustainable management should improve community benefits in long-term

9.4.4 Baseline Condition for the Resources, Ecosystems, and Human Communities

For the purposes of this CEA, the baseline condition is considered as the present condition of the VECs plus the combined effects of the past, present, and reasonably foreseeable future actions. Table 47 summarizes the added effects of the condition of the VECs (i.e., status/trends/stresses from Section 1.3 and Table 45) and the sum effect of the past, present, and reasonably foreseeable future actions (from Table 46). The resulting CEA baseline for each VEC is exhibited in the last column of Table 47(shaded). In general, only qualitative metrics are available for the VECs. For managed species, the baseline condition is likely positive given the continued fisheries that target and catch the managed species. For non-target species, none of the relevant species identified in section 1.3 are experiencing overfishing (although the Northern sea robin stock is unassessed, and the status is unknown). Black sea bass, scup, spiny dogfish, and species within the Northeast skate complex are not overfished with the exception of thorny skate; the status of sea robins is unknown. The conditions of the habitat and human communities VECs are complex and varied. As such, the reader should refer to the characterizations given in Section 1.3. For protected resources the baseline is negative in the short run given continued interaction but should be positive in the long run as additional mitigations are implemented. As mentioned above, the CEA Baseline is then used to assess cumulative effects of the proposed management actions.

Table 47: **Summary of the current status, combined effects of P,PR,RFF actions, and the combined baseline condition of each VEC.**

VEC	Status and Trends	Combined Effects of Past, Present, and Reasonably Foreseeable Future Actions (Table 46)	Combined CEA Baseline Conditions
Managed Resource	Not overfished, overfishing occurring as of 2015 fishing year. Biomass trending down since 2011.	**Positive** Stocks are being managed sustainably	**Positive** Stocks are being managed sustainably
Non-target Species	Black sea bass, scup, spiny dogfish are not overfished/overfishing is not occurring. No stocks in Northeast skate complex are experiencing overfishing and none are overfished except thorny skate. Status of Northern sea robin is unknown.	**Low positive** Decreased effort and reduced bycatch continue; most non-target stocks continue to be sustainably managed under ACLs/AMs	**Low positive** Decreased effort and reduced bycatch continue; most non-target stocks are not overfished/not overfishing
Habitat	Fishing impacts are complex and variable and typically adverse (see section 1.3); Non-fishing activities have had historically negative but site-specific effects on habitat	**Mixed** Continued fisheries management will likely control effort and thus fishery related habitat impacts but fishery and non-fishery related activities will continue to	**Low positive** Continued fisheries management will likely control effort and thus fishery related habitat impacts; recovery will be limited, but overall knowledge of and

VEC	Status and Trends	Combined Effects of Past, Present, and Reasonably Foreseeable Future Actions (Table 46)	Combined CEA Baseline Conditions
		reduce habitat quality and/or prevent recovery	protection of key habitats continues to improve
Protected Resources	Sea Turtles: Endangered or threatened under ESA Large whales: Some endangered under ESA, all protected under MMPA Small cetaceans and pinnipeds: protected under MMPA Atlantic salmon (Gulf of Maine DPS): threatened under ESA Atlantic sturgeon: New York Bight, Chesapeake, Carolina, and South Atlantic DPSs are endangered under ESA	**Positive** Continued effort controls along with past regulations will likely help stabilize protected species interactions	**Positive** Stocks are being managed for sustainability, but some in poor status. Reduced gear encounters through effort reductions and additional management actions taken under ESA/MMPA have resulted in generally positive baseline conditions with the exception of some species, e.g., northern right whales.
Human Communities	Complex and variable. Landings have since 2011 due to declining stock biomass and catch limits. From 2012-2016, commercial ex-vessel value averaged $28 million per year. 766 commercial moratorium permits were issued in 2017, with 332 reporting summer flounder landings. 19 ports from MA through NC have averaged over 100,000 lb of summer flounder landings annually from 2012-2016. Over 200 federally-permitted dealers from Maine through North Carolina purchased summer flounder in 2016.	**Mixed** Continued fisheries management will likely control effort and thus fishery related habitat impacts but fishery and non-fishery related activities will continue to reduce habitat quality	**Positive** Short term negative impacts occur from effort limitations, but long-term positive conditions result from higher prices and continued management under ACLs and AMs. Resource supports viable communities and economies.

Managed Resource Impacts CEA Baseline

The summer flounder stock is currently not overfished but is experiencing overfishing as of 2015 (the most recent year of data available for overfishing status). Biomass has generally been declining since 2011, although the stock has not reached the overfished threshold. Despite this trend, generally catch has not been exceeding the implemented ACLs, and overfishing has been largely resulting from several years of below average recruitment and a retrospective pattern in the stock assessment. Managers continue to adapt to changing scientific information to set catch limits to prevent overfishing and overfished status. In general, the stock is being managed for continued sustainability and the **baseline condition of the managed resource is positive**.

Non-target Species Impacts CEA Baseline

In general, interactions with non-target species in the commercial summer flounder fishery do not presently have a major impact on non-target stock status. Removals of these species as the result of the summer flounder fishery are generally low relative to their total removals. Most non-target species caught in this fishery have a positive stock status (with the exception of thorny skate, which is overfished, and Northern sea robin, which is unknown) and most are managed under ACLs and AMs to control and account for their total removals.

Incidental catch in the fishery is regularly monitored, and measures may be put in place to address any problematic increases in non-target bycatch that may occur. As mentioned above, non-fishing effects, although potentially negative to all fish species, are likely not exerting much negative effects on non-target species, due to the small scale of the habitat perturbation relative to the populations at large.

Overall, the baseline condition of the non-target species is positive as most non-target species have a positive stock condition and are managed for sustainability. Incidental catch is monitored and bycatch in the summer flounder fishery does not appear to be heavily influencing stock status at present.

Habitat Impacts CEA Baseline

For habitat, the summary effects of past and present actions assessed above in section 9.4.3 were considered to be low positive. Effort reduction or gear modifications will, in effect, reduce the magnitude of the direct negative impact on this VEC that results from fishing activities. Again, although the negative effects of past and present actions associated with non-fishing activities (Table 45) may have increased negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. Considering fishing effort over the next 5 years will likely remain similar to current levels, a resultant low positive impact on the habitat of "other" actions is anticipated. **Overall, the baseline condition of habitat is low positive**, due the combination of overall effort reductions reducing the extent of negative interactions with habitat, and continued advancement of the knowledge of and protection of important habitats.

Protected Resource Impacts CEA Baseline

For the protected species affected by this Amendment (listed in Section 7), the summary effects of the "other" past and present actions assessed above were considered to be negative in the short term but positive in the long term due to future effort reduction or gear modifications (gear modifications lessen the negative impact of a given level of effort). There are no currently planned actions that would directly reduce the mortality of protected resources from encounters with the summer flounder fishery.

Current and future actions and the current protection under MMPA and ESA are expected to result in positive cumulative impacts for these protected resources. Overall, while negative impacts occur in the short term due to fishery interactions, **the baseline condition of protected resources is generally positive over the long term** due to effort reduction and other efforts to reduce gear interactions, with the exception of species with particularly poor stock status, i.e., northern right whales.

Human Communities Impacts CEA Baseline

The net effect of past and present "other" actions is considered to be positive in that the fisheries managed under the FSB FMP currently support viable domestic and international market demand. While some short-term economic costs have been associated with effort reductions and gear modifications (See Table 45), economic returns have generally been positive and as such, have tended to make a positive contribution to the communities associated with harvest of these species. In the short-term future (i.e., within the temporal scope of this CEA), costs may occur. The negative impact is expected to the byproduct of an adjustment to the improved management of natural resources. In the longer term, positive impacts on human communities should come about as sustainability of natural resources is attained. **Overall, the baseline condition of human communities is uncertain but generally positive in the long term.**

9.4.5 Magnitude and Significance of Cumulative Effects

Determining the magnitude of the cumulative effects consists of determining the separate effects of the past actions, present actions, the proposed action (and reasonable alternatives), and other future actions. Once that is done, cumulative effects can be described. The significance of the effects is related to the magnitude, but also takes into account context distribution. Table 45 in section 7.4.3 lists the effects of individual past, present, and future actions to assist the reader in understanding the conclusions presented below regarding the summary effects of these separate actions. Note that fishery-related activities consist almost entirely of positive effects (with the exception of some short term negative effects on human communities) while non-fishing activities are generally associated with negative effects. This is not to say that some aspects of various VECs are not experiencing negative impacts, but rather that when taken as a whole and compared to the level of unsustainable effort that existed prior to and just after the fishery came under management control, the overall long-term trend is positive. The basis for this general outcome is explained in the text provided in section 9.4.3. Table 46 and associated text describes the summary effects of the past, present, and future actions on the VECs.

Summary Incremental Impacts of the Proposed Actions

The impacts of the proposed actions are described in Section 7 and summarized in the executive summary. Since the impact of every alternative on every VEC is described in those sections, they are not repeated here. For the Final EIS the incremental impacts of the preferred alternatives will be repeated here but there are no preferred alternatives yet.

Summary Cumulative Effects of the Proposed Actions

The cumulative effects of the proposed actions are strongly dependent on which combinations of actions are ultimately implemented. Once preferred alternatives have been selected a summary effects comparison will be made. However, regardless of which actions are ultimately implemented through this amendment, it is expected that the overall long-term cumulative effects should be positive for all VECs. This is because, barring some unexpected natural or human induced catastrophe, the regulatory atmosphere within which Federal fishery management operates requires that management actions be taken in a manner that will optimize the conditions of resources, habitat, and human communities. Consistent with NEPA, the MSA, requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. The document functions to identify the likely outcomes of various management alternatives. Identification of alternatives that would compromise resource sustainability should make implementation of those alternatives unlikely. With this in mind, the expected likely cumulative impacts for the VECs are described below. While again, the final selection of alternatives are not known, all of the alternatives in this document are geared toward goals of improved management of summer flounder. Assuming that some alternatives are ultimately selected, and the ones that are selected are those predicted to have positive impacts as described above in section 9, there should be positive impacts related to the above goals.

To determine the magnitude and extent of cumulative impacts of the alternatives, the incremental impacts of the direct and indirect impacts should be considered, on a VEC-by-VEC basis, in addition to the effects of all actions (those effects identified and discussed relative to the past, present, and reasonably foreseeable future actions of both fishing and non-fishing actions).

Table 48 provides a summary of likely cumulative effects found in the various groups of management alternatives contained in this Amendment. The CEA baseline that, as described above in Table 47, represents the sum of past, present, and reasonably foreseeable future (identified hereafter as “other”) actions and conditions of each VEC. When an alternative has a positive impact on the VEC, for example, reduced fishing mortality on a managed species, it has a positive cumulative effect on the stock size of the species when combined with “other” actions that were also designed to increase stock size. In contrast, when an alternative has negative effects on a VEC, such as increased mortality, the cumulative effect on the VEC would be negative and tend to reduce the positive effects of the other actions. The resultant positive and negative cumulative effects are described below for each VEC.

Table 48: Summary of cumulative impacts expected on the VECs.

Management measures	Target species (summer flounder)	Non-target species	Habitat/EFH	Protected Resources	Human communities
Federal permit requalification	**Slight positive:** Contributes to managing for a sustainable stock	**Slight positive:** Contributes to maintaining positive stock status for non-target species	**No impact:** Measures are not expected to create additional impacts on habitat	**Slight positive:** Measures will contribute to overall trend of reduced takes	**Mixed:** Cumulative effects will vary by community
Commercial allocation	**Slight positive:** Contributes to managing for a sustainable stock	**Slight positive:** Contributes to maintaining positive stock status for non-target species	**No impact:** Measures are not expected to create additional impacts on habitat	**Slight positive:** Measures will contribute to overall trend of reduced takes	**Mixed:** Cumulative effects will vary by community
Landings flexibility framework provisions	**Slight positive:** Contributes to managing for a sustainable stock	**Slight positive:** Contributes to maintaining positive stock status for non-target species	**No impact:** Measures are not expected to create additional impacts on habitat	**Slight positive:** Measures will contribute to overall trend of reduced takes	**Mixed:** Cumulative effects will vary by community

Cumulative Managed Resources Impacts

As noted in Table 45, the combined impacts of past federal fishery management actions have increased summer flounder biomass and increased the resilience of the stock, for example, by allowing the age structure of the stock to expand relative to its truncated status in earlier years. For the most part, the actions proposed by this amendment are expected to have slight positive impacts and continue the sustainability of the summer flounder resource.

Past fishery management actions taken through FMP and the annual specifications process have had a positive cumulative effect on managed resources. It is anticipated that the future management actions described in Table 45 will have additional indirect positive effects on the managed resources through actions which reduce and monitor bycatch, protect habitat, and protect the ecosystem services on the productivity of managed species depends. Overall, the past, present, and reasonably foreseeable future actions that are truly meaningful to the managed resources have had positive cumulative effects.

Catch limits, commercial quotas, and recreational harvest limits for summer flounder have been specified to ensure that the rebuilt stocks are managed sustainably and that measures are consistent with the objectives of the FMP under the guidance of the MSA. The impacts of annual specification of management measures are largely dependent on how effective those measures are in meeting the objectives of preventing overfishing and achieving optimum yield, and on the extent to which mitigating measures are effective. The proposed actions described in this document would positively reinforce the past and anticipated positive cumulative effects on the managed resources individually or in conjunction with other anthropogenic activities (Table 45). The impacts of this action (all permit requalification and reallocation alternatives) are expected to result in moderate positive impacts to summer flounder by maintaining the current positive stock status (sections 9.1.1 and 9.2.1).

The CEA baseline for managed resources is likely positive (Table 46). While the stock biomass has decreased somewhat in recent years, the stock remains above an overfished status, and catch limits are continually implemented based on the best available scientific information in order to prevent overfishing.

The past and present impacts, combined with any alternatives from the proposed alternatives and future actions which are expected to build stock biomass to target levels and strive to maintain sustainable stocks, should continue to yield non-significant positive impacts to the managed resources in the long term.

Cumulative Non-target Species Impacts

As noted in Table 45, the combined impacts of past federal fishery management actions have decreased effort and improved habitat protection, which benefits non-target species. In addition, current regulations continue to manage for sustainable stocks, thus control effort on direct and discard/bycatch species. The actions proposed by this amendment are expected to continue this trend. Finally, future actions are anticipated to continue rebuilding and thus limit the take of discards/bycatch in the summer flounder fishery, particularly through ACL management with AMs. Continued management of directed stocks will also control catch of non-target species. In addition, the effects of non-fishing activities on bycatch are potentially negative.

The CEA baseline for non-target resources is low positive (see Table 48). The provisions considered in this amendment are expected to have no impact to small impacts on non-target species, resulting in overall slight negative to moderate positive impacts to non-target species depending on possible effort shifts. In general, the alternatives in this amendment are expected to maintain the current positive stock status for non-target species.

The past and present impacts, combined with any alternatives selected from the proposed alternatives and future actions which are expected to continue to minimize impacts to non-target species, should continue to reduce negative impacts to non-target species and produce no impact to slight positive cumulative impacts in the future.

Cumulative Habitat Impacts

As noted in Table 45, the combined impacts of past federal fishery management actions have had positive impacts on EFH. In addition, better control of non-fishing activities has also been positive for habitat protection. However, both fishing and non-fishing activities continue to decrease habitat quality. None of the measures in this amendment are expected to have substantial impacts on habitat or EFH.

Past fishery management actions taken through the FMP and annual specifications process have had positive cumulative effects on habitat. The actions have constrained fishing effort both at a large scale and locally and have implemented gear requirements, which may reduce impacts on habitat. As required under these FMP actions, EFH and Habitat Areas of Particular Concern were designated for the managed resources. It is anticipated that the future management actions described in Table 45 will result in additional direct or indirect positive effects on habitat through actions which protect EFH and protect ecosystem services on which these species' productivity depends. These impacts could be broad in scope. All the VECS are interrelated; therefore, the linkages among habitat quality, managed resources, and non-target species productivity, and associated fishery yields should be considered. For habitat, there are direct and indirect negative effects from actions which may be localized or broad in scope; however, positive actions that have broad implications have been, and will likely continue to be, taken to improve the condition of the habitat. Some actions, such as coastal population growth and climate change may indirectly impact habitat and ecosystem productivity; however, these actions are beyond the scope of NMFS and Council Management. Overall, the past, present, and reasonably foreseeable future actions that are truly meaningful to habitat have had no impact to positive cumulative effects.

The proposed actions described in this document would not significantly change the past and anticipated cumulative effects on habitat and thus would not have any significant effect on habitat individually or in conjunction with other anthropogenic activities (Table 45). The impacts of this action (all permit requalification and reallocation alternatives) are expected to be indirect slight negative due to a continuation of current levels of fishing effort and as a result, prevention of habitat recovery in fished areas.

Overall, the combination of past, present, and future actions is expected to reduce fishing effort and hence reduce damage to habitat; however, it is likely that fishing and non-fishing activities will continue to degrade habitat quality and/or prevent habitat recovery. Thus, when the direct and indirect effects of the alternatives are considered in combination with all other actions (i.e., past, present, and reasonably foreseeable future actions), the cumulative effects should yield non-significant no impacts on habitat and EFH.

Cumulative Protected Resources Impacts

As noted in Table 45, the combined impacts of past federal fishery management actions have had positive effects on protected resources. Given their life history dynamics, large changes in protected species abundance over long time periods, and the multiple and wide-ranging fisheries management actions that have occurred, the cumulative impacts on protected species were evaluated over a long-time frame (i.e., from the 1980’s through the present). While some protected species are doing better than others, overall the trend of stock condition for protected resources has improved over the long-term due to reductions in the number of interactions. Past fishery management actions taken through the respective FMPs and annual specifications process have contributed to this long-term trend toward positive cumulative effect on protected species through the reduction of fishing effort (and thus reduction in potential interactions) and implementation of gear requirements. It is anticipated that future management actions, described in Table 45 will result in additional indirect positive effects on protected species. These impacts could be broad in scope. Overall, the past, present, and reasonably foreseeable future actions that are truly meaningful to protected species have had a positive cumulative effect.

The proposed actions described in this document would not change the past and anticipated cumulative effects on protected species and thus would not have any significant effect on protected species individually or in conjunction with other anthropogenic activities (Table 45) .

Continued fishing activity will continue to result in interactions with protected resources, potentially resulting in short-term negative impacts on these species, depending on their stock status. However, these fishing activities will continue to be regulated through FMPs and various federal agency actions to ensure that species of concern are protected.

Take reduction teams for marine mammals will continue to be convened and will continue to develop strategies and gear modifications for reducing interactions with protected marine mammals. Foreseeable future summer flounder FMP actions may have positive impacts on protected resources by reducing interaction rates with protected species.

Thus, when the direct and indirect effects of the alternatives are considered in combination with other actions (i.e. past, present, and reasonably foreseeable future actions), the cumulative effects should yield generally non-significant positive impacts on protected resources, with some exceptions for species with a mixed or negative baseline condition (e.g., northern right whales; note that this proposed action does not directly impact right whales).

Cumulative Human Communities Impacts

As noted in Table 45 the past federal fishery management actions have had mixed but generally positive impacts on human communities over the long-term.

Past major fishery actions such as Amendment 2, Amendment 10, and Amendment 15 have had impacts that have varied by community and in some cases have had negative short-term impacts by reducing access to the fishery (through permitting, allocations, and other measures). However, in the long-term, these measures generally contribute to a management system designed to maintain a sustainable stock for the long-term benefits of human communities. Implementing a system of limited access, allocated quotas, and overall annual catch and landings limits has had overall positive long-term benefits to human communities by maintaining a positive stock condition and generally improving prices and stability of the resource over time. In general, revenues have tended to increase over time.

Past fishery management actions taken through the FMP and annual specifications process have had both positive and negative cumulative effects by benefiting domestic fisheries through sustainable fishery management practices while also sometimes reducing the availability of the resources to fishery participants. Sustainable management practices are, however, expected to yield broad positive impacts to fishermen, their communities, businesses, and the nation as a whole. It is anticipated that the future management actions described in Table 45 will result in positive effects for human communities due to sustainable management practices, although negative effects on the human communities could occur if management actions result in reduced revenues. Overall, the past, present, and reasonably foreseeable future actions that are truly meaningful to human communities have had overall positive cumulative effects.

Catch limits, commercial quotas, and recreational harvest limits for summer flounder have been specified to ensure that these rebuilt stocks are managed in a sustainable manner and that management measures are consistent with the objectives of the FMPs under the guidance of the MSA. The impacts from annual specification of management measures on the managed species are largely dependent on how effective those measures are in meeting their intended objectives and the extent to which mitigating those measures are effective.

Overages may alter the timing of commercial fishery revenues such that revenues can be realized a year earlier. Impacts to some fishermen may be caused by unexpected reductions in their opportunities to earn revenues from commercial fisheries in the year during which the overages are deducted. For the commercial fishery, landings trends have generally been within 5% of the annual landings limits for the past 15 or more years, so generally any overage deductions for landings limits have been minor. While there have also been commercial ACL overages resulting in paybacks, these have been relatively small for summer flounder. The recreational fishery in some years has exceeded their harvest limit and/or their recreational ACL, resulting in short-term negative impacts resulting from necessary restrictions on recreational measures.

Despite the potential for negative short-term effects on human communities, positive long-term effects are expected due to the long-term sustainability of the managed stocks. Overall, the proposed actions described in this document would not change the past and anticipated cumulative effects on human communities and thus, would not have any significant effects on human communities individually or in conjunction with other anthropogenic activities (Table 45). The direct and indirect effects of the measures under consideration in this amendment are expected to be mixed in the short term and low positive in the long-term compared to the No Action because while a redistribution of fishery access may impact some communities negatively and some communities positively, over the long-term the measures in this action are expected to contribute to a management program that balances the needs of many stakeholder groups with the health of the resource, and results in long-term stock benefits that will provide long-term social and economic benefits to human communities.

Therefore, net cumulative impacts of the proposed measures and past actions on revenues and economic benefits from the summer flounder fishery would be low positive compared to the No Action.

Thus, the overall effects of reasonably foreseeable future actions on the fishery-related businesses and communities are low positive. In addition, the effects of non-fishing activities on fishing-related businesses and communities are mostly potentially negative (Table 45).

In this proposed action, the impacts of federal permit requalification alternatives are expected to have impacts on human communities ranging from moderate negative to slight positive, due to restricted access for some participants and a limitation of competition for others. For allocation alternatives, the impacts will vary by state and community, but could range from high negative to high positive.

The CEA baseline for human communities is positive. In summary, when the direct and indirect effects of the alternatives are considered in combination with other actions (i.e., past, present, and reasonably foreseeable future actions), these actions yield potentially low positive impacts on the fishery-related businesses and communities.

Atlantic States Marine Fisheries Commission

Horseshoe Crab Management Board

May 1, 2019
2:45 p.m. – 5:15 p.m.
Arlington, VA

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order *(J. Cimino)*	2:45 p.m.
2. Board Consent • Approval of Agenda • Approval of Proceedings from October 2018	2:45 p.m.
3. Public Comment	2:50 p.m.
4. 2019 Horseshoe Crab Benchmark Stock Assessment **Action** • Presentation of Stock Assessment Report (*J. Sweka*) • Presentation of Peer Review Panel Report (*L. Jacobson*) • Consider Acceptance of Benchmark Stock Assessment and Peer Review Report for Management Use (*J. Cimino*)	3:00 p.m.
5. Consider Management Response to 2019 Horseshoe Crab Benchmark Stock Assessment (*J. Cimino*) **Possible Action**	4:00 p.m.
6. Review and Populate Advisory Panel Membership (*T. Berger*) **Action**	5:00 p.m.
7. Other Business/Adjourn	5:10 p.m.

The meeting will be held at the Westin Crystal City, 1800 S Eads Street, Arlington, VA 22202; 703.486.1111

MEETING OVERVIEW

Horseshoe Crab Management Board Meeting
Wednesday May 1, 2019
2:45 p.m. – 5:15 p.m.
Arlington, Virginia

Chair: Dr. Malcolm Rhodes (SC) Assumed Chairmanship: 10/17	Horseshoe Crab Technical Committee Chair: Jeff Brunson (SC)	Stock Assessment Subcommittee Chair: Dr. John Sweka (FWS)
Vice Chair: Joe Cimino (NJ)	Horseshoe Crab Advisory Panel Chair: Allen Burgenson (MD)	Law Enforcement Committee Representative: Doug Messeck (DE)
Delaware Bay Ecosystem Technical Committee Chair: Greg Breese (FWS)		Previous Board Meeting: October 24, 2018
Voting Members: MA, RI, CT, NY, NJ, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (16 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from October 24, 2018 Board Meeting

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. 2019 Horseshoe Crab Benchmark Stock Assessment (3:00-4:00 p.m.) Action
Background • A benchmark stock assessment was recently completed and externally peer reviewed (**Briefing Materials**). • The assessment uses autoregressive integrated moving average (ARIMA) models to examine trends of fishery-independent surveys in four regional populations of horseshoe crabs. For the Delaware Bay region, the assessment also estimates population abundance using a catch multiple survey analysis (CMSA) model.

- The Peer Review Panel endorses the use of the ARIMA models to describe trends in the regional populations. The Peer Review Panel also endorses use of the CMSA model to estimate abundance of horseshoe crabs in the Delaware Bay region.

Presentations

- 2019 Horseshoe Crab Benchmark Stock Assessment Report by J. Sweka.
- 2019 Horseshoe Crab Benchmark Stock Assessment Peer Review Panel Report by L. Jacobson.

Board actions for consideration at this meeting

- Consider approval of the Stock Assessment and Peer Review Reports for management use.

5. Consider Management Response to 2019 Horseshoe Crab Benchmark Stock Assessment (4:00 p.m.-5:00 p.m.) Possible Action

6. Review and Populate Advisory Panel Membership (5:00 -5:10 p.m.) Action

Background

- South Carolina nominated Nora Blair to be appointed to the Horseshoe Crab Advisory Panel (AP) as a representative of the biomedical industry (**Briefing Materials**).

Board actions for consideration at this meeting

- Approve the nomination to appoint Nora Blair to the Horseshoe Crab AP.

7. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

HORSESHOE CRAB MANAGEMENT BOARD

The Roosevelt Hotel
New York, New York
October 24, 2018

These minutes are draft and subject to approval by the Horseshoe Crab Management Board
The Board will review the minutes during its next meeting

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).

2. **Approval of Proceedings of October 2017** by Consent (Page 1).

3. **Move to select Harvest Package 3 (500,000 male-only crabs) for 2019 horseshoe crab bait harvest in Delaware Bay** (Page 5). Motion by David Borden; second by Roy Miller. Motion carried (Page 6).

4. **Move to accept the Horseshoe Crab 2018 FMP Review and State Compliance Reports and approve *de minimis* requests for the Potomac River Fisheries Commission, South Carolina, Georgia and Florida.** (Page 8). Motion by Robert Boyles; second by Pat Geer. Motion carried (Page 9).

5. **Move to elect Joe Cimino as Vice Chair** (Page 9). Motion by Bob Ballou; second by John Clark. Motion carried (Page 9).

6. **Move to approve the nomination for Lawrence Voss to the Horseshoe Crab Advisory Panel** (Page 9). Motion by John Clark; second by Robert Boyles. Motion carried (Page 9).

7. **Move to adjourn,** by Consent (Page 9).

ATTENDANCE

Board Members

Raymond Kane, MA (GA)
Rep. Sarah Peake, MA (LA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Jay McNamee, RI (AA)
Bob Ballou, RI, Administrative proxy
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
David Borden, RI (GA)
Justin Davis, CT, proxy for P. Aarrestad (AA)
Sen. Craig Miner, CT (LA)
Bill Hyatt, CT (GA)
Michael Falk, NY, proxy for Sen. Boyle (LA)
Emerson Hasbrouck, NY (GA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
Joe Cimino, NJ, proxy for L. Herrighty (AA)
Tom Fote, NJ (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
John Clark, DE, proxy for D. Saveikis (AA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Roy Miller, DE (GA)
Michael Luisi, MD, proxy for D. Blazer (AA)
Russell Dize, MD (GA)
Ed O'Brien, MD, proxy for Del. Stein (LA)
Pat Geer, VA, proxy for S. Bowman (AA)
Bryan Plumlee, VA (GA)
Sen. Monty Mason, VA (LA)
Chris Batsavage, NC, proxy for S. Murphey (AA)
Robert Boyles, Jr., SC (AA)
Spud Woodward, GA (AA)
Doug Haymans, GA (GA)
James Estes, FL, proxy for J. McCawley (AA)
Rep. Thad Altman, FL (LA)
Sherry White, USFWS
Chris Wright, NMFS
Martin Gary, PRFC

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Doug Messeck, Law Enforcement Representative

Staff

Robert Beal
Toni Kerns
Kirby Rootes-Murdy
Mike Schmidtke
Kristen Anstead

Guests

Rachel Baker, NOAA
Peter Burns, NOAA
Lewis Gillingham, VMRC
Brett Hoffmeister, Assoc. of Cape Cod
Arnold Leo, E. Hampton, NY
Mike Millard, USFWS
Julia Socrates, NYS DEC
Benjie Swan, Limuli Labs

The Horseshoe Crab Management Board of the Atlantic States Marine Fisheries Commission convened in the Terrace Ballroom of the Roosevelt Hotel, New York, New York; Monday, October 24, 2018, and was called to order at 11:15 o'clock a.m. by Chairman Toni Kerns.

CALL TO ORDER

CHAIRMAN TONI KERNS: Good morning everybody. Malcolm Rhodes is not able to join us today; and as you can see on the agenda we'll be electing a Vice-Chair, so I will be subbing in as your Chair Woman today.

APPROVAL OF AGENDA

CHAIRMAN KERNS: We have an agenda before us. Are there any changes to the agenda? Seeing none; we will approve the agenda as it is presented.

APPROVAL OF PROCEEDINGS

CHAIRMAN KERNS: The proceedings from the October, 2017 meeting was on the materials. Are there any changes to the proceedings? Seeing none; those proceedings are approved by the Board.

PUBLIC COMMENT

CHAIRMAN KERNS: I think there is some public comment from a member of the public on items that are not on the agenda; if so please come up to the public microphone. When you come up to the microphone please identify yourself. You could also just use the one right there if it's easier.

MR. BRETT HOFFMEISTER: Good morning, my name is Brett Hoffmeister; I'm the LAL Production Manager for Associates of Cape Cod in Falmouth, Massachusetts. I first want to thank you; for allowing me the opportunity to speak today. I had just two quick things I would like to cover; and I will make it brief.

One, just a few comments on the FMP, I just got the supplementary materials the other day; and something I review every year. I look hard at are the numbers and what not. I've got a little laundry list of things; suggested improvements I guess. I've already talked to Mike about that a little bit.

But I think some of the things you may consider that would be improved upon are some more consistent reporting. As a for instance, you know us being in the biomedical field, and particularly our plant using bay crabs as part of that biomedical collection. There are inconsistencies with the numbers that are reported.

I can understand why some of that is; but even in the year-to-year from 2017 to 2016, for instance, we've got a discrepancy of almost 35,000 crabs in the number of bait crabs used. Somewhat minor stuff, but I try to keep a spreadsheet of this stuff and keep track of it throughout my time, and we see a lot of changes like that.

Any sort of improvements we could make for the consistent reporting that would include the same timeline, again as a for instance, crabs reported for the biomedical company are reported on a five-year average against this year's harvest; whereas the bait it's reported against last year's harvest. Maybe if you want to pick a five-year timeline and report those numbers, the consistency would be there. I think overall your reporting would improve. Again, not a major issue, something I'll probably work with Mike on. I can contact him directly.

I do appreciate everybody's effort, so I realize how difficult that is managing all those numbers. But I did want to make those comments while I was here. More importantly, my second comment is something that I'm personally very, very excited to share with you; something I've been working on for quite some time, a team and I, and I have a prepared statement.

As you all know there is a lot of interest in the horseshoe crabs; it's a very complex fishery, and there is a passionate following of people interested in conservation efforts around the horseshoe crabs. I would like everybody here to know that Associates of Cape Cod has always and will always deeply care for the resource on which we depend on for the manufacture of our products.

I am pleased to inform you about our most recent project; which we call the Horseshoe Crab Sustainability Project. This project is aimed at complementing our 45 year old history of crab conservation efforts; one of which is our rent-a-crab program, which we talked about earlier. In Massachusetts we used bait crabs prior to them being sold for bait.

The rent-a-crab program has been endorsed by the state since the year 2000; and allows us to take in some bait crabs and bleed them first. This gives us a unique opportunity to harvest gametes from those horseshoe crabs; both the eggs and the sperm, and fertilize them in vitro. Working with the state we've been issued a Class 1, Type 4 Aquaculture Permit by the state of Massachusetts Division of Marine Fisheries.

We've been working with our bait dealers, and we've come up with a process where we can easily collect these eggs and sperm from the crabs without harming the crabs. We have been very successful in not only raising larvae, but bringing them to the first and second instar juvenile molts.

The system that we have has a patent pending; and can literally produce tens of thousands or hundreds of thousands of juvenile crabs within a season. We began our research efforts back in 2017, really focused on getting the system in place and scaling up to a position that we could feel comfortable repeating large numbers of crabs.

I'm happy to say that to date we've released over 36,000 crabs to the waters of the state of Massachusetts, and lots more to come. ACC believes that this program will help ensure a stable population of horseshoe crabs; as well as help to ensure the genetic diversity for generations to come. This is something that we've just brought to the marketplace recently in the past month. It's my pleasure to share that with you today. That's all.

CHAIRMAN KERNS: Thank you, Brett, and that's very exciting news. We look forward to hearing more about that. We can work with you; Mike and I can work with you on the inconsistency in the numbers, just noted that we are completing a benchmark stock assessment; so the data does get reviewed quite thoroughly, and we have been making a lot of changes due to that scrutiny of the data, so some updates this year are in light of the assessment and the extra scrutiny that we've been giving to the data.

MR. HOFFMEISTER: Fantastic! Thank you very much.

CHAIRMAN KERNS: I think that there is one other public comment; so please identify yourself and come to the microphone. Thank you.

MS. BENJIE L. SWAN: Hi, Benjie Swan from Limuli Labs in Cape May, New Jersey. Sorry if I sound out of breath; but the Lincoln Tunnel had a delay of like an hour and a half or something this morning, and the taxi ride over was very crowded as well. I am extraordinarily privileged to manufacture lysate and study horseshoe crabs for three decades.

I remain mindful of the immense importance of the horseshoe crab within the ecosystem. I've attended most Atlantic States Marine Fisheries Commission board meetings, and have commented chiefly on actions that affect our industry. For the last 40 years our industry has produced a quality product with a proven track record that saved and will continue to save billions of lives.

We handle the horseshoe crabs in a manner that ensures their survival, and release them back into the water following a return-to-sea policy established at the onset of our industry. We report our fishing numbers to our state and the Atlantic States Marine Fisheries Commission; with a reported mortality rate around 1 percent, and participate in the horseshoe crab management plan.

However, the horseshoe crab management plan is no longer about managing horseshoe crabs based on science; and promoting a sustainable fishery, but more about creating more restrictions in the Delaware Bay. The already strict restrictions in the Delaware Bay, the site of the greatest population of horseshoe crabs numbering in the millions, have pushed the harvest of horseshoe crabs into smaller subpopulations where the impacts may be significant.

We've focused on gathering data from only the Delaware Bay Area; a detriment to the other populations of horseshoe crabs along the east coast. We are managing the horseshoe crab for the red knot; in spite of the entire horseshoe crab population. We're also managing the horseshoe crab for the red knot, even though we know that many other factors contribute and are involved in the natural history of the red knot.

Lately biomedical companies have been unjustly criticized and misrepresented; in order to make the case for limiting biomedical collection. Biomedical companies have adjusted their collection of horseshoe crabs; particularly in the Delaware Bay Region, and any further limits puts the essential manufacture of the product in jeopardy.

We carry a tremendous responsibility to people worldwide to make a quality product. To make that product, biomedical companies must have access to healthy, sustainable horseshoe crab populations up and down the east coast. I am dumbfounded by the lack of respect for our industry; and the backroom dealings that diminish the critical importance of our use. Thank you for listening to me.

SET 2019 HARVEST SPECIFICATIONS

CHAIRMAN KERNS: Thank you, Benjie. All right, we will move on to the next agenda item; looking at the setting of the 2019 Harvest Specifications.

We will start with the review of the horseshoe crab and red knot indices of abundance for 2019 for the ARM model runs. I think Kristen will be going through that for us.

REVIEW HORSESHOE CRAB AND RED KNOT INDICES OF ABUNDANCE FOR 2018 ADAPTIVE RESOURCE MANAGEMENT (ARM) MODEL RUNS

DR. KRISTEN ANSTEAD: This morning I'm going to go through the population numbers for horseshoe crab and the red knots; and the annual running of the ARM model, and the recommendation it has for harvest in the Delaware Bay. Just as a reminder, the ARM model which operates in the Delaware Bay, this is its operating statement to manage the harvest of horseshoe crabs in the Delaware Bay to maximize harvest, but also maintain ecosystem integrity and provide adequate stopover habitat for migrating shore birds.

Every year we put in the red knot and horseshoe crab population estimates; and we measure them against these thresholds; which I will go back over just as a reminder. Then there are five harvest packages that the model picks from and makes a recommendation based on that. The ARM model takes into consideration both the horseshoe crab population dynamics, as well as the red knots.

It goes through several iterations of this with considerations for the numbers coming out of the Virginia Tech Trawl Survey; as well as the stopover population in the Delaware Bay, and the annual bait harvest in the region to come up with the recommendation. These are the five harvest packages.

They range from full moratorium, which is Harvest Package 1 that is no male or female harvest in the Delaware Bay, and then 2 that have a male-only harvest of different levels, and then two packages that have some female allowance. There are two population thresholds in the ARM model; one is for the female horseshoe crabs, which are set at 80 percent carrying capacity so that's 11.2 million female horseshoe crabs, as well as a red knot population threshold, which are 81,900 birds.

There are a few things to consider when the ARM model runs; which is if you're not at either of those thresholds there is unlikely to be any female harvest recommended for the Delaware Bay. The thought is if the horseshoe crabs get up to this level there should be sufficient eggs for the birds to stopover; so that would be the reaching of one of the thresholds, as well as if the crabs hadn't come up to that population.

But the birds have rebounded to their threshold; there is the potential for female harvest. There is also another constraint on female harvest in the Bay and that is the sex ratio of two males to one female for the spawning beach. That is just a reminder of how this works; and how you get female harvest or male-only harvest in the Bay.

REVIEW RESULTS OF 2018 ARM MODEL RUNS

DR. ANSTEAD: These are the red knot population numbers for the last few years. This year was very similar to last year; it's been pretty stable the last few years, and you can see the confidence intervals around it, and the red line is that population threshold. You can see that we're still under the population threshold for red knots. The stopover duration was also similar to last year; and overall it's kind of tracking pretty similarly to previous years. The horseshoe crab abundance is mainly determined by the Virginia Tech Trawl Survey. I have included the orange dots; which is the composite index, which was developed for the years that the Virginia Tech Survey did not run. There were several years there where it wasn't funded; and so the Committee pulled from three other surveys that operate in that region, the Delaware 30 Foot Trawl, the New Jersey Delaware Bay Trawl, and the New Jersey Ocean Trawl, and came up with a composite index to kind of gap fill those years, because the ARM model has to have something to run off of.

You can see that it looks, based on the years that the Virginia Tech Trawl is run that they track pretty well; but those are the orange dots. Those are the years where the Virginia Tech Trawl was not operating. For this year we have 8.4 million female horseshoe crabs coming out of this ARM model as a population estimate. That is still under the threshold, but it is an increase over the last few years. The males have ticked down a little bit.

I'm not sure if that's a product of sampling, or if that's a product of the male-only harvest. I think we'll need a couple more years to really determine if that's a real tick down, or if that's just an anomaly for the year. They are still quite high; and the sex ratio is fine. Just to recap. There is a slight delay here; so we take the horseshoe crabs from 2017 fall, because the Virginia Tech Trawl operates in the fall.

Then the third estimate from the spring; and those go into the ARM model. We have 8.4 million female horseshoe crabs; which are below threshold, and then 45,000 red knots, which is also below their threshold. The harvest package recommendation this year is Harvest Package 3 again; which is the 500,000 male-only harvests for the Delaware Bay states.

Then finally, you may recall that a couple years ago you all tasked us with doing a review of the ARM model; I think we did that in 2016, and it wasn't the full double loop review. We just kind of did what we could to look at some redundancies in the model; and we corrected those. We were also tasked with considering the incorporation of biomedical harvest into the ARM model the same way that bait is.

What are the amount of females being harvested in both of those, and put those into the ARM model; and we came back to you with two suggestions of how we could incorporate biomedical into the ARM model. I think we delayed that or you delayed that until we get the results of the benchmark stock assessment.

Once that stock assessment comes out, we're looking forward to getting back into some of this ARM review; and just making the model more applicable to all the data sources we have for the Bay. That's it and I'm happy to take any questions about the output of the ARM model this year.

CHAIRMAN KERNS: Are there any questions for Kristen? Bob Ballou.

MR. ROBERT BALLOU: Thank you, Kristen, great presentation. Is the recommendation essentially a status quo recommendation? I think it is, yes. Thank you.

DR. ANSTEAD: Yes.

CHAIRMAN KERNS: We'll get into that in a minute. David Borden.

MR. DAVID V. BORDEN: Do we have any sense for what the demand is; in terms of market demand for horseshoe crabs? I mean does it far exceed? I have no idea; I'm asking a question that I don't know the answer to.

DR. ANSTEAD: I believe, because we're going through the benchmark right now so I've made some figures about where harvest is in the Delaware Bay and how that's been tracking. I know previous years it had tracked down below quota; because I had heard that it is likely because of the market demand. I can't speak to the market; because we don't deal with that as far as the stock assessment, but I will say the landings have come back up closer to their quota in the last couple years, compared to those first years of male-only harvest.

CHAIRMAN KERNS: Mike.

DR. MIKE SCHMIDTKE: Just to add to that conversation with TC members. Sometimes for the bait use of horseshoe crabs, the crabs will be taken in one year and if they're not used in that year for the eel or the whelk fishery, sometimes they're frozen and kept for future years. That can affect the market price with the availability of frozen crabs from previous years.

CHAIRMAN KERNS: Craig.

MR. CRAIG D. PUGH: In our area, the Delaware Bay area, we find that what is harvested is consumed. If it is frozen it's generally frozen from the springtime and reused in the fall. But most of it is consumed on a year-to-year basis. There is very little holdover; and the marketability could always allow more in our situation.

CHAIRMAN KERNS: Tom Fote.

MR. THOMAS P. FOTE: The reason we're all under quota in the Delaware Bay is New Jersey has a moratorium that's been in effect by legislation all these years. There are no crabs and there is a market for them in New Jersey but there is no crabs being harvested.

SET 2019 HARVEST SPECIFICATIONS

CHAIRMAN KERNS: Any additional questions for Kristen**? We are looking now for a motion to set the 2019 harvest specifications. We had a recommendation for a status quo harvest package of 500,000 male-only crabs; it's Package 3. David Borden, is there a second? Roy Miller**. I will read that motion into the record.

Move to select Harvest Package 3; 500,000 male-only crabs for the 2019 horseshoe crab bait harvest in the Delaware Bay. Motion by Mr. Borden, seconded by Mr. Miller, David do you want to speak to your motion? No, all right. Are there any comments on this motion? Emerson Hasbrouck.

MR. EMERSON C. HASBROUCK: I think the question was asked earlier; but I didn't completely hear the response, I just want to verify. This is status quo, essentially. It's just a continuation of what the quota has been; is that right?

CHAIRMAN KERNS: That is correct.

MR. HASBROUCK: Thank you.

CHAIRMAN KERNS: Any comments or questions on this motion? Are there any members of the public that would like to comment on this motion? **Seeing none; since this is a specification it is a final action. Is there any objection to this motion? Are there any abstentions? All right, seeing none; motion approved unanimously.**

UPDATE ON THE HORSESHOE CRAB BENCHMARK STOCK ASSESSMENT

CHAIRMAN KERNS: We will move on to an update on the Horseshoe Crab Benchmark Stock Assessment. Kristen.

DR. ANSTEAD: I'll be brief here. We're on track to hit our revised deadline for turning in the stock assessment and getting it to you all. We hope that the TC will review it in February; and we'll address any comments at that time and take it to Peer Review in March. That means we will be presenting the benchmark stock assessment to the Board in the May meeting.

Again, just as a reminder, for the regions outside of Delaware Bay, we mainly have trend analysis. Inside the Delaware Bay we will have a catch-survey analysis. We've developed some reference points and the model is fully functioning; and we're excited about it. The only reason we can do this in the Delaware Bay is because of the Virginia Tech Trawl Survey; because they stage the crabs.

I just want to stress how critical this survey is to being able to assess the population in the Delaware Bay. With the catch survey model in the Delaware Bay, we will have bycatch estimates from the NEFOP dataset. We will have the biomedical numbers and we will have the bait numbers. We hope that it is more developed than the last time we had this in our benchmark stock assessment.

Finally, just as a reminder that the stock assessment is looking at the biomedical numbers on a regional level; so it's a confidential process, and the peer review will also be confidential. But what we will present to you is the same things we will present to the public; which will have some redacted parts, and we'll still have to find a way to work around that.

But we will be running that catch survey model with biomedical, without biomedical, and we will be talking about the differences and any changes in a stock status that we see by including it, or not including it. It will be a challenge; but that's just a reminder that it's an unusual stock assessment process and we kind of have to figure it out as we go. I'm happy to take any questions about that.

CHAIRMAN KERNS: Are there any questions for Kristen? Mike Millard.

DR. MIKE MILLARD: Thank you, Madam Chair. Kristen, Service staff has informed me there was a fair amount of discussion about the geographic and demographic resolution of the assessment that is underway; how to divide up what units to actually assess. Can you either one, confirm that or give us some sort of look ahead on what sort of the results are going to look like from this assessment, in terms of management as a coastwide, and in Delaware Bay. What is this assessment going to look like?

DR. ANSTEAD: You know that's a good question. Determining that population structure was one of our TORs and that is a challenge; because with horseshoe crab it does seem like there is really embayment specific populations that we don't have the data to support assessment at that level.

We have maintained the same regions as the previous assessment; because kind of the broader tagging study seems to indicate that they move within these kinds of more general areas. We will have the individual fishery independent survey trends for each of those regions; so one could look at it on that very specific, you know the Connecticut Long Island Trawl Survey as an index.

Then we will have also combined that with all the other indices for that New York region. Because it is trend analysis, I mean it is what it is for those regions; and we will say we think that in general for the New England region the stock is doing this or the southeast region seems to be increasing like it was for the previous assessment, based on trend analysis.

The Delaware Bay is the only one where we're going to get more substantial information out of. Yes we are developing the reference points for that region and a model; but really how that's used will be up to the Board, because we have the fully functioning ARM model, which has similar inputs and I think ultimately similar population estimates now. But I hesitate to say too much before we go through a peer review.

2018 FISHERY MANAGEMENT PLAN REVIEW AND STATE COMPLIANCE REPORTS

CHAIRMAN KERNS: Any additional questions? Seeing none; thank you Kristen and we will move on to the 2018 Fishery Management Plan Review and State Compliance Reports. Mike.

DR. SCHMIDTKE: Thank you Madam Chair. The Horseshoe Crab Plan Review Team got together on a conference call and conducted the 2018 FMP Review. Horseshoe crabs are currently managed under the original FMP; which was approved in 1998 along with associated addenda, the most recent of which was Addendum VII that established the ARM framework for the Delaware Bay.

Coastwide bait harvest declined shortly after establishment of the FMP; and has remained fairly consistent since about 2004. Similarly, coastwide biomedical-only collections and estimated mortalities for the biomedical use have been fairly consistent since about 2010. Reported coastwide bait landings in 2017 remain well below the quota.

Bait landings increased 23 percent from the previous year due to increases in Massachusetts, Connecticut, New York, Delaware, Maryland, Virginia, and Florida. Delaware harvested 39,000 crabs over their quota in a fishing season lasting only two weeks. They have stated in their compliance report that a crab-for-crab reduction in quota will occur in 2019.

North Carolina harvested 1,100 crabs over their quota and received a 1,200 crab quota transfer from Georgia that was approved earlier this year. In 2017, 483,000 crabs were collected solely for biomedical use. This was a 4 percent increase from the 2012 through '16 average; 95,000 crabs harvested for bait were bled prior to entering the market. Mortality attributable to the biomedical bleeding of horseshoe crabs is currently estimated as the number of crabs observed dead during the process; plus 15 percent of the number of bled crabs. In 2017 this estimate was about 73,000 crabs; a 4 percent increase from the average of the previous five years. This accounts for 7 percent of the total removals from the population; while bait harvest accounts for the other 93 percent. *De minimis* can be requested by states who have a combined average for bait landings for the last two years of less than 1 percent of the coastwide bait landings for the same two year period.

De minimis has been requested this year by Potomac River Fisheries Commission, South Carolina, Georgia, and Florida; all of these jurisdictions qualify for *de minimis* status. New Jersey qualified as they are currently in a moratorium for their bait harvest; but they did not request *de minimis* status.

With all this information the Plan Review Team has formed these recommendations as well as others that are mentioned in the report. They recommend continued seeking out of long term funding for the Virginia Tech Trawl Survey. Kristen highlighted the real need for this survey to continue for stock assessment; as well as ARM model purposes.

The survey has been funded through 2019; but the Commission is still looking for a long term funding source for that survey. So 2018 was the first year that a new format was used in compliance reports for reporting biomedical information. For the states that entered their information in this format, it was very useful from a staff perspective of being able to clearly see what information belongs in which category.

I would ask that in the future that states would consider using this format in future compliance reports. It will be included in the template that is sent out every year. Finally, the Plan Review Team recommends that the Board approve the 2018 FMP Review, State Compliance reports, and *de minimis* status for Potomac River Fisheries Commission, South Carolina, Georgia, and Florida and I can take any questions.

CHAIRMAN KERNS: Are there any questions for Mike? Yes, Justin.

DR. JUSTIN DAVIS: Mike, could you just remind me where does the 15 percent mortality rate come from for biomedical bleeding?

DR. SCHMIDTKE: It's a midpoint of several studies. Several studies have been conducted on biomedical mortality; some of them more than others replicating the actual biomedical process. Sometimes it's not able to be fully replicated within a research lab, university type of setting. There are a bunch of different studies; and 15 percent is kind of a midpoint of those studies.

That number is actually under review as part of the stock assessment process that's underway right now. We've gotten contributions from biomedical representatives; Benjie, Dr. Jim Cooper has also sent their reviews of different studies that are out there. In addition we are going to be trying to look at some tagging information to see if that can lend any additional light to that biomedical mortality estimate. That number will be assessed within that stock assessment as well.

CHAIRMAN KERNS: Bob Ballou.

MR. BALLOU: Mike, could you just review again the Delaware overage issue. I think I heard you say that they had a very brief two week season, they went over and they plan to adjust for that next year. If so, I'm thinking that is going to be a really short season next year, so I'm just wondering if I understood that correctly.

CHAIRMAN KERNS: John Clark.

MR. JOHN CLARK: Yes, what happened this year, the crabs obviously are really thick on the beach. This is hand harvest. We have an IVR system so the catch is called in every day. I think what happened this year was that we saw we were getting to the point where we were going to go over on a Friday.

By the time we were able to put the notice out to close the fishery, we went quite a bit over as you saw, just because it was more of a logistics issue. I mean we are getting the updated information every day. But there are just so many out there; and as Craig said the market is strong, so it was a few days without being able to close it and that's how far over we would get.

CHAIRMAN KERNS: Robert Boyles.

MR. ROBERT H. BOYLES, JR.: **If you're ready for a motion I would move that the Board accept the 2018 FMP Review and State Compliance Reports and grant *de minimis* status to Potomac River Fisheries Commission, South Carolina, Georgia, and Florida.**

CHAIRMAN KERNS: Seconded by Pat Geer. Are there any questions or comments on this motion? **Seeing none; is there any opposition to this motion? Seeing none; the motion is approved by unanimous consent.**

ELECT VICE CHAIR

CHAIRMAN KERNS: Moving on, as I said earlier we do not have a Vice-Chair for this management board, so I open the floor to nominations. Bob Ballou.

MR. BALLOU: **I move to nominate the distinguished gentleman from New Jersey; Joe Cimino for Vice-Chair of the Horseshoe Management Board.**

CHAIRMAN KERNS: Thank you, Bob; John Clark seconded. Robert.

MR. BOYLES: **I would move that we close the floor to nominations and that by acclamation we would select Joe Cimino from the Garden State as Vice-Chair.**

CHAIRMAN KERNS: Thank you, Robert, welcome, Joe!

ADVISORY PANEL MEMBERSHIP

CHAIRMAN KERNS: Tina Berger has an Advisory Panel nomination for the Board's consideration.

MS. TINA BERGER: I offer for the Board's consideration and approval Lawrence Voss; a commercial pot fisherman from Delaware as an addition to the Horseshoe Crab AP.

CHAIRMAN KERNS: John Clark.

MR. CLARK: I move that Lawrence Voss be added to the Horseshoe Crab Advisory Panel.

CHAIRMAN KERNS: Is there a second? Robert. **Any questions or comments, is there any objection to this motion? Seeing no objection; the motion carries by unanimous consent.**

ADJOURNMENT

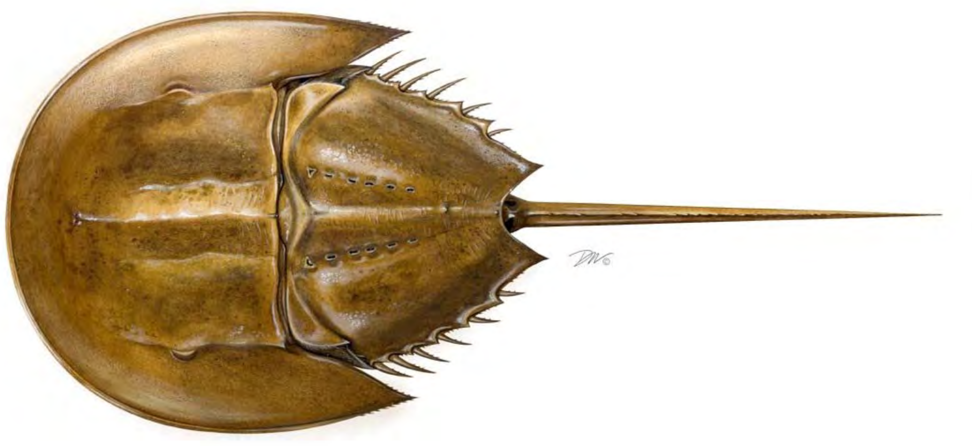
CHAIRMAN KERNS: That takes us to other business. Is there any other business that this Board wishes to address? Seeing none; I will entertain a motion to adjourn. Thank you, this Board is adjourned.

(Whereupon the meeting adjourned at 11:50 o'clock a.m. on October 24, 2018)

DRAFT DOCUMENT FOR BOARD REVIEW. PLEASE DO NOT CITE OR DISTRIBUTE.

Atlantic States Marine Fisheries Commission

2019 Horseshoe Crab Benchmark Stock Assessment
Non-Confidential Report



Vision: Sustainably Managing Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

Horseshoe Crab Benchmark Stock Assessment

Prepared by the
ASMFC Horseshoe Crab Stock Assessment Sub-Committee

John Sweka (Chair), U.S. Fish & Wildlife Service
Natalie Ameral, Rhode Island Division of Fish and Wildlife
Kristen Anstead, Atlantic States Marine Fisheries Commission
Linda Barry, New Jersey Division of Fish and Wildlife
Jeffrey Dobbs, North Carolina Division of Marine Fisheries
Michael Kendrick, South Carolina Department of Natural Resources
Kim McKown, New York State Department of Environmental Conservation
Michael Schmidtke, Atlantic States Marine Fisheries Commission
Dave Smith, U.S. Geological Survey
Rich Wong, Delaware Division of Fish and Wildlife

A publication of the Atlantic States Marine Fisheries Commission pursuant to National Oceanic and Atmospheric Administration Award No. NA15NMF4740069.

ACKNOWLEDGEMENTS

The Atlantic States Marine Fisheries Commission thanks all of the individuals who contributed to the development of the horseshoe crab stock assessment. The Commission specifically thanks the ASMFC Horseshoe Crab Technical Committee and Stock Assessment Subcommittee members who developed the consensus stock assessment report as well as the Atlantic Coastal Cooperative Statistics Program staff Heather Konell for validating landings. Thank you to Josh Newhard (USFWS) for additional help on the tagging data and Mike Wilberg (UMCES) for support with the CMSA modelling in ADMB.

Statement Regarding Confidential Data

Note: The stock assessment and peer review was conducted with the inclusion of biomedical data, which is confidential. Much of the report that details confidential data has been redacted for this public report and noted as **CONFIDENTIAL**. Results have been summarized when data was removed. Confidential data are data such as commercial landings, including biomedical harvest, which can be identified down to an individual or single entity. Federal and state laws prohibit the disclosure of confidential data, and the Atlantic States Marine Fisheries Commission abides by those laws. In determining what data are confidential, most agencies use the "rule of 3" for commercial catch and effort data. The "rule of 3" requires three separate contributors to fisheries data in order for the data to be considered non-confidential. This protects the identity of any single contributor. In some cases, annual summaries by state and species may still be confidential because only one or two dealers process the catch. Alternatively, if there is only one known harvester of a species in a state, the harvester's identity is implicit and the data for that species from that state is confidential.

EXECUTIVE SUMMARY

The purpose of this assessment was to evaluate the current status of horseshoe crab (*Limulus polyphemus*) along the U.S. Atlantic coast. Data from a variety of fisheries-dependent and – independent sources were reviewed and used to develop bait landings, commercial discard estimates, indices of abundance, and biomedical collection and mortality estimates as well as perform trend analyses, survival estimates, and a catch survey model.

Stock Identification and Management Unit

The Atlantic States Marine Fisheries Commission (ASMFC) manages the horseshoe crab stock from Maine to eastern Florida. Genetics, isotope analyses, and tagging data suggest that the horseshoe crab population is comprised of multiple units, some distributed across multiple states and others embayment-specific. Due to varying quantity and quality of data at these levels, for the purpose of this assessment, horseshoe crabs are evaluated on a coastwide and regional level consisting of the Northeast, New York, Delaware Bay, and the Southeast.

Commercial Fisheries

Horseshoe crabs are primarily harvested commercially as bait for the commercial American eel and whelk/conch fisheries along the Atlantic coast. Since 1998, states have been required to report annual landings to ASMFC through the compliance reporting process and bait landings were validated from Maine to Florida for 1998-2017 for this assessment. The majority of horseshoe crab harvest comes from the Delaware Bay region, followed by the New York, the Northeast, and the Southeast regions. Trawls, hand harvests, and dredges make up the bulk of commercial horseshoe crab bait landings. In recent years, the Delaware Bay region has been limited to male-only harvest through an adaptive management process that constrains the value of horseshoe crab harvest based on the needs of shorebirds. Horseshoe crab landings for 1998-2017 peaked in 1999 at 2.6 million horseshoe crabs and have decreased since the late 1990s. Landings have remained under 1 million horseshoe crabs since 2003 and from 2004-2017 average landings were 752,886 horseshoe crabs.

Horseshoe crabs are also collected by the biomedical industry to support the production of Limulus amebocyte lysate (LAL), a clotting agent that aids in the detection of endotoxins in patients, drugs, and intravenous devices. Blood from the horseshoe crab is obtained by collecting and extracting a portion of their blood. Most crabs collected and bled by the biomedical industry are, as required by the FMP, released alive to the water from where they were collected; however, a portion of these crabs die from the procedure. Crabs harvested for bait are sometimes bled prior to being processed and sold by the bait industry; these crabs are counted against the bait quota. Biomedical use has increased since 2004, when reporting began, but has been fairly stable in recent years. Previous assessments and management documents have applied a mortality rate of 15% to the number of horseshoe crabs bled and released alive to estimate the number of crabs that die each year during the process and this assessment maintains the 15% mortality rate based on an updated meta-analysis of available literature on this topic.

Horseshoe crabs are also encountered in several other commercial fisheries. Discard mortality occurs in various dredge fisheries and may vary seasonally with temperature, impacting both mature and immature horseshoe crabs; however, the actual rate of discard mortality is unknown. Commercial discards were estimated for the Delaware Bay region as part of this assessment with data from the NMFS' Northeast Fisheries Science Center's Northeast Fisheries Observer Program. Estimates indicate a significant amount of horseshoe crabs are captured and discarded in other fisheries, although a large amount of uncertainty is associated with the estimates.

Indices of Relative Abundance

There are spawning beach surveys available to monitor horseshoe crab spawning activity and one trawl survey designed to directly measure horseshoe crab abundance in the Delaware Bay region. These surveys were used to develop indices of relative abundance for the species. Additionally, several other fishery-independent surveys along the Atlantic coast that encounter horseshoe crabs were used to develop abundance indices. Many of these data sets had a high proportion of zero catches per tow in the survey and therefore all indices were developed using the delta distribution for the mean and variance for each year of a survey to specifically take into account the number of zero catches.

Assessment Methods

Tagging data from the USFWS horseshoe crab database were explored by region to estimate survival. The highest survival rates were in Delaware Bay and coastal Delaware-Virginia regions. The lowest were in coastal New York-New Jersey and the Southeast.

The horseshoe crab population was primarily evaluated using autoregressive integrated moving average models (ARIMA) on the coastwide-level and a catch multiple survey analysis (CMSA) for the Delaware Bay region. The CMSA modelling approach could only be developed in the Delaware Bay region due to the availability of the Virginia Tech Trawl Survey that collects stage-based data.

The results of ARIMA indicated that, in general, the Northeast surveys had conflicting trends, New York surveys showed decreasing trends, Delaware Bay surveys indicated increasing or neutral trends, and the Southeast showed increasing or neutral trends.

The CMSA indicated that adult abundance in the Delaware Bay was stable from 2003-2012 and then began increasing considerably in the last few years. This finding is consistent with stock rebuilding due to a period of significantly reduced commercial landings and tight management controls on the fishery beginning in the early 2000s in this region. Recruitment is less stable throughout the time series due to the missing years of data from the survey.

Prior to this assessment, biomedical data were not included in the modeling efforts as a source of harvest. For this assessment, the CMSA was run with and without the biomedical and discard estimates to evaluate the contribution of these other sources of mortality. Population estimates were largely unaffected by the estimated biomedical or discard numbers. Omitting biomedical harvest resulted in a decrease of fishing mortality (*F*) by a small number that did not affect stock status. Commercial discards had a larger effect on *F* and omitting the discard estimates decreased *F* by more than omitting the biomedical data. Commercial discards are likely a larger source of removals than biomedical mortality although much uncertainty is associated with the estimates. Sensitivity runs around varying levels of biomedical mortality rates and the discard estimates indicate that harvest in the region, including biomedical, bait, and discard estimates, appear to be sustainable at current levels and management strategies.

Stock Status

To date, no overfishing or overfished definitions have been adopted by the Management Board. For this assessment, biological reference points were developed for the Delaware Bay horseshoe crab population although not endorsed by the Peer Review Panel for use in management. Stock status was determined on coastwide and regional stocks based on the results from the ARIMA and in comparison to similar analysis in past assessments. The current stock status indicates that the Northeast region, which has two surveys with conflicting results, is in a neutral state whereas the horseshoe population in the New York region is poor and has been declining in status from previous assessments. Based on ARIMA results, the Delaware Bay region is in a neutral state and the Southeast region is in a good state.

Region	2009 Benchmark	2013 Update	2019 Benchmark[1]	2019 Stock Status
Northeast	2 out of 3	5 out of 6	1 out of 2	Neutral
New York	1 out of 5	3 out of 5	4 out of 4	Poor
Delaware Bay	5 out of 11	4 out of 11	2 out of 5	Neutral
Southeast	0 out of 5	0 out of 2	0 out of 2	Good
Coastwide	7 out of 24	12 out of 24	7 out of 13	Neutral

[1] The number of surveys below the index based 1998 reference point in the terminal year from ARIMA modeling

Table of Contents

LIST OF TABLES

LIST OF FIGURES

TERMS OF REFERENCE

For the 2018 ASMFC Horseshoe Crab Benchmark Stock Assessment

Board Approved October 2017

Terms of Reference for the Horseshoe Crab Assessment

1. Define population structure based on available data. If alternative population structures are used in the models (e.g., coast-wide, regional, sub-regional or estuary-specific), justify use of each population structure.

2. Characterize precision and accuracy of fishery-dependent and fishery-independent data, including biomedical data, that are used in the assessment, including the following but not limited to:
   a. Provide descriptions of each data source (e.g., geographic location, sampling methodology, potential explanation for outlying or anomalous data)
   b. Describe calculation and potential standardization of abundance indices.
   c. Discuss trends and associated estimates of uncertainty (e.g., standard errors)
   d. Justify inclusion or elimination of available data sources.
   e. Discuss the effects of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size) on model inputs and outputs.

3. Develop models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, and analyze model performance.
   a. Describe stability of model (e.g., ability to find a stable solution, invert Hessian)
   b. Justify choice of CVs, effective sample sizes, or likelihood weighting schemes.
   c. Perform sensitivity analyses for starting parameter values, priors, etc. and conduct other model diagnostics as necessary.
   d. Clearly and thoroughly explain model strengths and limitations.
   e. Briefly describe history of model usage, its theory and framework, and document associated peer-reviewed literature. If using a new model, test using simulated data.
   f. If multiple models were considered, justify the choice of preferred model and the explanation of any differences in results among models.
   g. State assumptions made for all models and explain the likely effects of assumption violations on synthesis of input data and model outputs.
   h. Incorporate biomedical data into the models used. Reassess associated mortality of bled crabs coast-wide, or regionally if possible.

4. Characterize uncertainty of model estimates and biological or empirical reference points.

5. Perform retrospective analyses, assess magnitude and direction of retrospective patterns detected, and discuss implications of any observed retrospective pattern for uncertainty in population parameters (e.g., F, SSB), reference points, and/or management measures.
6. Recommend stock status as related to reference points (if available). For example:
    a. Is the stock below the biomass threshold?
    b. Is F above the threshold?

7. Other potential scientific issues:
    a. Compare trends in population parameters and reference points with current and proposed modeling approaches, including the results of the ARM model for the Delaware Bay. If outcomes differ, discuss potential causes of observed discrepancies.
    b. Evaluate the sub-lethal effects of biomedical bleeding on horseshoe crabs.
    c. Compare reference points derived in this assessment with what is known about the general life history of the exploited stock. Explain any inconsistencies.

8. If a minority report has been filed, explain majority reasoning against adopting approach suggested in that report. The minority report should explain reasoning against adopting approach suggested by the majority.

9. Develop detailed short and long-term prioritized lists of recommendations for future research, data collection, and assessment methodology. Highlight improvements to be made by next benchmark review.

10. Recommend timing of next benchmark assessment and intermediate updates, if necessary relative to biology and current management of the species.

Terms of Reference for the Horseshoe Crab Peer Review

1. Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:
    a. Presentation of data source variance (e.g., standard errors).
    b. Justification for inclusion or elimination of available data sources,
    c. Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),
    d. Calculation and/or standardization of abundance indices.

2. Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:

   a. Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?
   b. If multiple models were considered, evaluate the analysts' explanation of any differences in results.
   c. Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, plus group treatment).

3. Evaluate the diagnostic analyses performed, including but not limited to:
   a. Sensitivity analyses to determine model stability and potential consequences of major model assumptions
   b. Retrospective analysis

4. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

5. If a minority report has been filed, review minority opinion and any associated analyses. If possible, make recommendation on current or future use of alternative assessment approach presented in minority report.

6. Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.

7. Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods/measures.

8. Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.

9. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.

10. Prepare a peer review panel terms of reference and advisory report summarizing the panel's evaluation of the stock assessment and addressing each peer review term of reference. Develop a list of tasks to be completed following the workshop. Complete and submit the report within 4 weeks of workshop conclusion.

1 INTRODUCTION

1.1 Brief Overview and History of the Fisheries

Historically, horseshoe crabs (*Limulus polyphemus*) were harvested commercially for fertilizer and livestock feed. Between the mid-1800s and mid-1900s harvest ranged from approximately 1 to 5 million crabs annually (Shuster 1960; Shuster 1982; Shuster and Botton 1985; Finn et al. 1991). Harvest numbers dropped to between 250,000 and 500,000 crabs annually in the 1950s (Shuster 1950) and 42,000 crabs were reported annually by the early 1960s (Finn et al. 1991). Early harvest records should be viewed with caution due to potential under-reporting. The period between 1950 and 1960 is considered the lowest period of horseshoe crab abundance. The substantial commercial-scale harvesting of horseshoe crabs ceased in the 1960s (Shuster 1996).

Since the mid to late 1900s, horseshoe crabs have been commercially harvested primarily for use as bait and to support a biomedical industry. Horseshoe crabs are commercially harvested primarily for use as bait in the conch (*Busycon* spp.) and American eel (*Anguilla rostrata*) pot fisheries, although they are also harvested to a lesser extent for use as bait in the catfish (*Ictalurus* spp.) and killifish (*Fundulus* spp.) fisheries. The biomedical industry uses crabs, most notably, for the manufacture of Limulus Amebocyte Lysate (LAL), a product used to test pharmaceuticals for the presence of gram-negative bacteria. Since 1998, horseshoe crabs have been managed under the Interstate Fishery Management Plan (FMP) for Horseshoe Crab (1998) and its subsequent addenda (Addenda I-VII) by the Atlantic States Marine Fisheries Commission (ASMFC).

Commercial harvest information prior to 1998 is available through the National Marine Fisheries Service and the previous ASMFC stock assessments (ASMFC 2009a, 2013). Commercial landings from 1998-2017 were validated through the Atlantic Coastal Cooperative Statistics Program (ACCSP) by the states during this assessment process, and non-validated landings were not used in any models or analyses. Shortly after establishment of the Interstate Fishery Management Plan (FMP) for Horseshoe Crab in 1998, commercial landings declined until approximately 2004, after which they fluctuated without a long-term directional trend around an average of 753,000 crabs from 2004-2017 (Table 1, Figure 1). A notable increase in coastwide harvest occurred in 2017, with the largest harvest since 2003. However, this harvest was still over 500,000 crabs less than the coastwide quota established by the FMP (1.587 million crabs).

Horseshoe crabs from the Delaware Bay region (New Jersey-Virginia) have been of particular concern due to their relationship with red knots (*Calidris canutus*), a shorebird species currently listed as Threatened by the US Fish and Wildlife Service (USFWS). In 2012, the Adaptive Resource Management (ARM) model was approved for use, beginning with the 2013 fishing season. The ARM model determines bait harvest levels for the Delaware Bay using population estimates of horseshoe crabs and red knots in that region. Prior to the ARM model's use, New Jersey enacted a commercial harvest moratorium (2006) and Delaware instituted regulations allowing commercial harvest of male crabs only (2008) through state laws. Since use of the ARM model began, the model has recommended and the Horseshoe Crab Management Board

(Board) has annually specified harvest package 3 (500,000 male-only crabs) for the Delaware Bay. This regional quota has been allocated among states or areas where crabs of Delaware Bay origin are harvested (New Jersey, Delaware, Maryland, and Virginia east of the COLREGS line). Although they receive a share of the Delaware Bay quota, the commercial moratorium in New Jersey remains in effect.

1.2 Management Unit Definition

The fishery management unit includes the horseshoe crab stock(s) of the Atlantic coast of the United States (Maine to eastern Florida). The coastwide stock is currently managed on state by state, multi-state (e.g., Delaware Bay region), and embayment levels. See section 2.1 Stock Definition for more information.

1.3 Regulatory History

1.3.1 Interstate Management

Prior to 1998, horseshoe crab harvest was unregulated in most states. The Horseshoe Crab Management Board approved the Horseshoe Crab FMP in October 1998. The goal of the FMP is "management of horseshoe crab populations for continued use by: current and future generations of the fishing and non-fishing public (including the biomedical industry, scientific and educational research) migratory shorebirds; and other dependent fish and wildlife (including federally listed sea turtles)" (ASMFC 1998a). The FMP outlined a comprehensive monitoring program and maintained controls on the harvest of horseshoe crabs put in place by New Jersey, Delaware, and Maryland prior to the approval of the FMP. These measures were necessary to protect horseshoe crabs within and adjacent to the Delaware Bay, which is the epicenter of spawning activity along the Atlantic coast. However, subsequent increased landings in other states largely negated these conservation efforts.

In April 2000, the Management Board approved Addendum I to the Horseshoe Crab FMP (ASMFC 2000a). This Addendum established a coastwide, state-by-state annual quota system to further reduce horseshoe crab landings. Through Addendum I the Board recommended to the federal government the creation of the Carl N. Schuster Jr. Horseshoe Crab Reserve, an area of nearly 1,500 square miles in federal waters off the mouth of Delaware Bay that is closed to horseshoe crab harvest. In May 2001, the Board approved Addendum II, which established criteria for voluntary quota transfers between states (ASMFC 2001). In March 2004, the Board approved Addendum III to the FMP (ASMFC 2004a). This addendum sought to further the conservation of horseshoe crab and migratory shorebird populations in and around the Delaware Bay. It reduced harvest quotas, implemented seasonal bait harvest closures in New Jersey, Delaware, and Maryland, and revised monitoring components for all jurisdictions.

Addendum IV was approved in May 2006 (ASMFC 2006a). It further limited bait harvest in New Jersey and Delaware to 100,000 crabs (male only) and required a delayed harvest in Maryland and Virginia. Addendum V, adopted in September 2008, extended the provisions of Addendum IV through October 31, 2009 (ASMFC 2008a). Through a vote, the Board extended the provisions of Addendum IV through October 31, 2010. Addendum VI further extended

Addendum IV provisions through April 30, 2013. It also prohibited directed harvest and landing of all horseshoe crabs in New Jersey and Delaware from January 1 through June 7, and female horseshoe crabs in New Jersey and Delaware from June 8 through December 31 (ASMFC 2010). Addendum VI also mandated that no more than 40% of Virginia's annual quota may be harvested east of the COLREGS line in ocean waters. It also requires that horseshoe crabs harvested east of the COLREGS line and landed in Virginia must be comprised of a minimum male to female ratio of 2:1.

Addendum VII was approved in February 2012 (ASMFC 2012). This addendum implemented the Adaptive Resource Management (ARM) Framework for use during the 2013 fishing season and beyond. The Framework considers the abundance levels of horseshoe crabs and shorebirds in determining the optimal harvest level for the Delaware Bay states of New Jersey, Delaware, Maryland, and Virginia (east of the COLREGS). The Board annually reviews recommended harvest levels from the ARM Subcommittee, who run the ARM model, and specifies harvest levels for the following year in New Jersey, Delaware, Maryland, and Virginia. Since initial implementation in 2013, the ARM model has recommended harvest package 3, and the Board has acted in accordance with this recommendation, specifying annual Delaware Bay harvests of 500,000 male-only horseshoe crabs in every year. State quotas throughout the Atlantic coast, with regards to the interstate FMP, have been specified through 2019 (Table 2) and have generally remained the same since 2013. In accordance with the FMP, any overages of quotas set by the FMP have been accounted for through Board-approved quota transfers between states or by a crab-for-crab quota reduction for the state with the overage in the following year.

1.3.2 State Management

Summaries of state-specific horseshoe crab management regulations are provided below. These summaries are not intended to be comprehensive. For complete sets of regulations, please reference states' marine fisheries agencies.

1.3.2.1 Massachusetts

Massachusetts is issued an annual bait harvest quota of 330,377 crabs, but voluntarily imposes a more restrictive quota of 165,000 crabs. The biomedical fishery is not subjected to an annual quota. There are two permits under which horseshoe crabs can be harvested, a limited entry fishery regulated permit endorsed for horseshoe crab bait harvest, or a biomedical harvest permit. A permit is not required to harvest or possess six or fewer crabs per day. Licensed pot fishermen may possess more than six crabs without a regulated horseshoe crab permit as long as the source of the crabs is a documented permitted wholesale or bait dealer.

After they are bled, crabs collected under the biomedical harvest permit are required to be released back in to the waters from which they were collected. Mobile gear fishermen harvesting with a permit endorsed to harvest horseshoe crabs for bait are subjected to a possession and landing limit of 300 crabs per calendar day or fishing trip (whichever is longer). Non-mobile gear bait harvesters are prohibited from landing or possessing more than 400 crabs per day. Biomedical harvest permit holders are prohibited from landing or possessing more than 1,000 crabs per day. Regardless of permit type, there is a 7-inch minimum legal size. The import of Asian horseshoe crabs is prohibited.

Bait harvesters can only sell to bait dealers, and biomedical harvesters can only sell to biomedical dealers. However, bait dealers can loan bait crabs to biomedical dealers in what is known as the “rent-a-crab” program, where crabs intended for the bait market can be sold to biomedical dealers, bled, and then returned to the bait dealer. Rent-a-crabs are counted against the bait quota.

Permit restrictions are issued annually through a letter of authorization (LOA) to those permitted to receive crabs for biomedical purposes. This LOA states that crabs collected by the biomedical fishery must be returned in good condition to the embayment in which they were collected. All bled horseshoe crabs must be marked after bleeding with a distinct marking (changing each year) to avoid re-bleeding within a season. Crabs with the current year’s marking cannot be re-bled during the same year. Crabs also must be transported in temperature-controlled trucks set to between 50-60 F°, and temperature in lab and holding areas cannot exceed 70 F°. Containers holding crabs cannot be more than 2/3 full to reduce the chance of crushing crabs at the bottom of a container. Crabs also must be kept moist. Horseshoe crabs cannot be harvested during five-day lunar closures, starting two days prior and ending two days after the new and full moons from mid-April through the end of June. In addition, those using mobile gear cannot harvest on Fridays or Saturdays during the summer flounder season (beginning June 10th and lasting until the summer flounder quota is reached). Pleasant Bay, located in Eastern Cape Cod has been closed to bait harvest since 2007.

1.3.2.2 Rhode Island

Commercial harvest of horseshoe crabs in Rhode Island is currently managed using seasons, quota, and mandated reporting. In addition to possessing either a Rhode Island Multipurpose license or a Principal Effort/Commercial fishing license with a non-lobster crustacean endorsement, commercial harvesters must also obtain a horseshoe crab permit approving their participation in either bait, biomedical, or both fisheries. As of the 2017 season, commercial bait harvest has been closed during the month of May and restricted to 60 crabs per day when open. The commercial biomedical harvest is closed from two days before to two days after new and full moons (a five-day closure) during the month of May and does not entail a daily possession limit. Reporting of commercially harvested crabs is required via phone call to the Department of Marine Fisheries every Monday for the previous calendar week’s landings and monthly via paper report delivered no later than 15 days after the close of the month being reported. Minimum size limit remains at seven inches in prosomal width.

1.3.2.3 Connecticut

All horseshoe crab harvest from Connecticut waters requires a commercial license, and directed hand harvest of horseshoe crabs also requires an additional Horseshoe Crab Endorsement. All applicable license types are restricted to those with previous history, although license transfer is allowed under specific conditions. When taken under a commercial horseshoe crab trawl license, the possession limit is 25 crabs per vessel per trip or per day, whichever is the longer period of time. No transfer at sea is allowed. When taken under a commercial horseshoe crab hand-harvest license, the possession limit is 500 crabs per license holder per 24-hour period that begins at 12:00 pm. No person taking horseshoe crab under a hand-harvest license shall use any tool, except that gloves may be worn by the license holder. Any person that does not hold a commercial hand-harvest license and an endorsement letter is prohibited from entering the water to assist a licensee. Such unlicensed or unendorsed persons are not prohibited from carrying crabs that have been placed on the beach by the license holder to a storage container or vehicle or taking crabs from a license holder for storage while remaining in a boat. Since December 2000, hand-harvest of horseshoe crabs is not allowed from three closed areas; (1) Menunketesuck Island in Westbrook; and (2) the area known as Sandy Point in West Haven; and (3) the area known as Milford Point in Milford.

Connecticut's quota is 48,689 crabs, as set by Addendum IV in 2001. From 2001-2006 the open harvest season included only June, and since 2007 it extends from May 22 through July 7, exclusive of weekends. Since 2000, all commercial license holders have been required to report horseshoe crab landings (numbers of crabs) monthly by gear type and fishing area. All harvest is recorded as commercial landings regardless of whether it is sold for any purpose or kept for personal use.

1.3.2.4 New York

To commercially harvest horseshoe crabs for bait a person must have a commercial crab permit and a commercial horseshoe crab permit. Five or less horseshoe crabs may be harvested for personal use without a commercial bait permit. To harvest horseshoe crabs for biomedical purposes a person must have a biomedical harvester permit and must sell to a company that has a biomedical user permit. A person must have a valid commercial crab license to be eligible for a biomedical harvester permit. A person must be approved by the FDA to produce LAL to be eligible for a biomedical user permit. Biomedical user permit holders must ensure all horseshoe crab used in the production of LAL are either returned to the location of harvest as soon as possible after the bleeding process or sold as bait and reported as bait harvest. A person may only apply for and hold one horseshoe crab permit type in a calendar year.

The total annual commercial fisheries bait harvest of horseshoe crabs may not exceed the amount annually allocated to New York State by ASMFC pursuant to the FMP (currently 366,272 crabs). For more than a decade New York has voluntarily limited the commercial harvest quota to 150,000 crabs. The Department of Environmental Conservation (DEC) is authorized to set seasonal quota caps and daily trip limits.

Commercial bait harvest permit holders must file monthly harvest reports, except during May, June, and July, when harvest reports must be submitted weekly. Biomedical harvest permit holders must file monthly harvest reports. In addition, they must notify the DEC 24 hours in advance with details on the planned harvest. Biomedical user permit holders must file monthly reports. In addition, they must notify the DEC 24 hours in advance of releasing horseshoe crabs back into the water.

Horseshoe crabs may only be taken for commercial and biomedical purposes by: hand harvest, pound net, trap net, gill net, otter trawl, seine or dredge. Dredges used to harvest horseshoe crabs shall not be greater than six feet in width. Except during the months of September and October, dredges may not be used to harvest horseshoe crabs in the Atlantic Ocean. The possession or landing of horseshoe crabs from any vessel having a dredge onboard is also prohibited while the dredge fishery is closed.

The DEC may establish closed areas for commercial hand-harvest of horseshoe crabs if it determines that the area receives significant use by spawning horseshoe crabs or shorebird species for which horseshoe crab eggs are an important food source. The DEC may also close harvest in areas managed by a local, state, or federal agency or governing body as public recreation areas, at the request of that agency or governing body.

1.3.2.5 New Jersey

A moratorium is in place on the harvest of horseshoe crabs and horseshoe crab eggs for an indeterminate period of time. The law prohibits the possession of horseshoe crabs and horseshoe crab eggs except for those individuals in possession of a scientific collecting permit, allowing them to possess horseshoe crabs or horseshoe crab eggs for research or educational purposes only. Those fishermen utilizing horseshoe crabs as bait must provide adequate documentation that the horseshoe crabs in their possession were not harvested in New Jersey. For those commercial fishermen in possession of horseshoe crabs, documentation shall include a receipt or bill that provides the name, address, and phone number of the person or company that provided the horseshoe crabs, the permit or license number of the person or company named, and the state and, if possible, the location where the horseshoe crabs were harvested.

1.3.2.6 Delaware

Delaware's annual horseshoe crab harvest is determined in accordance with the annual sex-specific allocations identified in Addendum VII to the FMP. Harvest is required to be reported by phone to the Delaware Department of Natural Resources Division of Fish and Wildlife (DNREC DDFW) on a daily basis. Upon reaching 95% of the annual allocation, DNREC establishes a date and time to close the fishery, based on recent fishery performance and landings. Any overages incurred are subtracted from the following year's horseshoe crab quota allocation.

Two methods of harvest are permitted and employed in Delaware's horseshoe crab fishery. Hand harvest licenses were capped in 1998, although transfer of licenses between qualified individuals is lawful. Individuals that have a current commercial eel license are also allowed to harvest horseshoe crabs for personal bait use. Harvest by eel licensees may not be sold or commingled with any other commercial harvest of horseshoe crabs. Annual hand harvest may not begin until June 8 and ends upon reaching the quota allocation. No more than 300 cubic feet of horseshoe crabs may be collected in a 24-hour period. If the quota has not been reached by June 30, five horseshoe crab dredge permits are issued via lottery, if more than five applications are received. Only current holders of oyster harvesting licenses are eligible for horseshoe crab dredge permits. Dredge harvest is limited to 1,500 horseshoe crabs per day. No harvest, by any method, is allowed to occur between sunset and sunrise.

Delaware has prohibited the use of more than one-half of a female horseshoe crab or one male horseshoe crab as bait in any type of pot on any one day. Bait saving devices are mandatory in all whelk pots employed in the state. Possession of Asian horseshoe crabs or parts thereof are prohibited without written authorization from the Director of the Division of Fish and Wildlife.

1.3.2.7 Maryland

The annual quota of male horseshoe crabs for the commercial fishery is 255,980 male crabs. There is no female harvest permitted. Harvest is subject to daily catch limits, determined by whether the harvester has a valid landing permit. Non-permitted harvesters may not land more than 25 horseshoe crabs per day. Permitted harvesters may not land more than 150 horseshoe crabs per day from May 1-July 9. From July 10-November 30, permitted harvesters are subject to daily limits as designated on their respective permits.

The bait fishery is subject to seasonal restrictions. From May 1-July 9, horseshoe crabs from outside one mile of the Atlantic coast or from Maryland's coastal bays and tidal tributaries may be caught and landed, but crabs may not be caught within one mile of the Atlantic Coast or the Chesapeake Bay and its tidal tributaries. From July 10-November 30, horseshoe crabs from the state tidal waters may be caught and landed. From December 1-April 30, horseshoe crabs may not be caught or landed in Maryland.

Horseshoe crabs used for scientific purposes (including biomedical use) must be collected by individuals with scientific collection permits. These permits are only granted with proof that collected crabs are being supplied to a facility approved by the US Food and Drug Administration (FDA). Only male crabs may be collected from January 1-June 6. Crabs must be transported in a refrigerated truck and returned within 48 hours. A chain of custody form must follow the crabs from collection to release, and an annual report detailing use of horseshoe crabs is due to the state by January 31 of the following year.

1.3.2.8 Potomac River Fisheries Commission (PRFC)

Potomac River commercial watermen are required to keep an accurate and complete daily account of their catches and releases and submit these reports to the PRFC on a weekly basis.

1.3.2.9 Virginia

Virginia allocates its quota annually among five different harvest gear types including trawl, dredge, pound nets, by-hand, and by other gear. Each one of these gear types is limited entry and requires a gear-specific harvesting permit to participate in the fishery. The harvest of horseshoe crabs in Virginia requires a Commercial Fishing Registration License as well as a gear-specific horseshoe crab harvesting permit. The daily landing limits for each gear-specific license are 2,500 crabs by Trawl Permit, 2,500 crabs by Class A Dredge Permit, 1,000 crabs by Class B Dredge Permit, 500 crabs by Hand Harvest Permit, 500 crabs by Pound Net Permit, and 250 crabs by General Category Permit.

Daily harvest of horseshoe crabs in Virginia must be reported to the agency on a monthly basis through the Virginia Mandatory Reporting Program. Individuals also must call in daily harvests of horseshoe crabs to the agency each day. Each dealer must obtain a Horseshoe Crab Buying Permit in order to buy horseshoe crabs in Virginia. These permitted buyers must supply daily reports of all horseshoe crabs bought on a monthly basis.

The landing of horseshoe crabs in Virginia by trawl is prohibited from January 1 through June 7 of each year and is limited to male only harvest. Virginia prohibits the harvest of horseshoe crabs within 1,000 feet in any direction of the mean low waterline from May 1 through June 7 of each year. Individuals must obtain a Scientific Collection Permit from the Virginia Marine Resources Commission in order to harvest horseshoe crabs for biomedical purposes.

1.3.2.10 North Carolina

Commercial harvest regulations are set by proclamation of the Division of Marine Fisheries Director as stated in North Carolina Marine Fisheries Commission Rule 15A NCAC 03L .0207. The current harvest season is January 1 to April 30 each year with a 50 crab per day limit. An additional opening can occur later in the year if sufficient quota remains uncaught.

Biomedical use crabs are subject to the same harvest regulations as the commercial harvest. Additionally, a biomedical use permit is required as outlined in North Carolina Marine Fisheries Commission Rule 15A NCAC 03O .0503 (a) pursuant to the ASMFC Horseshoe Crab FMP.

1.3.2.11 South Carolina

Taking or possessing horseshoe crabs is unlawful except under permit granted by the South Carolina Department of Natural Resources (SCDNR). Horseshoe crabs may be possessed for educational purposes or for use in LAL production, with appropriate permits. There is no commercial harvest or sale of horseshoe crabs in South Carolina.

Educational permits allow harvest and possession of no more than 25 horseshoe crabs or parts of horseshoe crabs taken in South Carolina state waters.

Horseshoe crabs from which blood is collected for production of LAL may be held in facilities approved by the SCDNR and must be handled so as to minimize injury to the crab. Horseshoe crabs collected must be returned unharmed to state waters of comparable salinity and water quality as soon as possible after bleeding unless subsequent retention is permitted. Horseshoe crabs must be collected by hand outside of restricted areas. Facilities permitted to use horseshoe crabs for LAL production are required to submit monthly reports of collection activity and any mortality that occurs while crabs are possessed.

1.3.2.12 Georgia

All Georgia salt waters are closed to the taking of horseshoe crabs for bait except during those times when the salt waters or portions thereof are opened to the taking of shrimp, whelk, or blue crab by trawling. All horseshoe crab harvest by gear other than a trawl requires a commercial license with a horseshoe crab endorsement. Harvest by trawl requires a commercial trawl license.

It is unlawful for any person taking horseshoe crabs to take or possess more than 25 horseshoe crabs at any one time or for there to be on board the boat used for the taking more than 75 horseshoe crabs at any one time, whichever is less. The taking or catching of horseshoe crabs incidentally during legal fishing operations of other marine species is not a violation of this Rule if the horseshoe crabs so taken in excess of the limits are immediately returned to the water from which they were taken without being intentionally or negligently harmed by the taker or the equipment being used. Horseshoe crabs landed in other states may be imported with appropriate documentation.

Collections of crabs for biomedical use must be conducted by harvesters licensed by the Georgia Department of Natural Resources (GADNR). Individuals that possess crabs for biomedical use must also have a license from GADNR. There are no restrictions on the number of horseshoe crabs that may be taken for biomedical use. Crabs collected for biomedical use are to be returned unharmed to state waters of comparable salinity and water quality as soon as feasible after blood extraction.

1.3.2.13 Florida

Harvest, possession, and sale of horseshoe crabs within Florida state waters requires a current Saltwater Product License (SPL), and no recreational harvest is allowed. Horseshoe crabs must be harvested by hand or gig; all other gear and methods are prohibited. Those possessing a current SPL, can harvest 25 crabs per day. An SPL holder with a Marine Life endorsement can harvest 100 crabs per day, and SPL holders with a permit to harvest eels commercially in freshwater may harvest 100 crabs per day. Harvesting crabs for biomedical purposes require a Horseshoe Crab Biomedical Collecting Permit. This permit has no bag or possession limits if the crabs are maintained and released alive in the area where collected. Biomedical permits are valid for one year and require an activity report detailing the number of crabs collected, areas of collection, and percent mortality up to the point of release, to be submitted by May 1 each year.

1.4 Assessment History

1.4.1 Previous stock assessments

The initial stock assessment for horseshoe crab was completed and peer reviewed in 1998 (ASMFC 1999; ASMFC 1998b). A new assessment framework was proposed in 2000 (ASMFC 2000b), and an internally peer-reviewed assessment was produced in 2004. The most recent externally peer-reviewed benchmark stock assessment was completed in 2009 (ASMFC 2009a) and updated in 2013 (ASMFC 2013).

The ARM model currently used to provide management advice for horseshoe crab in the Delaware Bay region (ASMFC 2009b). Since the first year of implementation of the ARM, the model is renewed annually to set harvest specifications in the region.

1.4.2 Summary of Previous Assessment Models

1.4.2.1 Model Description

The 2013 stock assessment update consisted of trend analyses using autoregressive integrated moving averages (ARIMA). In previous assessments (ASFMC 2004b, 2009a), linear trend analyses were also conducted and a meta-analysis (Manly 2001) was used to evaluate consensus among trends. The peer-review panel for the 2009 assessment concluded that the ARIMA modeling was a good advancement in trend analysis and superseded other trend analyses (ASMFC 2009a, 2009c).

The 2009 benchmark stock assessment also included the application of a surplus production model (Prager 1994) and a catch-survey model (Collie and Sissenwine 1983) for the Delaware Bay region. Those models were not included in the 2013 stock assessment update because of improvements that needed to be made as per peer review comments which could be addressed only as part of a benchmark stock assessment. Previous application of these models to the Delaware Bay region did not include mortality due the biomedical industry – an oversight.

Multispecies models have been developed to support adaptive management of horseshoe crab harvest and recovery of the migratory shorebird populations that rely on horseshoe crab eggs in Delaware Bay (primarily Red Knot). The predictive horseshoe crab models are stage-based models based on Sweka et al. (2007). The ARM Framework is described in separate reports developed by the ARM workgroup and reported through the Delaware Bay Ecosystem Technical Committee. The ARM Framework, established through Addendum VII (2012), incorporates both shorebird and horseshoe crab abundance levels to set optimized harvest levels for horseshoe crabs of Delaware Bay origin and is fully described in ASMFC 2009b. This model is updated annually to set harvest specifications and operates outside of the ASMFC benchmark and update stock assessment processes.

1.4.3 Results of the Previous Assessment

No overfishing or overfished definitions have been adopted by the Management Board. Models that could be used in determining overfishing and overfished status were not run as part of the stock assessment update in 2013, the last time the stock was assessed. The 2013 stock assessment update found that horseshoe crab abundance trends varied regionally/sub-regionally based on the ARIMA results. Positive trends were observed in the Southeast and for some indices in Delaware Bay regions. In the Southeast region there was evidence that abundance has remained stable or continued to increase since the 2009 stock assessment. In Delaware Bay, there was evidence for demographic-specific increases in abundance through the time series of data, but trends have been largely stable since the 2009 stock assessment. An exception was the continued sharp increase in abundance indices from the New Jersey Surf Clam Dredge Survey. Declining abundance was evident in the New York and the Northeast regions. These declines were evident in the previous 2004 and 2009 stock assessments, and trends have not reversed. The status of horseshoe crabs in the Northeast region appeared worse in 2013 than what it was during the 2009 stock assessment, with more indices likely less than their Q_{25} and 1998 reference points.

1.4.4 Previous Peer Review Comments

The 2009 peer review panel commended the SAS on advances they made during the benchmark stock assessment including the development of the ARM model and the use of ARIMA. They encouraged the continued development of the catch survey analysis (CSA) and made several recommendations during the 2009 benchmark stock assessment for the application of trend analyses, ARIMA, the surplus production model, and the CSA for future assessments (ASMFC 2009c).

2 LIFE HISTORY

Horseshoe crabs are characterized by high fecundity, high egg and larval mortality, and low adult mortality (Botton and Loveland 1989; Loveland et al. 1996). They breed in late spring on low-energy coastal beaches along the Atlantic and Gulf of Mexico coasts, laying eggs in nests buried in the sand. Larvae hatch from the eggs within 2-4 weeks, although some larvae may overwinter within nests and hatch out the following spring (Botton et al. 1992). Planktonic larvae typically settle within one to two weeks of hatching and begin molting. Juvenile crabs remain in the intertidal flats, usually near breeding beaches. Older individuals move out of intertidal areas to deeper waters (Botton and Ropes 1987). Crabs are thought to mature around 10 years of age and may live up to 20 or more years.

2.1 Stock Definitions

This stock assessment is for the Atlantic coast horseshoe crab populations that range from Gulf of Maine to Florida. The species range extends into the Gulf of Mexico from Florida west into Louisiana and south to the Yucatán Peninsula. The species is considered to be absent from Texas to Tabasco, México.

Ecological processes, genetic patterns, and tagging analyses suggest a regional or sub-regional population structure. Botton and Loveland (2003) examined abundance and dispersal of horseshoe crab larvae in Delaware Bay. They found a strong tendency for larvae to stay close to spawning beaches. This finding suggests that larval dispersal is not the mechanism for mixing populations (Botton and Loveland 2003). Studies revealing high genetic diversity among populations allow assessments of sex-specific gene flow patterns, which indicate that males disperse at higher rates than females (Pierce et al. 2000, King et al. 2005). This sex-biased dispersal of sexually mature individuals implies that if a population becomes extirpated, gene flow alone may not be sufficient to repopulate an area due to limited larval dispersal potential (Botton and Loveland 2003) and female migration (Swan 2005) among embayments (King et al. 2005).

King et al. (2005), with the intent to account for the genetic structure at a scale relevant to conservation and management, suggested that the distribution of the American horseshoe crab is comprised of multiple population units divided among large geographic regions. Based on the major zones of discontinuity in the genotypic patterns of nDNA, Smith et al. (2017) structured a rangewide risk assessment into the following regions and then integrated the regional assessments to the species level. The transnational genetically-informed regions were:

- Gulf of Maine (USA), including embayments from Great Bay estuary in New Hampshire and north into Maine
- Mid-Atlantic (USA), including all embayments south of New Hampshire to and including North Carolina
- Southeast (USA), including embayments in South Carolina and Georgia, but note that the Georgia population extends into northern Florida
- Florida Atlantic (USA), including embayments along the Atlantic coast of Florida south of the Georgia population
- Northeast Gulf of Mexico (USA), including embayments along the Gulf coast of Florida, Alabama, barrier islands of Mississippi, and easternmost barrier island of Louisiana.
- Yucatán Peninsula (México), including embayments on the western, northern, and eastern portions of the peninsula (the Mexican states of Campeche, Yucatán, and Quintana Roo) and Mexican portion of the Caribbean Sea.

Also, tagging data indicate that a majority of adult crabs remain within local regions and some overwinter in local embayments (ASMFC 2004; James-Pirri et al. 2005; Swan 2005; Smith et al. 2006; Moore and Perrin 2007). Tag release and recapture data from the United States Fish and Wildlife Service horseshoe crab tagging database was used to examine patterns in release and recapture location. Tag recaptures after more than three months at large were examined for the following regions: Northeast, coastal New York-New Jersey, coastal Delaware-Virginia, Delaware Bay, Chesapeake Bay, and Southeast (Table 3 and Table 4).

More than 93% of recaptures were within the region of release except for those released in the coastal Delaware-Virginia. Among those released in coastal Delaware-Virginia, 66% were recaptured in coastal Delaware-Virginia and 31% were recaptured in Delaware Bay. These results are consistent with a regional horseshoe crab population structure. Rutecki et al. (2004) argued for management to consider harvest rates and population abundances possibly down to the embayment level.

Evidence of regional differences are further supported by stable isotope analyses, which indicate adult crabs are loyal to local feeding grounds (Carmichael et al. 2004; O'Connell et al. 2003). Trends in horseshoe crab abundance and population dynamics differ among regions (ASMFC 2004; Smith et al. 2017). Smaller sized populations such as those in Cape Cod waters may be localized based on spawning densities, size structure, and movement patterns (Carmichael et al. 2003; James-Pirri et al. 2005).

Finally, different embayments and regions are subject to different types and levels of harvest for different purposes. Since different types of harvest (bait, biomedical, or scientific) select for different size and sex segments of the population, different populations may experience different harvest pressures due to their location-specific population dynamics (Rutecki et al. 2004). Widener and Barlow (1999) studied a population of horseshoe crabs that appeared to be a local one. They concluded, “Harvesting large numbers of animals from such a local population would have significant impact on its size” (Widener and Barlow 1999). In Delaware Bay waters, commercial harvest is conducted by hand and dredge (Kraemer and Michels 2009), while in areas such as Cape Cod most harvest is conducted by hand from local beaches (Rutecki et al. 2004). In Delaware Bay, the majority of harvested crabs are collected for bait. In contrast, among Cape Cod populations, the primary purpose for which crabs are harvested (bait, biomedical, or scientific) varies by embayment (Rutecki et al. 2004) with bait harvest predominating except in Pleasant Bay where only biomedical harvest is permitted (A. Leschen, personal communication). Since mortality associated with each harvest type varies, the extent of harvest pressure and depletion by overharvest also necessarily varies among embayments (Widener and Barlow 1999; Rutecki et al. 2004). Hence, there is strong support for local management based on regional or sub-regional population structure and harvest pressures.

For purposes of this assessment, the coastwide stock of horseshoe crabs was divided into four geographic regions based on genetic analysis, data availability, and state boundaries. These four regions include: 1) Northeast – Maine south to Rhode Island; 2) New York – Connecticut south to northern New Jersey; 3) Delaware Bay – northern New Jersey south to Virginia; and 4) Southeast – North Carolina south to the Florida Keys (Figure 2).

2.1.1 Genetics

A range of molecular genetic techniques applied across multiple studies has been used in attempts to assess population structure (stock identification) in horseshoe crabs. These studies now include the first range-wide surveys of nuclear DNA variation in any horseshoe crabs (King et al. 2015). King et al. (2003, 2005, 2015) found that the correlation of genetic and geographic distance among horseshoe crab populations sampled along the Atlantic coast suggests isolation by distance as the driving force behind population structure. The more recent findings (King et al. 2005, 2015) suggest the presence of similar levels of genetic diversity and variation among the collections, punctuated with a series of genetic discontinuities of varying “depth” across the species’ range that could indicate demographic independence or regional adaptation, and reflect vicariant geographic events. Populations sampled within these regional groupings exhibit shallow but statistically significant differentiation. Moreover, populations at the ends of the range are more differentiated from nearby populations than are populations in the middle of the range from their neighbors. A separate study showed possible subdivision between collections from the upper Chesapeake Bay and near the entrance of Delaware Bay (Pierce et al. 2000). However, this finding is in contrast to what King et al. found. Pierce et al. (2000) also suggest that the samples from the upper Chesapeake Bay show a resident population. In addition, based on electrophoretic evidence, gene flow does occur between widely separated populations, although considerable genetic variation exists within and between populations of horseshoe crabs (Selander et al. 1970). Saunders et al. (1986) found no evidence for genetic divergence between New England and middle Atlantic populations based on mitochondrial DNA analysis.

2.1.2 Morphometric Information

Shuster (1979) suggested that each major estuary along the coast had a discrete horseshoe crab population, which could be distinguished from one another by adult size, carapace color and eye pigmentation. Differences between the morphologic characteristics of discrete populations were seen among geographically distinct populations (Riska 1981). Larger animals and populations are reported in the middle of the species' distribution (Maryland to New York), while smaller animals and populations are found in the southern and northern extent of its range (Shuster 1982). However, based on morphometric data collected in South Carolina the greatest mean adult size occurs in the South Atlantic Bight and decreases in size north and south (Shuster 1950; Thompson 1998). Thompson (1998) hypothesized that larger individuals occur in the South Atlantic Bight due to optimal temperature and salinity for horseshoe crab development in this region.

Due to their morphological similarity to mid-Mesozoic taxa, horseshoe crabs are considered to be evolutionarily static (Kin and Błażejowski 2014) and have been referred to as phylogenetic relics (Selander et al. 1970). However, close inspection has revealed the presence of considerable morphological and genetic variability (Shuster 1979; Riska 1981; Selander et al. 1970; King et al. 2005; Faurby et al. 2010). Recent genetic studies (King et al. 2015), reveal a pattern of genetic variation that is consistent with patterns of morphological variation identified previously (Shuster 1979; Riska 1981).

2.1.3 Tagging Information

Tagging data from the USFWS horseshoe crab database were analyzed by region to estimate survival and evaluate the dataset for movement analysis. The regions identified in the database are Northeast, coastal New York-New Jersey, Delaware Bay, coastal Delaware-Virginia, Chesapeake Bay, North Carolina, Southeast, and Gulf (Table 3). The Northeast, Delaware Bay, Southeast, and Gulf showed high rates (>93%) of within-region recaptures (Table 4).

Survival analysis was conducted using program MARK (White and Burnham 1999) which showed regional variation in annual survival rate (Table 5). The Jolly-Cormack-Seber (JCS) model was fit to all data. Releases were sufficient to support survival analysis for the Northeast, coastal New York-New Jersey, Delaware Bay, coastal Delaware-Virginia, and the Southeast. The numbers of years of release varied by region. Models were fit for each region separately and then combined for the years 2009-2017, which are the years that all regions had in common. The survival analysis showed that models with regional and time-specific survival and probability of capture fit best based on AIC (Table 5). The highest survival rates were in Delaware Bay and coastal Delaware-Virginia regions. The lowest were in coastal New York-New Jersey and the Southeast.

Movement rates that were estimated by fitting multi-state models in program MARK (Lebreton et al. 2009) showed significant exchange between coastal areas and Delaware Bay (Table 6). Multi-state models have been used to estimate within-region movement for Long Island populations (J. Bopp, SUNY, personal communication). Problems with convergence were encountered and further analysis is needed. However, results for the Delaware Bay region under constant rate model are shown in Table 6.

2.2 Migration Patterns

The current understanding of horseshoe crab migratory patterns is that juveniles move from shallow estuarine waters to deeper estuarine or ocean waters as they grow and mature, reaching sexual maturity either in their natal estuary or ocean waters (Baptist et al. 1957; Shuster 1979; Shuster and Botton 1985; Botton and Ropes 1987; Botton and Loveland 2003; Smith et al. 2009). After maturation, adults migrate annually from the deeper estuary or ocean waters to spawn on estuarine beaches. It is currently unclear why some horseshoe crabs remain within natal estuary waters to mature while others migrate to ocean water to mature. The vast majority of horseshoe crabs from Delaware Bay, for example, migrate to the continental shelf to grow and mature (Botton and Ropes 1987; Smith et al. 2006; Hata and Hallerman 2008), but this population may exhibit some sex-specific migratory patterns. While all juveniles tend to remain within the Bay. Smith et al. (2009) showed that at about eight years of age, females were more likely than their male counterparts to migrate to the continental shelf to mature and males tended to reach sexual maturity without leaving the bay.

While the continental shelf is an important area for maturing horseshoe crabs from the Delaware Bay population, horseshoe crabs from other regions appear to remain within local embayments while maturing (Botton and Ropes 1987; James-Pirri et al. 2005; Swan 2005; Smith et al. 2006; Moore and Perrin 2007; Beekey and Mattei 2009; Schaller et al. 2010; Beekey and Mattei 2015). The importance of local embayments to horseshoe crabs was shown by Landi et al. (2015), who found that spawning locations within Long Island Sound tended to be close to offshore locations where adults had been caught in trawl surveys. Stable isotope analyses also show that adult crabs are loyal to their local feeding grounds (O'Connell et al. 2003; Carmichael et al. 2004). In addition, acoustic telemetry has demonstrated that many animals remain year-round within one bay or estuary (Rudloe 1980; Ehlinger et al. 2003; Beekey and Mattei 2009; Schaller et al. 2010; Watson et al. 2016). The annual migration of mature horseshoe crabs from deeper waters to estuarine spawning beaches appears to be triggered, at least in part, by the onset of warm water temperatures (Smith and Michels 2006; Watson et al. 2009).

Microsatellite genotyping has shown the presence of distinct regional populations for horseshoe crabs, as well as evidence for some gene flow among these regional populations (King et al. 2005; Smith et al. 2017). A low level of gene flow among regional populations is also supported by an analysis of USFWS tagging database showing that horseshoe crabs may migrate significant distances as mature crabs. Crabs tagged in the Gulf of Mexico, for instance, were later recorded from the Southeast and Delaware-Virginia regions while horseshoe crabs tagged in the Southeast region have been documented along the Atlantic coast up to the Northeast region. In addition, horseshoe crabs tagged in the Northeast region have been documented in the Southeast, and horseshoe crabs tagged in New York and New Jersey have also been documented to move towards the Southeast region. Additional genotyping analysis within the southeastern population showed no evidence of genetic structuring across the study area and indicated significant gene flow was occurring across multiple estuaries in South

Carolina (Cushman et al., *in review*). While the vast majority of horseshoe crabs appear to stay within or near their natal estuaries, genetic and tagging data highlight the importance of movement within and among regional populations of horseshoe crabs. Because the boundaries separating regional populations of horseshoe crabs may not align with state-level management zones, it is important to understand how horseshoe crab movement might affect horseshoe crab populations in different management zones. As such, further research is needed to better understand the movement patterns of horseshoe crabs both within and among areas of distinct management jurisdiction.

Adult horseshoe crabs are known to be important predators of a variety of benthic macrofauna (Carmichael et al. 2004, 2009; Botton 2009). Primary prey for adult horseshoe crabs are blue mussels (*Mytilus edulis*) and surf clams (*Spisula solidissima*; Botton and Haskin 1984, Botton and Ropes 1989). Horseshoe crabs serve as prey for endangered sea turtles (Keinath 2003; Witherington and Witherington 2015), and their eggs are consumed by migrating shorebirds (Haramis et al. 2007). Their burrowing activities are a form of bioturbation that affects the habitat available for other species (Gilbert and Clark 1981; Kraeuter and Fegley 1994), and predatory activities affect the intertidal and subtidal meio- and macrofaunal communities (Wenner and Thompson 2000; Ehlinger and Tankersley 2009).

2.3 Age

No reliable method is available to directly age horseshoe crabs. Botton and Ropes (1988) and Grady et al. (2001) used epifaunal *Crepidula fornicata* (shell length / shell weight) on the crab's prosoma to indirectly determine age. Shuster (2000) developed criteria for assigning approximate age based on carapace color and the extent of carapace wear. Hata and Berkson (2003) used shell wear, color and structural changes of the pedipalps (males) to stage horseshoe crabs by maturity in conjunction with the Virginia Polytechnic Institute and State University's horseshoe crab trawl survey. Smith et al. (2009) used shell wear, color, size, structural changes of pedipalps and egg presence to characterize maturity and approximate age. Several researchers have proposed the use of ommatidia (units that compose the compound eye) to age juvenile horseshoe crabs, but funding sources are necessary to more formally investigate this possibility. Research using lipofuscin for aging has not been shown to be reliable (Smith et al. 2009). Estimating age by length/width measurements, at least over a wide geographical range, is complicated by the apparent latitudinal differences in size (Shuster 1954; Botton et al. 1992).

Indirect aging methods have provided estimates of longevity. Botton and Ropes (1988) estimated that Delaware Bay horseshoe crabs live at least 17 to 19 years using *C. fornicata*. Swan (2005) found a similar range for Delaware Bay horseshoe crabs based on tagging data. Grady et al. (2001) estimated that Pleasant Bay, New Hampshire, crabs live at least 17 years using *C. fornicata*. Ropes (1961) estimate longevity at 14 to 19 years using tagging data from Pleasant Bay. Shuster and Sekiguchi (2003) reported that horseshoe crabs may live for 20 years in the northern part of their range. Recent tagging data have shown adult crabs at large for up to 17 years before recapture (D. Smith, personal communication), indicating an individual at least 27 years of age.

2.4 Growth

Horseshoe crabs undergo stepwise growth, with females typically attaining larger sizes than males. Smith et al. (2009), reviewing several studies, reported the average prosomal width growth increment for all instars was 1.28 (range: 1.15 – 1.52). Growth is relatively rapid during the first several years progressing through stages I-V in the first year, stages VI – VII the second year, stages VII – IX the third year, with a single molt per year until reaching maturity (Shuster 1982). Shuster (1950) citing “different” sources and a series of exuviae from a captive specimen, approximated that it took 9 to 12 years for horseshoe crabs to reach sexual maturity. Sekiguchi et al. (1982) concluded that male horseshoe crabs molt 16 times and mature in their ninth year; females molt 17 times and mature in their tenth year. Smith et al. (2009) found that males in Delaware Bay tended to mature at age 10 and 11, while females tended to mature at ages 10, 11, and 12.

Carmichael et al. (2003) concluded that male and female horseshoe crabs may continue to molt upon maturation and that males and females had differential growth rates with females also molting more times than males. Female exuviae from crabs of a mature size with amplexus scars have been encountered (G. Breese, G. Gauvry, and C. Shuster, personal communication; Carmichael et al. 2015), further supporting the conclusions of Carmichael et al (2003). The steeply decreasing tag return rates among older adult crabs, and shiny shells with possible tag scars found in a tagging study conducted by Schaller and Dorsey (2011) provide more evidence for this conclusion. However, Smith et al. (2009) examined the hypotheses of differential maturity, differential growth and indeterminate molting and also concluded that females did not grow at a faster rate than males, but rather underwent an additional molt. Although they could not confirm or rule out post-amplexus molting, they did find that it is likely uncommon (<1% of population) and had no discernable population-level effect within the Delaware Bay population.

To test how prosomal width-to-weight relationships vary by sex and region, width and weight data were separated by sex, and split into four regions; Northeast (Maine, Massachusetts, Rhode Island), New York (Connecticut, New York), Delaware Bay (New Jersey, Delaware, Maryland, Virginia), and Southeast (North Carolina, South Carolina, Georgia, Florida).

Graham et al. (2009) established a log-transformed prosomal width-to-weight relationship using the form

$$log_e(Wt) = log_e(PW) * \alpha + log_e\,(b)$$

where Wt = weight of a horseshoe crab (kg); PW = prosomal width (mm); α = slope; and b = y-intercept.

Linear regressions were used to determine the regional and sex-specific slopes and y-intercepts for the width-to-weight relationships. Two-way ANCOVAs were used to test whether sex specific and regional differences existed in the prosomal width-to weight relationship. The

ANCOVAs revealed a significant difference by sex ($P<0.001$). Male prosomal width-to-weight relationships showed no significant difference when specific regions were compared to a coastwide aggregate relationship, although the Northeast region was significantly different from the Southeast ($P=0.021$), Delaware Bay ($P<0.001$), and New York ($P=0.004$) regions when compared region-to-region. Females showed no regional differences.

Regional and sex specific width-to-weight relationships were calculated to be;

Coastwide, female: $\log_e(Wt) = \log_e(PW) * 2.8659 – 15.1802$

Northeast, male: $\log_e(Wt) = \log_e(PW) * 2.8357 – 15.1309$

Southeast, Delaware Bay, New York, male: $\log_e(Wt) = \log_e(PW) * 2.4381 – 12.9439$

2.5 Reproduction

Warming spring temperatures often provide a cue for adult horseshoe crabs to move from deep bays and shelf waters that serve as overwintering habitat to the intertidal zone of beaches where spawning occurs (Shuster 1982; Moore and Perrin 2007; Watson et al. 2009; Schaller et al. 2010; Cheng et al. 2015). In the Gulf of Mexico, spawning extends from February until October, with peaks in March or April (Rudloe 1980; Brockmann et al. 2015). In south Florida, spawning can occur throughout the year (Ehlinger and Tankersley 2007) whereas spawning activity in Georgia and South Carolina occurs from March to July (Thompson 1998). In the Delaware Bay area the crabs spawn from April through at least July, with peak spawning occurring in May and June (Shuster and Botton 1985, Michels et al. 2008; Smith and Michels 2006) and in Long Island Sound, spawning generally begins in May (Beekey and Mattei 2009). In Cape Cod, Massachusetts, spawning begins in May and continues into July (Barlow et al. 1986; Widener and Barlow 1999; James-Pirri et al. 2005), although Carmichael et al. (2003) reported the spawning season in Pleasant Bay, Massachusetts may span from late March through mid-July, based on observations of pairs of horseshoe crabs in amplexus. Variability in the timing of horseshoe crab spawning migrations is associated with water temperature (Smith et al. 2017). Because the current warming trend of estuarine and ocean temperatures is expected to continue, it will be important to understand how increases in water temperatures will affect the timing of horseshoe crab migrations and spawning activity. As such, further research is necessary to understand how temperature sensitivity might vary regionally and how climate warming will affect the timing and magnitude of annual horseshoe crab migrations.

Horseshoe crabs prefer to spawn during high tides, using changes in water depth as a cue (Chabot et al. 2008; Chabot and Watson 2010; Chabot et al. 2011). Some researchers have also reported that peak spawning is associated with the highest tides of the month on the new and full moons (Rudloe 1980, Shuster and Botton 1985, Barlow et al. 1986, Smith et al. 2002a). Lunar period, however, may not always be a valid predictor of horseshoe crab spawning. For example, Leschen et al. (2006) and James-Pirri et al. (2005) found similar levels of spawning activity during all daytime high tides regardless of lunar phase in the vicinity of Cape Cod. Similarly, in Great Bay Estuary, New Hampshire, temperature was shown to be an important determinant of spawning activity with little relationship with lunar phase or time of day

(Watson and Chabot 2010; Cheng et al. 2016). The higher of the two daily tides can also be related to spawning activity (Barlow et al. 1986; Rudloe 1980; Chabot and Watson 2010; Brockmann and Johnson 2011). In Delaware, however, the highest levels of spawning activity occur during the evening high tides (Shuster and Botton 1985; Smith et al. 2010). In microtidal areas, wind-blown surge can have a greater effect on water level than tides. Under these conditions, wind-blown surge can strongly influence the numbers of spawning horseshoe crabs (Brockmann and Johnson 2011).

Males are known to locate females using both visual and chemoreceptive cues (Brockmann 2003a; Saunders et al. 2010) and female crabs often arrive at the spawning beach with a male attached to the opisthosoma (Cohen and Brockmann 1983; Loveland and Botton 1992; Brockmann 2003a; Shuster 1982; Cheng 2014). Often several satellite males accompany the attached pair on the beach (Cohen and Brockmann 1983; Brockmann and Penn 1992). Males in amplexus are not shown to differ in size from satellite males, but males in amplexus are generally in better condition, more active, have a higher sperm concentration, remain attached longer and are more recently molted into the adult phase than males not in amplexus (Cohen and Brockmann 1983; Brockmann and Penn 1992; Loveland and Botton 1992; Brockmann 2002; Duffy et al. 2006; Sasson et al. 2012). The males externally fertilize the eggs as they are being deposited. Although a single attached male can fertilize all of a female's eggs, satellite males, when present, may fertilize a majority of eggs (Brockmann et al. 1994, 2000).

Female horseshoe crabs prefer to lay their eggs in well-drained sandy beaches that are protected from surf, although they are also known to spawn in cobble, mud, and peat. It is currently unclear how important these non-sandy habitats are to the reproductive potential of horseshoe crabs across their range. On a single tide, females can excavate a pit and deposit from two to five clusters of about 1000 – 4000 eggs at depths from 5 to 20 cm (Rudloe 1979; Brockmann 1990; Leschen et al. 2006; Brockmann 2003b). However, estimates of eggs per cluster vary: Shuster and Botton (1985) reported 3,650 to 4,000 eggs per cluster and Weber and Carter (2009) reported an average of 5,786 ± 2,834 eggs per cluster. Egg cluster size was 1,644 – 1,739 eggs/cluster in Florida (Johnson and Brockmann 2010), 2,365–5,836 eggs/cluster in Delaware Bay (Shuster and Botton 1985; Weber and Carter 2009), 3,741 eggs/cluster in Long Island Sound (Beekey et al. 2013), and 640–1,280 in Cape Cod, Massachusetts (Leschen et al. 2006). There does not appear to be a relationship between cluster size and female size (Brockmann 1996; Leschen et al. 2006), but larger females carry more eggs and lay more clusters per spawning season than smaller females. Leschen et al. (2006) found a correlation between female size and the number of eggs laid by horseshoe crabs in Pleasant Bay, Massachusetts. Overall, much of the variability in horseshoe crab fecundity appears to be related to female size and latitude (Botton et al. 2010; Smith et al. 2017). Because female size can vary with latitude, more research is needed to understand how latitude, and thus temperature, interacts with female size to affect fecundity in horseshoe crabs.

Female horseshoe crabs typically complete their spawning activity during one tidal cycle (5 days of high tide around new or full moon; Brockmann and Penn 1992; Brousseau et al. 2004; Smith et al. 2010; Beekey and Mattei 2015). In Florida, females return to beaches to nest on average

3.4 times and most spawn during only one tidal cycle (Brockmann 1990). Female horseshoe crabs in Delaware Bay were shown to spawn over two to five consecutive nights, remaining within 50 to 715m of their established spawning beach before moving away from the beaches several days after the new moon (Brousseau et al. 2004; Smith et al. 2010). In Long Island Sound, females were found returning to the same beach up to six days after their initial appearance (Beekey and Mattei 2015). Significant beach fidelity over successive years, however, has not been demonstrated.

Egg development is dependent on temperature, salinity, moisture, and oxygen content (Vasquez et al. 2015b). Larval horseshoe crabs, termed trilobites, generally hatch from the eggs within 2–4 weeks, with a small proportion of larvae overwintering within nests and hatching the following spring (Botton et al. 1992; Shuster 1950). Hatching of eggs is triggered by environmental cues related to high water conditions including hydration, physical disturbance, and hypoosmotic shock, which facilitate survival of newly-hatched larvae (Ehlinger and Tankersley 2003; Botton et al. 2010). Trilobite larvae do not appear to be strong swimmers, relying on vertical movements to take advantage of selective tidal stream transport. Larvae that become planktonic settle to benthic habitats within approximately one week of hatching (Shuster 1982). Larval and juvenile crabs appear to show little dispersal because they remain in the intertidal flats near breeding beaches (Botton and Loveland 2003; Cheng et al. 2015). After approximately two weeks as larvae, they molt to the juvenile (second instar) stage where the telson is formed. As they grow, the older juveniles move out of intertidal areas (Botton and Ropes 1987).

2.6 Natural Mortality

Two field studies have published direct estimates of survival rates of horseshoe crabs. Botton et al. (2003) reported only 3 of 100,000 trilobite larvae were found as fourth instars on adjacent tidal flats by the end of their first summer in New Jersey. Carmichael et al. (2003) calculated annual survival rates for juvenile and adult horseshoe crab stages based on size-based cohort progressions in Pleasant Bay, MA. Very low mortality was reported on juvenile horseshoe crabs after instar 7 (age 1) through the sub-adult stage (age 8), with increasing mortality on adult stages (Table 7) (Carmichael et al. 2003). No significant difference in mortality rates were seen between adult males and females. A natural mortality rate schedule based on these survival estimates along with an assumed 20-year lifespan has been employed in subsequent horseshoe crab operational models (Sweka et al. 2007), stock assessments (ASMFC 2009a), and adaptive resource models (McGowan et al. 2011) (Table 7).

Horseshoe crab egg predation/consumption by shorebirds is well documented (Botton 1984; Botton et al. 1994; Haramis et al. 2007; Botton 2009; Beekay et al. 2013). Despite significant shorebird predation on eggs, such activity probably has little impact on the horseshoe crab population since consumption is mostly relegated to surface eggs, which would not survive regardless of predation (Botton et al. 1994; Botton 2009). Egg burial depths (>5 cm) in Delaware Bay generally outreach the bill penetration of shorebirds (Loveland et al. 1996; Weber and Carter 2009), while successive horseshoe crab spawning and wave action produce high levels of naturally exhumed eggs unrelated to predation (Jackson et al. 2005; Smith 2007; Botton 2009).

Eggs and trilobite larvae are also preyed upon by numerous surf zone fishes and crustaceans including eels, catfish, juvenile striped bass, white perch, killifish, weakfish, Atlantic silversides, bluefish, sand shrimp, blue crabs, spider crabs, and hermit crabs (*summarized in:* Botton 2009). In Delaware Bay, eggs or trilobites were found in stomachs of 95% of killifish (*Fundulus heteroclitus*) and 96% of Atlantic silverside (*Menidia menidia*) (Botton and Loveland unpublished).

Evidence of post-larval horseshoe crabs has been found in stomachs of bluefish (*Pomatomus saltatrix*) (Friedland et al. 1988) and bonnethead sharks (*Sphyrna tiburo*) (Cortes et al. 1996). Horseshoe crabs can be a major (>40%) component in the diet of loggerhead turtles (*Caretta caretta*) (Seney and Musick 2007). Botton and Loveland (1993) also observed direct predation on adult horseshoe crabs by Herring Gulls and Great Black-backed Gulls in Delaware Bay. Abundant numbers of durophagous, benthic, and large opportunistic predators are found in Delaware Bay with horseshoe crabs, such as black drum, cownose rays, bullnose rays, spiny dogfish, smooth dogfish, sandbar sharks, sand tiger sharks (McElroy 2009), various skate species, striped bass, Atlantic sturgeon, blue crabs, summer resident sea turtles, bullnose rays (Szczepanski and Bengtson 2014). Some predation by these species is likely, but to what extent has not been studied in Delaware Bay. American eel and whelks are also potentially significant predators on the Delaware Bay population, given the importance of horseshoe crabs as the preferred bait in these commercial fisheries.

A major source of adult natural mortality is related to spawning, as excessive energy expenditure, stranding, desiccation, and predation are elevated during mating and egg-burying behaviors. Botton and Loveland (1989) estimated nearly 200,000 mortalities related to stranding on New Jersey beaches in 1986. They believed this could be responsible for up to 10% of the adult population in Delaware Bay, although this is likely an overestimation based on a very conservative population estimate. The population estimate of 2.3 to 4.5 million individuals was based on scaled-up NMFS trawl survey catches that admittedly lacked sufficient sampling in inshore strata containing highest densities of horseshoe crabs (Botton and Ropes 1987). Botton and Loveland (1989) suggested this stranding percentage likely varies among estuaries due to population density, weather and tidal conditions, and beach geomorphology. The condition of the individual, which is probably age-related, is also a factor in stranding-related mortality (Penn and Brockmann 1995). Natural and man-made impingements are also factors that affect stranding-related mortality. The reTURN The Favor program implemented by The Wetlands Institute has rescued over 197,000 horseshoe crabs in the 5 years since its establishment. Of these rescued horseshoe crabs, it was found that approximately 3.7-7.2% of crabs were entrapped in natural impingements and 14-20% of crabs were entrapped by man-made impingements over the years (Ferguson et al. 2017).

Recent mark-recapture analyses (summarized in Section 2.1.3) produced annual survival rates of adult horseshoe crabs ranging from 59% to 79% across various embayments (D.R. Smith, unpublished). In Delaware Bay, the instantaneous natural mortality rate (M) was M=0.274 (from the estimate of survival 76%), which is considerably lower than the adult M=0.47 employed in modeling to-date (Table 7). A lower M (e.g. <0.47) is supported by the empirical ratio of multiparous to primiparous females (ratio=3.8) observed in the Virginia Tech Trawl Survey. Given its biology, newly mature primiparous females will spawn in the upcoming year and exhibit multiparous indicators thereafter, generally occurring between ages 9 and 10. Given a longevity of 20 or 27 years, *M* would need to be 0.215 or 0.231 to produce a 3.8 multiparous (ages 10+) to primiparous (age 9) ratio.

Protracted at-large durations were also noted in the mark-recapture analyses (up to 17 years), which sheds new light on potential longevity. A mark-recapture duration of 17 years suggests a longevity of roughly 27 years given a minimum age-at-tagging of nine to 11 (based on onset of maturity (Shuster 1950)). Maximum age has heretofore been assumed to be 20 years (Ropes 1961; Botton and Ropes 1988; Swan 2005).

Greater longevity changes the understanding of natural mortality. Indirect estimates of age-invariant, constant, *M* based on a maximum age of 27 years would range between *M*=0.11 and *M*=0.17 (depending on selected mortality model), as opposed to a range of 0.15 to 0.22 given a maximum age of 20 years (Hoenig 1983; Hewitt and Hoenig 2005). Other indirect estimates of constant *M* can be generated from models that incorporate von Bertalanffy (LVB) growth parameters and environmental information (Pauly 1980; Jensen 1996) (Table 8 and Table 9), although these estimates appear too high to allow for the population to reach maximum ages of 20 plus years.

Von Bertalanffy (LVB) parameters were fit to Carmichael et al.'s (2003) sub-adult growth trajectory, with the assumption of asymptotic size occurring at instars 18 and 20 for males and females. These instars correspond to ages 9 and 11 for males and females, consistent with longstanding expectations about maturity and terminal molting (Shuster 1950; Botton and Ropes 1988; Schuster and Sekiguchi 2003). Stockpiling of males and females also occurred at these instar stages in Pleasanton Bay (Carmichael et al. 2003), further supporting the timing of growth cessation. Asymptotic sizes of adult stages were based on average carapace widths of adult horseshoe crabs (males=203 mm and females=245 mm) observed in the Delaware Division of Fish and Wildlife 30-foot trawl survey from 1966-2018 (M. Greco unpublished data).

Age-variable mortality models allow for *M* to vary inversely with size (Peterson and Wroblewski 1984; McGurk 1986; Lorenzen 1996; 2000; Gislason et al. 2010). Age-based mortality schedules, utilizing von Bertalanffy parameters and width:weight relationships (Graham et al. 2009), were calculated using Lorenzen (1996) and Gislason et al. (2010) models (Table 10).

These mortality schedules did not accommodate higher adult mortality rates caused by excessive spawning mortality. Replacing the size-based mortality rates for adults (ages ≥10) with mortality estimates (*Z*=0.238 to 0.528) from recent mark and recapture analyses of adult tagged crabs (D.R. Smith, unpublished) is an option that would better describe mortality in adult age classes.

However, both models, the Lorenzen (1996) model especially, generate mortality rates that appear too high to suit the life history and extended longevity of horseshoe crabs. The extremely elevated early stage mortality rates do not allow for enough survival for the population to reach maturity (age 10) or its maximum age (20-27 years). Extremely high Age 0 mortality (*M*=8, 11) from the Gislason et al. model does correspond well with Botton et al.'s (2003) field estimate of *M*=10.4. Other Age 0 estimates of *M*=4.6 (equivalent to 99% mortality) in Pleasant Bay, MA (Carmichael et al. 2003) and *M*=3.6 in Delaware Bay (R. Wong, unpublished) mesh well with the Lorenzen (1996) model. Future work is needed to better understand size and age-based natural mortality rates for horseshoe crabs.

2.7 Sex Ratio

Two types of sex ratios are useful for understanding horseshoe crab ecology and informing management decisions. The population sex ratio is the ratio of males to females among individuals in the population. The operational sex ratio is the ratio of males to females among adults that are actively spawning. While juveniles show a balanced population sex ratio (Shuster and Sekiguchi 2003; Smith et al. 2009), the population sex ratio among adults has been observed to be somewhat skewed toward males in Delaware Bay (2.2:1 M:F; Smith et al. 2006) and Pleasant Bay, MA (2.3:1 M:F; Carmichael et al. 2003). This difference has been attributed to higher fishing or natural mortality among adult females compared to males, but also might be due to males maturing earlier than females and living as long as females (Smith et al. 2009). The operational sex ratio of horseshoe crabs on the spawning beaches is highly skewed toward males because of behavior and population demographics (Brockmann and Smith 2009). One male attaches to a female in amplexus prior to spawning. During fertilization, however, the amplexed pair is often surrounded by unattached (i.e. satellite) males (Brockmann and Penn 1992). Hence, the operational sex ratio on spawning beaches is expected to be male biased compared to the population sex ratio among adults.

A population sex ratio over 1 is likely to be required among adults to ensure that reproduction is not limited by sex ratio. Brockmann (1990) found that female horseshoe crabs will tend not to nest unless they are in amplexus with a male, and that satellite males are not needed to fertilize eggs. Some males (approximately 30%) are not capable of amplexus because of their condition (Brockmann and Smith 2009). Thus, there needs to be an excess of males in the population to ensure a sufficient number of males capable of amplexus to pair with the females ready to spawn. In the Delaware Bay population, the operational sex ratio averaged 3.8 M:F (SD = 0.51) over 1999 to 2008 (Michels et al. 2008). In contrast, the population sex ratio averaged 2.0 M:F (SD = 0.19) over 2002 to 2008 (Hata and Hallerman 2008). Thus, on average, the operational sex ratio is 1.88 times (SD = 0.19) the population sex ratio for the Delaware Bay population (Hata and Hallerman 2008; Michels et al. 2008).

Sex ratios in estuarine habitats sampled in the Delaware Bay Adult Trawl Survey for the 1990-2017 time period were significantly different for the spring and fall seasons averaging 1.27 and 2.2 M:F in the spring and fall, respectively (Paired t-test; $P<0.001$; Table 11). The seasonal difference in sex ratios for the Delaware Bay Adult Trawl Survey indicates that the relative abundance of females in estuarine habitats is greater during the spring, compared to the fall. This finding is broadly consistent with previous research showing that female horseshoe crabs are more likely than their male counterparts to migrate out of estuarine waters (Smith et al. 2009). While the Delaware Bay Adult Trawl Survey shows seasonal differences in sex ratio, the

New Jersey Ocean Trawl Survey that samples coastal habitats showed no significant difference between seasons with sex ratios of 1.13 and 1.03 in the spring and fall, respectively (Paired t-test; P=0.20; Table 11). The presence of seasonal shifts in sex ratios for the Delaware Bay, but not for the New Jersey Ocean Trawl Survey, could reflect differences in habitat where sex-specific migration patterns may be more likely to occur within estuarine habitats such as Delaware Bay. Annual average sex ratio in offshore habitats sampled in the New Jersey Surf Clam Survey was 0.51 M:F, much lower than sex ratios for the Delaware Bay and New Jersey Ocean Trawl Surveys. It is unclear why the New Jersey Surf Clam survey has lower sex ratio compared to other surveys. Together, these data provide further evidence for sex-specific migration patterns in horseshoe crabs that warrant further study in order to better understand behavior and migration patterns of male and female horseshoe crabs.

Temporal trends in sex ratios for surveys used in this assessment were conducted using Mann-Kendall analysis for the New Jersey Surf Clam Survey as well as both the spring and fall surveys of the Delaware Bay Adult Trawl and the New Jersey Ocean Trawl. Only one of the fishery-independent surveys analyzed showed a significant temporal trend in sex ratio with the available data (Table 11). A significant increase in the sex ratio for the spring season (March-August) of the Delaware Bay Adult Trawl Survey from 1990 – 2017 was documented (Table 11; Figure 3). These data show a sex ratio for the spring of 1990 of 0.76 M:F (CL: 0.30-1.23) increasing to 2.0 M:F (CL: 1.31-2.68) in the spring of 2017 (Table 12). While Mann-Kendall analysis found significant increases in sex ratio in these data (τ=0.39, P=0.004, sen-slope=0.033), breakpoint analysis was also conducted to assess shifts in the stability of the linear relationship. Breakpoint analysis fits linear models to sections of the data and detects locations of breaks in the relationship by minimizing residual sums of squares and determines the optimal number of breaks by minimizing information criterion (Bai and Perron 2003; Zeileis et al. 2003). This breakpoint analysis indicated the presence of a single breakpoint at the year 2006 for the spring season of the Delaware Bay Adult Trawl survey. This breakpoint year is consistent with the regulatory change that reduced the total harvest of horseshoe crabs in Delaware Bay and implemented male-only harvest for portions of Delaware Bay. Mean sex ratio for this survey from 1990-2006 was 0.94 M:F, whereas mean sex ratio from 2007-2017 was 1.79 M:F.

Significant increases in the M:F sex ratio were also observed in some of the fishery-dependent data, specifically, the Virginia off-shore waters and Virginia landings data (Table 11, Table 12). These changes in the sex ratio are not necessarily representative of the population, but rather, reflect changes in the regulations concerning collection and harvest of horseshoe crabs in these regions.

3 HABITAT DESCRIPTION

3.1 Brief Overview of Habitat Requirements

Essential habitat is defined as those waters and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. Habitat requirements change throughout the horseshoe crab life cycle, extending from intertidal beach fronts and tidal flats in coastal embayments for eggs and larvae, to the edge of the continental shelf for adults. *Limulus* has been described as an ecological generalist (Sekiguchi and Shuster 2009) able to tolerate a wide range of environmental parameters throughout its distribution. Various environmental tolerances have been documented for horseshoe crabs in several areas; however, Sekiguchi and Shuster (2009) suggest that individual sub-populations may have a narrower tolerance than the species.

3.1.1 Spawning, egg, larval habitat

Spawning adults prefer sandy beach areas within bays and coves that are protected from wave energy (Shuster and Botton 1985; Smith et al. 2002b; Jackson et al. 2002; Landi et al. 2015). Nests are primarily located between the low tide terrace (tidal flat) and the extreme high tide water line (Penn and Brockmann 1994; Weber and Carter 2009). Weber and Carter (2009) found that 85% of nests were deposited between the tidal flat and the nocturnal high tide wrack line on the western shore beaches of Delaware Bay. Penn and Brockmann (1994) found similar results in Delaware Bay, but noted that nest deposition occurred in a narrower band within the beach front on Seashore Key, Florida. The differences in nest site selection between Florida and Delaware can be explained by differences in beach morphology, particularly sediment grain size, and its effect on interstitial conditions (Penn and Brockmann 1994). In Massachusetts, New Jersey, and Delaware, beaches are typically coarse-grained and well drained, as opposed to Florida beaches which are typically fine-grained and poorly drained. Spawning is sometimes observed on offshore sandbars and oyster bars (Wenner and Thompson 2000). In Long Island Sound, nests can be found on beaches ranging from coarse-grained and well drained to cobble-dominated substrates to fine grained and poorly drained muddy substrates (Beekey and Mattei 2009).

Beach habitat also must include a sufficient depth of porous, well-oxygenated sediments to provide a suitable environment for egg survival and development (Botton et al. 1988). Nest depth on the western shore of Delaware Bay generally ranged between 3.5 and 25.5 cm (mean 15.5, SD 3.5), although nest depth may be affected by wave energy, bioturbation, or other factors after deposition (Weber and Carter 2009). These results are similar to those found by previous investigators on Delaware Bay beaches (e.g., Hummon et al 1976; Penn and Brockmann 1994; Botton et al 1994). Sediment grain size, in particular, can influence spawning site selection as environmental conditions in the sand affect development (moisture, temperature, and oxygen gradients) (Penn and Brockmann 1994; Jackson et al. 2005). Previous studies suggest that females avoid laying eggs in eroded beaches that are high in hydrogen sulfide and where sediment pore water is low in oxygen, factors that are known to affect development (Botton et al. 1988; Penn and Brockmann 1994, Vasquez et al. 2015).

Rate of egg development is dependent on interstitial environmental parameters including temperature, moisture, oxygen, and salinity (French 1979; Jegla and Costlow 1982; Laughlin 1983; Penn and Brockmann 1994) and disturbance (bioturbation) from external forces (Jackson et al 2005). Placement of nests in the intertidal zone subjects horseshoe crab eggs to a wide range of environmental parameters, making it necessary for eggs and larvae to have wide tolerance ranges; however optimum egg development occurs within a much narrower range of conditions. Studies have shown that optimal development occurs at salinities between 20 and

30 ppt (Jegla and Costlow 1982; Laughlin 1983), although populations from microtidal lagoon systems that often experiences high salinities (>50 ppt) had an optimal range of 30 to 40 ppt, with hatching occurring at salinities as high as 60 ppt (Ehlinger and Tankersly 2004). Egg development occurs most readily at temperatures ranging from 25 to 30°C (Jegla and Costlow 1982; Laughlin 1983; Penn and Brockmann 1994; Ehlinger and Tankersly 2004), with temperatures of 20 and 40°C showing little to no development (Laughlin 1983; Ehlinger and Tankersly 2004). Penn and Brockmann (1994) found optimal development of horseshoe crab eggs from Delaware and Florida to occur at oxygen concentrations between 3 and 4 ppm and moisture content between 5 and 10%.

In addition to the influences of interstitial microhabitat on nest site selection, Thompson (1998) found that preferentially selected spawning sites were located adjacent to large intertidal sand flat areas, which provide protection from wave energy and an abundance of food for juveniles. Most nesting beaches have nearby nursery habitats for juveniles (Botton and Loveland 2003). Geographic differences in nest site selection can be explained by differences in wave energy, beach morphology, and geochemistry (Botton et al. 1988; Penn and Brockmann 1994; Smith et al. 2002a; Beekey and Mattei 2009; Landi et al. 2015).

Horseshoe crab spawning areas are limited by the availability of suitable sandy beach habitat. For example, based on geomorphology, Botton et al. (1992) estimated that only 10% of the New Jersey shore adjacent to Delaware Bay provided optimal horseshoe crab spawning habitat. However, spawning may occur along peat banks if there is sand in the upper intertidal regions and along the mouths of salt marsh creeks (Botton 2009). Shuster (1996) stated that spawning may occur along muddy tidal stream banks, but not on peat banks because adults are sensitive to hydrogen sulfide and anaerobic conditions. Subtidal spawning has been reported, but the extent to which this occurs is unknown. A Habitat Suitability Index model was developed for horseshoe crab spawning habitat within the Delaware Bay (Brady and Schrading 1996).

After hatching, some larvae delay emergence and overwinter within beach sediments, emerging the following spring (Botton et al. 1992). Larvae typically settle in shallow water areas to molt (Shuster 1982).

3.1.2 Juvenile and adult habitats

Nearshore, shallow water, intertidal flats are considered essential habitats for development of juvenile horseshoe crabs (Botton 2009). Juveniles usually spend their first two years on intertidal sand flats (Rudloe 1981; Sekiguchi and Shuster 2009). Thompson (1998) also found significant use of sand flats by juvenile horseshoe crabs in South Carolina. Prime spawning habitat is widely distributed throughout Maryland's Chesapeake and coastal bays, including tributaries. Horseshoe crabs are restricted to salinities that exceed 7 parts per thousand. In the Chesapeake Bay, spawning habitat generally extends to the mouth of the Chester River, but can occur farther north during years of above normal salinity levels. Prime spawning beaches within the Delaware Bay consist of sand beaches between Maurice River and the Cape May Canal in New Jersey and between Bowers Beach and Lewes in Delaware.

Older juveniles and adults are exclusively subtidal, except during spawning. Second and third year instars remain in the vicinity of the spawning beach but move just offshore into shallow subtidal water (Sekiguchi and Shuster 2009), with each succeeding stage moving toward deeper water. In the Delaware Bay, females begin to leave the Bay and move to continental shelf waters around age 7 to 8 to mature in the ocean (Hata and Hallerman 2009a, 2009b, 2009c; Smith et al. 2009). Smith et al. (2009) provide evidence that males remain in the Bay until maturity (age 9), but Hata and Halllerman (2009a, 2009b, 2009c) found evidence of significant numbers of immature males on the shelf one to two years prior to reaching maturity (Hata and Hallerman 2009a, 2009b, 2009c).

The diet of juveniles is varied, including particulate organic matter from algal and animal sources (Gaines et al. 2002; Carmichael et al. 2004). As horseshoe crabs mature, the diet composition shifts to larger prey, and horseshoe crabs are known to be important predators of benthic meiofauna (Carmichael et al. 2004; Carmichael et al. 2009; Botton 2009).
Delaware Division of Fish and Wildlife's 16-foot bottom trawl survey data indicated that more than 99 percent of juvenile horseshoe crabs (<16 cm prosomal width) were taken at salinities >5 parts per thousand.

As ecological generalists living in a shallow water environment over a wide geographic range, *Limulus* is subject to, and therefore adapted to, a wide range of environmental conditions. Specific requirements for adult habitat are not known, but it has been suggested that individual sub-populations may have a narrower tolerance than the species as a whole (Sekiguchi and Shuster 2009). Adult horseshoe crabs range from 21 N to 44 N and 68 W to 90 W (Sekiguchi and Shuster 2009), and have been found as far as 35 miles offshore at depths greater than 200 meters; however, Botton and Ropes (1987) found that 74 percent of the horseshoe crabs caught in bottom trawl surveys conducted by the National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center were taken in water shallower than 20 meters. They are observed in a wide range of salinity regimes, from low salinity (< 10 pp) areas such as the upper Chesapeake Bay, to the hypersaline (>50 ppt) environments of the Indian River Lagoon in Florida. During the spawning season, adults typically inhabit bay areas adjacent to spawning beaches. In Delaware Bay, horseshoe crabs are active in the Bay area at temperatures above 15°C (Sekiguchi and Shuster 2009; Smith et al. 2010), while crabs in Great Bay, NH increase activity at temperatures above 10.5°C (Watson et al 2009). In the fall, adults may remain in bay areas or migrate into the Atlantic Ocean to overwinter on the continental shelf.

Sekiguchi and Shuster (2009) have identified four possible large-scale factors that limit horseshoe crab distribution and habitat, including geomorphology, thermal tolerance, tidal regimes, and currents. Indo-Pacific species of horseshoe crab span the equator, but *Limulus* does not, perhaps due to limited availability of embayments with suitable spawning habitat, or the lack of a broad continental shelf to provide a migratory route. The northern extent of all horseshoe crab species may be limited by duration and severity of winter temperatures. The lack of horseshoe crab populations in the western Gulf of Mexico, which has suitable beach spawning habitat, is thought to be a result of the local tidal regime. Nearly all horseshoe crab populations occur in areas with semi-diurnal tides of moderate amplitude, but tides of this type are not observed in the western Gulf of Mexico.

Habitat degradation is likely an important component of the population dynamics of horseshoe crabs. Groins and bulkheads adversely impact horseshoe crab spawning habitat. Bulkheads may block access to intertidal spawning beaches, while groins and seawalls intensify local shoreline erosion and prevent natural beach migration. An estimated 10 percent of the New Jersey shoreline adjacent to the Delaware Bay has been severely disturbed by shoreline protection structures (Botton et al 1988). Rip-rap and revetments also adversely impact horseshoe crabs by minimizing potential spawning sites and by entrapping and stranding them. A contributing factor in the decline of horseshoe crabs in the Delaware Bay between 1871 and 1981 may be the increased number of jetties and residential development (Shuster and Botton 1985). The Wetland Insitute's reTURN The Favor program records data and information on the locations of impingements that are found while working at New Jersey beaches. Of the 22 beaches that are covered, almost all are affected by structures of variable severity that inhibit the ability for horseshoe crabs to spawn or survive. This data is used to identify beaches that are in need of small-scale restoration projects (Ferguson et al. 2017).

Shoreline erosion combined with shoreline development results in the loss of suitable and potentially suitable spawning beaches. Beach migration is a coastwide phenomenon, where beaches move landward associated with erosional events. However, hard structures (e.g., bulkheads, seawalls, revetments) associated with beach development interfere with the natural beach migration causing habitat loss. Beaches along the New Jersey shore of the Delaware Bay have generally eroded at varying rates ranging from 1 to 12 feet per year for the last 100 years (U.S. Army Corps of Engineers 1997). Erosion rates from 1 to 26 feet per year, averaging approximately 3 to 5 feet per year and the existence of hard structures limiting beach migration have resulted in a decline in Delaware beaches (U.S. Army Corps of Engineers 1991). McCormick and McCormick (1998) report the annual rate of erosion in the Chesapeake Bay averages 1 foot per year. Shoreline areas with high concentrations of silt or peat are less favorable to horseshoe crabs because the anaerobic conditions reduce egg survivability. Horseshoe crabs may detect hydrogen sulfide (which is produced in the anaerobic conditions of peat substrates) or low oxygen conditions, and actively avoid such areas (Botton et al 1988). Erosion affects spawning by influencing beach characteristics that are most important in site selection, such as beach topography, sediment texture, and geochemistry (Botton et al 1988).

Adult horseshoe crabs are known to be important predators of a variety of benthic macrofauna (Carmichael et al. 2004, 2009; Botton 2009). Botton and Haskin (1984) and Botton and Ropes (1989) found that the primary prey for adult horseshoe crabs are blue mussels (*Mytilus edulis*) and surf clams (*Spisula solidissima*). Recent declines in surf clam in the mid-Atlantic are being attributed to climate-change induced increases in water temperatures during late-summer and fall (E. Powell, personal communication). The effects of a declining prey base, in general, and of surf clam populations on horseshoe crab population carrying capacity is unknown.

In summary, horseshoe crabs are an important part of the ecology of the coastal systems in which they are found (Botton 2009). They are prey for endangered sea turtles (Keinath 2003, Witherington and Witherington 2015), and their eggs are consumed by migrating shorebirds (Haramis et al. 2007). Their burrowing activities affect the habitat available for other species through bioturbation (Gilbert and Clark 1981; Kraeuter and Fegley 1994), and predatory activities affect the intertidal and subtidal meio- and macrofauna (Wenner and Thompson 2000; Ehlinger and Tankersley 2009).

4 FISHERY DEPENDENT DATA SOURCES

Commercial fisheries for horseshoe crab consist primarily of directed trawls, hand harvest, and dredge fisheries for use as bait and are the major source of fishery-dependent data for the stock. Landings for horseshoe crabs have been reported since 1970 and fishery-dependent data of the catches have been collected since 1998. Horseshoe crabs are also commercially collected for use in the biomedical industry.

4.1 Commercial Bait Fishery

The commercial bait fishery consists primarily of trawl, hand harvest, and dredge fisheries. State and federal governments collected the fishery-dependent data included in this summary. Since 1998, ASMFC has compiled landings by state in the annual FMP review report. The horseshoe crab fishery supplies bait for the American eel, conch (whelk) and, to a lesser degree, catfish (*Ictaluridae*) fisheries. The American eel pot fishery prefers female horseshoe crabs to males, while the conch pot fishery uses both male and female horseshoe crabs. The conch fishery uses horseshoe crabs more frequently than the American eel fishery, with eel baits using blue crabs or fish more often than horseshoe crabs (ASMFC 2017).

Most fishing effort for horseshoe crabs is concentrated within the mid-Atlantic coastal waters and adjacent federal waters. However, Massachusetts and New York have also supported a significant fishery. The hand, trawl, and dredge fisheries accounted for 86% of the of the 2017 commercial horseshoe crab bait landings coastwide (by weight) by reported gear type (ASMFC 2018). This pattern is consistent with the distribution of landings by gear since the 1970s. During the past 25 years, the proportion of horshoe crabs caught by the hand fishery has increased and now accounts for the largest of any reported harvest, while the proportion caught by the trawl fishery has decreased during the same timeframe (ASMFC 2018).

Previous to 1998, commercial landings data for horseshoe crab were collected by the National Marine Fisheries Service (NMFS) by state, year, and gear type. Data were obtained from dealers, logbooks, and state agencies that require fishermen to report landings; however, NMFS records are often incomplete. In addition, the conversion factor used to convert numbers landed to pounds landed has been quite variable among the states and NMFS. Since 1998, states have been required to report annual landings to ASMFC through the compliance reporting process. Landings used in this assessment for 1998 through 2017 were validated by state agencies through ACCSP. Reported landings data show that commercial harvest of horseshoe crabs was high in the late 1990s, declined, and have been relatively stable from 2004 through 2017 (Table 1, Figure 1). Older landings, collected by NMFS, were not incorporated into any models in this assessment due to questionable accuracy of the data.

4.1.1 Data Collection and Treatment

4.1.1.1 Survey Methods

Commercial horseshoe crab landings data collection is a joint state and federal responsibility. The cooperative state-federal fishery data collection systems obtain landings data from state mandated fishery or mollusk trip-tickets, landings weigh-out reports provided by seafood dealers, federal logbooks of fishery catch and effort, shipboard and portside interviews, and biological sampling of catches. State fishery agencies are usually the primary collectors of landings data, but in some states NMFS and state personnel cooperatively collect the data. Statistics for each state represent a census of the horseshoe crabs landed, rather than an expanded estimate of landings based on sampling data. Although the NMFS reports landings in pounds, adoption of the Interstate Fishery Management Plan for Horseshoe Crab (FMP) in 1998 required states to collect and report all horseshoe crab harvest by numbers, pounds, sex, and harvest method (ASMFC 1998a). All states with an operating fishery require mandatory reporting. Horseshoe crab landings reported after 1997 were expressed as numbers of crabs and were obtained directly from the states.

Commercial sampling intensity varies from state to state. Most jurisdictions have implemented mandatory monthly or weekly reporting. Reporting compliance has substantially improved since adoption of the FMP, with all required states (those with landings >5% of the coastwide total) now providing landings by sex each year in compliance reports. In years initially following the adoption of the FMP, some sex information was missing.

4.1.1.2 Biological Sampling Methods

Under the 1998 FMP, states are required to characterize a portion of the commercial catch based on prosomal width and sex. Though many states implemented this compliance component, sampling intensity has been inconsistent among states and between years. Prosomal width measurements and some sex data from commercial biosampling programs are available from Massachusetts, New York, Delaware, Maryland, Virginia, and North Carolina. These data were included in the growth (Section 2.4) and sex ratio (Section 2.7) analyses for this assessment.

4.1.2 Commercial Bait Landings

The adoption of the FMP in 1998 improved harvest monitoring through mandatory reporting. The adoption of Addendum I to the FMP established reference period landings for the bait fishery that allowed for the implementation of quotas and served as a benchmark to evaluate subsequent bait landings. Addenda III (2004), IV (2006a), and V (2008a) further reduced harvest quotas, implemented seasonal bait harvest closures, and mandated male-only fisheries in some or all of the states in which harvest impacted the Delaware Bay population of horseshoe crabs (New Jersey, Delaware, Maryland, and Virginia).

Commercial bait landings for each state were validated through ACCSP. Inconsistencies between landings in the ACCSP data warehouse and annual compliance reports resulted in a second validation with most of the Atlantic states. For the Delaware Bay Region, ACCSP also validated 2017 landings to support the regional models. Outside the Delaware Bay, landings for 2017 were pulled from compliance reports. Landings previous to 1998 could not be validated by ACCSP and are not included in this assessment or any of the analyses. The coastwide bait landings of horseshoe crabs in Table 1 represent the best data available. Horseshoe crab landings for 1998-2017 peaked in 1999 at 2.6 million horseshoe crabs and have decreased since the late 1990s (Figure 1). Landings have remained under 1 million horseshoe crabs since 2003 and from 2004-2017 landings have averaged 752,886. Sex data were not available for all states, but based on the data available the sex ratio has shifted to predominantly male horseshoe crabs being caught in the bait fishery due to the implementation of the ARM Framework and resulting male-only harvest in the Delaware Bay. At a regional level, on average, commercial bait harvest of horseshoe crabs is predominantly from the Delaware Bay, followed by the New York region, then the Northeast (Table 13, Figure 4). The Southeast historically and presently harvests the smallest number of horseshoe crabs as part of the bait harvest.

Bait landings for the Delaware Bay states was developed to support the catch survey model for that region. Horseshoe crab landings from New Jersey and Delaware are considered to be 100% Delaware Bay origin (i.e., has spawned at least once in Delaware Bay) whereas 51% of Maryland's harvest and 35% of Virginia's are believed to be Delaware Bay origin based on genetic data and analysis (ASMFC 2012). These percentages were applied to the Delaware Bay states' bait harvest. Horseshoe crabs that were not sexed were portioned into males and females based on sex ratios in order to determine how many female horseshoe crabs were harvested in the commercial bait fishery in order to support modeling efforts (Table 14). Similar to the coastwide bait landings, bait landings of Delaware Bay origin were the highest in the late 1990s and have decreased since (Figure 5). The implementation of the ARM Framework through Addendum VII (ASMFC 2012), female harvest in the region has been restricted and this can be seen in the sex ratio of the catch.

4.1.3 Commercial Bait Catch Rates (CPUE)

Commercial catch rates are available from Delaware via the state's compliance report for 2017 (Figure 6). Delaware commercial catch rates were calculated by state employees by dividing the number of horseshoe crabs landed in the dredge and hand fishery by the respective number of trips for each fishery. The commercial CPUE in Delaware's dredge fishery peaked in 1996 and were the lowest in 2003, although there are several years since then when there was no dredge fishery. For the hand harvest CPUE, the highest value was in the terminal year of 2017 and the lowest was in 2013.

Interpretation of the Delaware catch rates are complicated by the imposition of regulations after 1997. For example, after 1997 trip limits were established on the dredge fishery of 1,500 crabs per day and the hand fishery was restricted to 300 ft^3 per day. In addition, the dredge fishery, which was capped at five permits issued annually to fishermen that had traditionally harvested using this gear became subject to a lottery that included non-traditional participants.

These non-traditional fishermen tended to be less efficient while they learned various gear nuisances and locations of horseshoe crab concentrations. Further harvest restrictions were imposed from 2004 and on.

No other state provided sufficient information for this assessment or through their 2017 compliance reports to calculate commercial CPUE. The SAS therefore relied entirely on fishery-independent data to characterize regional and coastwide trends for this assessment.

4.2 Commercial Biomedical Fishery

Research on horseshoe crabs for use in the biomedical industry began in the early 1900s (Shuster 1950). Scientists have used horseshoe crabs in eye research, surgical suture wound dressing development, and detection of bacterial endotoxins in pharmaceuticals (Hall 1992). The current major biomedical use of horseshoe crabs is in the production of LAL. LAL is a clotting agent in horseshoe crab blood that makes it possible to detect endotoxins in patients, drugs, and all intravenous devices. The LAL test was commercialized in the 1970s (J. Cooper, personal communication), and is currently the worldwide standard for screening medical equipment for bacterial contamination.

Blood from horseshoe crabs is obtained by collecting horseshoe crabs, extracting a portion of their blood, and typically releasing them alive. Crabs collected for LAL production are typically collected by hand or trawl. Crabs are inspected to cull out damaged or moribund animals, and transported to the bleeding facility. Following bleeding, most crabs are returned near the location of capture; however, some states allow facilities to bleed crabs caught by the bait industry prior to these crabs going to the market for sale (ASMFC 2004). Bled crabs that are caught and sold by the bait industry are counted against that state's bait harvest quota.

There are six companies along the Atlantic coast that extracted horseshoe crab blood during the time period examined by this assessment, 1999-2017: Associates of Cape Cod (MA), Limuli Labs (NJ), Lonza (MD, formerly Cambrex Bioscience), Wako Chemicals (MD, previously VA), Heptest Labs (VA), and Charles River Endosafe (SC). Addendum III requires states where horseshoe crabs are collected for biomedical bleeding to collect and report total collection numbers, crabs rejected, crabs bled (by sex) and to characterize mortality.

Estimates of biomedical harvest prior to 2004 are uncertain due to lack of standardized reporting; however, estimates from several sources are consistent, lending some credence to the estimates. The FDA estimated medical usage increased from 130,000 crabs in 1989 to 260,000 in 1997 (D. Hochstein, personal communication). This was consistent with other estimates ranging between 200,000 and 250,000 crabs per year on the Atlantic coast (B. Swan, personal communication; Manion et al. 2000). A survey of biomedical companies conducted by the Horseshoe Crab Technical Committee (TC) in 2001 indicated that about 280,000 crabs were bled in 1998 and 2000.

Since 2004, ASMFC has required states to monitor the biomedical use of horseshoe crabs to determine the source of crabs, track total harvest, characterize pre- and post-bleeding mortality, and determine fate (bait or release) of crabs used for biomedical purposes. As reported in annual compliance reports, the total number of crabs delivered to biomedical facilities has increased from 335,501 crabs in 2004 to 575,760 crabs in 2017 which includes crabs harvested as bait (Table 15).

Since 2011, biomedical companies along the Atlantic coast operate under a set of Best Management Practices (BMPs). These BMPs were a product of a collaboration between the LAL companies and ASMFC (Appendix A).

4.2.1 Biomedical Mortality Rate

For previous assessments and the annual compliance reports, mortality in the biomedical fishery (bait crabs excluded) was calculated in two steps. First, pre-bleeding mortality was determined from harvest and use reports provided by the biomedical harvesters. Second, a 15% mortality rate was applied to all bled crabs to determine the post-bleeding mortality. The two values were summed to provide a coastwide estimate of mortality from the harvest, transport, handling, and bleeding of horseshoe crabs used for biomedical purposes.

The 1998 FMP (ASMFC 1998a) established a biomedical mortality threshold of 57,500 crabs which, if exceeded, triggers the Management Board to consider action. The threshold has been exceeded every year since 2007 with the exception of 2016, although no management action has occurred. At the Management Board's request, the TC reviewed available literature and other information on mortality associated with the biomedical fishery (ASMFC 2008b). Despite limitations in study methodology and regional differences in results, the TC endorsed the use of a constant 15% mortality rate at that time.

The SAS developed a Biomedical Workgroup (WG) to review all available literature per region where biomedical facilities operate in order to reassess the 15% mortality rate for bled and released crabs. Each member assessed the studies in terms of how similar they were to the way the biomedical facilities in the region handle crabs and their adherence to the BMPs. The WG presented the results to the SAS, and the SAS also reviewed two additional submissions from Dr. James Cooper and Benjie Swan summarizing the literature, previous mortality rates, and a history of biomedical practices. The reports from the WG members as well as the additional submissions can be found in Appendix A.

The SAS discussed how to determine a biomedical mortality rate at length but with the paucity of long-term studies or studies that collaborate with biomedical facilities to mimic their procedure, it remained a challenging task. Despite having multiple studies and opinions from the SAS and some biomedical representatives on which studies should be considered, the SAS decided to expand Swan's approach from her submission of averaging among all biomedical studies without assigning any value to the studies (i.e., which are more in line with biomedical facilities and which are not) but apply a more rigorous statistical analysis than just a calculated mean.

In order to determine what mortality should be applied to crabs that were bled by the facility and released alive, the SAS compiled all the mortality rates and sample sizes (Table 16). Some studies had multiple rates from multiple treatments and each were treated independently. The rates and samples sizes were analyzed used R Markdown where an overall mortality rate distribution was found by simulating each reported rate as a separate random variable with its own binomial distribution. Then the expected values of the quantiles across the separate studies were calculated to determine a biomedical mortality of 15% with a 95% confidence interval of 4-30%. Therefore, the mortality rate of 15% remains unchanged for this assessment.

4.2.2 Sub-lethal Effects of Biomedical Bleeding

There are few studies regarding the sub-lethal effects of biomedical bleeding. Anderson et al. (2013) evaluated the behavioral and physiological impact of biomedical harvest on 28 female horseshoe crabs. The results showed similar mortality rates as previous bleeding studies (18%) but also showed that bleeding decreased the horseshoe crabs activity levels, changed the expression of circatidal rhythms, and altered the amounts of hemocyanin in their blood which may have immune function implications. The study concluded that bleeding horseshoe crabs may decrease female fitness.

A University of New Hampshire master's thesis by Owings (2017) focused on determining the effects of bleeding on the behavior of horseshoe crabs, impacts on activity and hemocyanin levels, and reduction of the effects by using a food supplement. Comparing 14 bled and 14 control horseshoe crabs, the study found that bled crabs mated less post-release. Additionally, the author noted that awareness of the overall health and hemocyanin levels of individual horseshoe crabs and avoidance of bleeding already-stressed or sick horseshoe crabs decreases mortalities. It should be noted that the Best Practices agrees and stipulates that horseshoe crabs should be sorted during collection so that unhealthy crabs are returned to the water on site (Appendix 12.1). The thesis concludes by suggesting the industry consider using a dietary supplement before or after bleeding to improve the effects of altering the horseshoe crabs physiological status and survivorship.

4.2.3 Biomedical Effect on Survival

The SAS wanted to examine potential differences in recapture rates and survival rates of bled and unbled horseshoe crabs. Current biomedical companies that participate in the US Fish and Wildlife Service's cooperative horseshoe crab tagging program include Lonza and Wako Chemicals. For the tagging study, both companies catch crabs off the coast of Maryland and Virginia mainly via trawl. While most of the other tagging partners tag crabs as they are spawning on beaches, there are additional trawl-caught crabs that are tagged (Table 17). The tagging programs that have captured horseshoe crabs with a trawl include: Maryland Dept. of Natural Resources (MDDNR), North Carolina Cooperative Research Cruise (NCCRUISE), New York Department of Environmental Conservation (NYDEC), Sacred Heart University (SHU), and Virginia Tech (VATECH).

The SAS explored two approaches for preliminary analyses of bleeding effects based on tagging data. For the first approach, the SAS summarized trawl captured and tagged crabs, in order to reduce bias of capture and/or resight probabilities that may occur between hand-captured and trawl-captured horseshoe crabs (Table 17 and Table 18). When horseshoe crabs are recaptured, their disposition is either alive, dead, or unknown. Unknown disposition occurs when a tag is found and it is not attached to a horseshoe crab carapace. Comparisons were made for the percent of reports for alive, dead, and unknown dispositions for bled and unbled, male and female crabs based on the number of years at large (YAL) for the individual crab. Only years where there were greater than 10 total recaptures were included (Table 19 and Table 20).

For the second approach, Cormack-Jolly-Seber (CJS) capture recapture models were fit for the subset of data tagged and released in the coastal region of Delaware, Maryland, and Virginia from 1999 to 2017. All observations regardless of capture and disposition were included in the capture history matrix. This allowed for sufficient data to fit the complex models while controlling for geography because nearly all tagged and bled crabs were released in the coastal Delaware, Maryland, and Virginia geographic area. There were 77,436 tagged animals with known sex and bleeding status: 8,449 unbled females, 20,435 bled females, 14,998 unbled males, and 33,554 bled males. Models, which were fit using RMark, included covariates for sex, bleeding status, and time for apparent survival (Phi) and capture probability (p).

4.2.3.1 Results

4.2.3.1.1 Trawl Captured and Tagged Crabs

There was a higher proportion of unbled horseshoe crabs reported as alive over time for both males and females (Figure 7). The greatest difference in recapture rates appears to be within the first year of release (0 YAL), as the rates generally become more similar with time. This trend also occurred with horseshoe crabs reported as dead (Figure 8). Again, it appears the effect of bleeding may be greatest within the first year of release, as the number of dead reports sharply declines between zero and one year at large, after which there is a steady increase over time for both bled and unbled horseshoe crabs.

There may also be a difference between sexes, as males appear to be captured alive at a higher rate than females (Figure 7), regardless if those males or females were bled. Males are also reported as dead at a lower rate than females (Figure 8).

Bled crabs (both male and female) are reported as unknown at a higher rate than unbled crabs (Figure 9). As time at large increases, the rate of bled female crabs reported as unknown increased from 27% (0 YAL) to 65 % (8 YAL). Bled males reported as unknown also increased, albeit at a lower rate than bled females. There was not much change in the number of unbled crabs reported as unknown for either males or females (Figure 9). It is likely that unknown reports are a combination of both tag loss and mortality.

4.2.3.1.2 Cormack-Jolly-Seber Model

The best fitting models included group-level effects on apparent survival due to bleeding and sex (Table 21). Survival also varied with time; however, year-specific survival was not estimable for many of the years. Thus, years were binned into periods defined by 2, 3, or 4 consecutive years and estimated average survival over the multiple year periods. The model with the binned 3-year periods fit best (Table 21). The estimated apparent survival was higher in most time intervals for crabs that had been bled, particularly for females (Table 22). On average, females had a lower survival rate than males, but the difference was higher for unbled crabs (70% for females and 73% for males) then for bled crabs (75% for females and 76% for males).

4.2.3.2 Discussion and Recommended Next Steps

Preliminary analysis presents some evidence for a short-term reduction in survival due to bleeding based on first year returns. In contrast, annual survival considering multiple years does not indicate a reduction in survival due to bleeding. Rather the multiyear estimates indicate higher survival for bled crabs compared to unbled crabs tagged and released in the coastal Delaware, Maryland, and Virginia geographic area. The pattern of higher survival for bled crabs could be due to confounding factors related to local harvest pressure on unbled crabs tagged on coastal beaches in the fishery or due to the culling of biomedical catches for selection of high condition individuals. Biomedical culling could result in biomedically tagged individuals representing a healthier subset of the overall population and thus having higher survival, all else equal.

These are preliminary analyses, and the SAS recommends continued evaluation of the tagging data by fitting capture-recapture models that include a short-term (1 year) bleeding effect, account for spatial distribution of harvest pressure, account for capture methodology, and account for disposition of recaptured tagged individuals. Potential methodological approaches include use of time-varying individual covariates to indicate which crabs are 1 year from bleeding and use of hierarchical models to estimate interannual variation in survival within time periods defined by major regulatory changes.

4.2.4 Biomedical Data Estimation

For this assessment, the SAS was tasked with evaluating the biomedical collection and mortality by region and use the mortality associated with biomedical bleeding in the modelling approach. In order to use the data regionally (by sex in some cases), consider the full range of biomedical mortality, and extend the time series, some estimation from the data set had to be performed prior to inclusion in analysis. When assessing the biomedical harvest by region, as opposed to coastwide, the data becomes confidential (*see Statement, page iv*) and therefore some information has been removed from this public document.

4.2.4.1 Methods

Data for the biomedical use of horseshoe crabs is reported to the Commission annually in state compliance reports. Under Addendum III, states are required to report biomedical collections by month and sex, along with the number or percent of observed mortality up to the point of release, collection method, disposition of bled crabs, and condition of holding environment of bled crabs prior to release (ASMFC 2004b). Clarity of reported information has improved throughout the years, and the information is now requested using a standardized template for data entry. To include the most extensive and accurate information possible, states were requested to resubmit biomedical data, including years prior to reporting as required in

Addendum III, as available. This also gave states the opportunity to confirm or update information that may have been preliminary at the time of submission for past compliance reports. Discrepancies with previous reports were confirmed by the states in coordination with biomedical facilities.

Data on biomedical use of horseshoe crabs were available for 1999-2017, but the amount, quality, and completeness varied. Within this timeframe several facilities had years of missing information on collections, observed mortality, number of crabs bled, and sex ratio of crabs caught and released solely for biomedical use (biomedical-only), i.e. those that did not enter the bait market after being bled. Mortality of crabs that entered the bait market after being bled is included in bait landings, not in biomedical mortality. To extend the time series of all facilities and account for biomedical mortality in as many years as possible, missing years were estimated based on available data. Biomedical company representatives and state permitting records were consulted to confirm whether and which facilities were operating during years without data.

To account for potential annual trends in the biomedical market as a whole, annual collections of biomedical-only crabs from states with incomplete time series from 1999-2017 were regressed against those with complete time series. Regressions were only conducted for relevant years, when data were reported and had the same facility or facilities operating as years requiring estimation. One state requiring estimation only had two years of data relevant to the missing years, thus a regression could not be conducted and values for missing years were estimated as the mean of the two years of relevant, available data. Relationships between facilities or averages of available years were only used to estimate collections of horseshoe crabs used solely for biomedical use. They were not used to estimate numbers observed dead, bled, or sex ratios when such information was missing. These estimates were made based on state-specific data as described below.

Annual state percentages of collected biomedical-only crabs that were observed dead during the biomedical bleeding process (capture to release) were calculated for all years when such data were available. Years when these data were not available were estimated as state averages of relevant reported annual percentages observed dead multiplied by reported or estimated collection numbers.

Annual state percentages of collected biomedical-only crabs that were bled were calculated for all years when such data were available. Years when these data were not available were estimated as state averages of relevant reported annual percentages bled multiplied by reported or estimated collection numbers.

Annual state sex ratios of biomedical-only crabs collected were calculated for all years when such data were available. Sex-specific collections for unreported years or crabs reported as unknown sex were estimated as relevant state average annual sex ratios multiplied by unsexed, reported or estimated collection numbers. Sex ratios estimated for collections are assumed to also be reflective of later stages and data for the biomedical process (e.g. crabs bled, observed mortality, post-bleeding mortality).

4.2.4.2 Results

Collection data were available for 101 (89%) of the 114 state-year combinations considered (Table 23). Sex, bleeding, and observed dead proportions were more available later in the time series. Sex was not reported for every stage of the biomedical process. Thus, all collection, bled, observed dead, and total mortality numbers are assumed to have the same sex ratio within each state-year combination.

Two significant relationships were observed for collection numbers of states requiring imputation with those of states with full time series of data from 1999-2017 (Figure 9). These relationships were used to estimate collections in missing years when collections were known to have been conducted.

Annual biomedical collections trend up early in the time series to a peak in 2011 (Figure 11). From approximately 2010 through 2017 collections have been fairly stable, outside of a significant, single-year decrease in 2016. This decrease was due to known, temporary changes in production. More typical collection numbers resumed in 2017.

The average annual proportion of collected crabs observed dead during the biomedical process and proportion bled had little variation by state and facility (Table 24). All facilities observed mortalities less than 10% while crabs were in their possession, with all currently operating facilities observing mortalities less than 4%. Most states/facilities bled over 90% of crabs collected.

The bleeding mortality estimate from the meta-analysis of bleeding studies (15%) was applied to numbers of bled crabs to estimate bleeding mortality. This was added to the number of crabs observed dead during the biomedical process to estimate the total mortality attributable to biomedical use (Figure 12). As Delaware Bay was the only region in which sex-specific mortality information was used to model the population, these mortality estimates are specified in Figure 12. These mortality estimates include apportioning of Virginia and Maryland crabs, with 35% and 51% of crabs from each state, respectively, being of Delaware Bay origin. These percentages are based on genetic population structure findings (ASMFC 2012).

4.2.5 Biomedical Biological Data

Sex ratios varied considerably among facilities (Table 25). These sex ratios are likely not representative of population sex ratios in collection areas, as gear selectivity and culling of crabs less likely to be selected for bleeding would alter these ratios. Some facilities have size-based criteria that exclude smaller individuals, making females, the larger of the sexes, more likely to be bled. Additionally, some facilities collect crabs by hand, which allows greater ability to select for large females than other gears, such as a dredge or trawl. Time series of sex ratios indicate greater use of male crabs more recently than in the past.

4.2.6 Biomedical Data to Support Modelling Efforts

The bleeding mortality estimate and 95% confidence limits from the meta-analysis of bleeding studies (15%; [4%, 30%]) were applied to numbers of bled crabs to estimate bleeding mortality.

Bleeding mortality was added to the number of crabs observed dead during the biomedical process to estimate the total mortality attributable to biomedical use (Figure 12, Table 26). Biomedical mortality accounted for less than 20% of coastwide mortality resulting from directed (bait and biomedical) use of horseshoe crabs in all years (Table 27). The percent of mortality attributed to the biomedical industry did vary by region, but is **CONFIDENTIAL** (Table 28). Annual sex-specific mortalities were estimated (Figure 12, Table 29) and used as inputs for the catch survey analysis, modeling the Delaware Bay population. These mortality estimates include apportioning of Virginia and Maryland crabs, with 35% and 51% of crabs from each state, respectively, being of Delaware Bay origin.

4.3 Commercial Discards

4.3.1 Northeast Fisheries Observer Program

4.3.1.1 Program Description

Discard information from observed commercial fishing trips was obtained from NMFS' Northeast Fisheries Science Center's (NEFSC) Northeast Fisheries Observer Program (NEFOP). The NEFOP program collects data on harvested and discarded catch, gear, effort, and species' lengths and weights using trained fishery observers from Maine to North Carolina. The total catch and a subsample of the total catch from each observation (e.g., towed trawl net) are weighed. The observer program is mandatory for federally-permitted vessels which are selected at random for observation during fishing trips. The program began in 1989 but data on horseshoe crab was available beginning in 2004. Horseshoe crab landings and observed discards were used to develop discard estimates from gillnets, trawls, and dredges in the Delaware Bay states for use in the catch survey analysis (CSA). Estimates for the other regions were attempted but lacked sufficient sampling to produce reliable estimates. See the NEFOP website for additional details about the program (http://nefsc.noaa.gov/fsb/program.html).

4.3.1.2 Methods

The NEFOP data set included all landings from observed trips, including those where no horseshoe crab were encountered, as well as horseshoe crabs discarded and horseshoe crabs kept, all in pounds (Figure 13 and Figure 14). NEFOP observer data were used to develop annual ratios of observed discarded horseshoe crab to observed landings of all species by gill nets, bottom trawls, and dredges from the Delaware Bay states (Delaware, New Jersey, Maryland, and Virginia) for 2004-2017. Ratios were then applied to reported gill net, bottom trawl, and dredge landings of all species from those states for 2004-2017 as queried from the Atlantic Coastal Cooperative Statistics Program (ACCSP; Figure 15) warehouse to estimate total discards of horseshoe crab. Some landings were not available at the gear level ("NOT CODED"). These landings were partitioned into trawl, gillnet, and dredge landings by calculating the annual proportion of landings by these gear categories and then these proportions were applied to the "NOT CODED" landings. Gears that were categorized as "trawl" or "gill net" but are unlikely to capture horseshoe crabs, such as midwater trawls or anchored and drift floating gill nets, were removed from the analysis.

The annual ratios by major gear type were calculated as the ratio of the mean discards of horseshoe crab per observation (i.e., tow or net set), in pounds, to the mean landings of aggregated species per observation, also in pounds (Equation 1).

$$Equation\ 1: R = \frac{\overline{D}}{\overline{L}} = \frac{\sum_1^n D_i}{\sum_1^n L_i}$$

This ratio estimator includes all observations with observed landings of any species, including those where no horseshoe crab were discarded. The variance of the ratio estimator was calculated with Equation 2 (Pollock et al. 1994).

$$Equation\ 2: Var(R) = \frac{1}{n(n-1)\overline{L}^2}\left(\sum_1^n D_i^2 + R^2\sum_1^n L_i^2 - 2R\sum_1^n D_i L_i\right)$$

It was assumed that discarding rates during observed trips were representative of overall discarding rates in these fisheries. Small sample sizes of positive observations precluded developing ratios at finer resolution (e.g., by state or season).

For trawls, annual mean weights were calculated as the total number counted from subsamples divided by the total subsample weight and were applied to the discard estimates in weight to derive discard estimates in numbers. In years with no observer data, averages of all the years combined were used. For gill nets and dredges, there was not sufficient biological sampling to calculate the mean weight of horseshoe crabs caught as bycatch in the gear. The SAS used the state-generated conversion factors of 1 pound for male horseshoe crabs and 2.67 pounds for female horseshoe crabs. Based on commercial biological sampling sex ratio of 48% female horseshoe crabs, the conversion factor of 1.8 pounds per horseshoe crab caught as bycatch in the dredge and gill net gears were used to convert from pounds to numbers.

Ratios estimates, variances, and discard estimates by gear are in Table 30-Table 32. A discard mortality rate of 50% was assumed for both gillnet and trawl discards of horseshoe crab due to the effects of being stuck in a gill or trawl net for extended periods of time or tows. The TC discussed that the trawl discard mortality is likely lower than 50% based on field observations, maybe even as low as 5% (S. Doctor, personal communication). The TC chose to maintain the rate at 50% to be precautionary since the discard estimates are likely biased low since they do not account for biomedical trips that are known to sort and discard catch at sea and observed trips target some species other than horseshoe crabs and may handle crabs differently. A discard mortality rate of 5% was assumed for dredge discards of horseshoe crab (D. Smith, unpublished data). These mortality rates were developed from SAS and TC discussions and members' field experience due to a lack of information about discard mortality rates from various gears for horseshoe crabs. For use in the female-only catch survey analysis, the 48% female sex ratio was applied to the dead discard numbers.

4.3.1.3 Results

Based on the data from NEFOP for the Delaware Bay region, observed landings of all species were variable (Figure 14) and most observed trips were in New Jersey and Virginia and few trips were observed in Maryland and Delaware. Of all the observed trips in the Delaware Bay region, 45% landed scallops, 16% landed short-fin squid, 7% landed Atlantic mackerel, 6% landed summer flounder, 6% landed Atlantic long-fin squid, and the remaining species comprised <5% the observed landings by weight. Horseshoe crab landings comprised <1% of the total observed landings in the data set. From 2004-2017, 51% of observed fishing trips used dredges, 46% used trawls, and 3% used gill nets.

Pounds of kept and discarded horseshoe crabs from observed fishing trips in the NEFOP data set was variable but generally increased in the Delaware Bay region from 2004-2017 (Figure 13). The increase in discards could in part be due to the male-only harvest which began in the 2014 fishing season through the present and the closure of New Jersey's horseshoe crab fishery in 2007 or be an artifact of sampling, particularly since Maryland and Delaware have fewer trips observed that encounter horseshoe crabs compared to New Jersey and Virginia. From 2004-2017, 96% of horseshoe crabs encountered on observed trips in New Jersey were discarded, 81% in Virginia, and 24% in Maryland. Delaware did not have enough encounters with horseshoe crabs to make any generalizations, but of the 136 pounds caught in observed trips in the state, 100% were discarded.

Total landings from gill nets, trawls, dredges, and not coded gears of all species by state in the Delaware Bay region from ACCSP (Figure 15) indicated stability throughout the time series with a slight decrease over time. Average landings from the Delaware Bay region for all fisheries was 558 million pounds from 2004-2017. The majority of all-species landings in the region were from New Jersey (which has had a moratorium on horseshoe crab bait harvest since 2006) followed by Virginia, Maryland, and then Delaware.

The ratio estimators varied by gear and year (Table 30-Table 32). Estimated discards of horseshoe crab also varied by gear and year (Figure 16-Figure 18) where dredges discarded the most horseshoe crabs and trawls discarded the least. Conversely, trawls were the most subsampled trips for weights used to convert discards in pounds to discards in numbers. Discards from dredges increased remarkably in 2014-2017 due to several observed trips with high discarded horseshoe crabs in those years. Estimated discards from gill nets and trawls followed similar patterns with peaks in 2011 and 2013 and decreased discards from 2014-2017. Estimated discards for all three gears combined showed an increase of discards throughout the time series (Figure 19), although those estimates were highly influenced by the dredge discard estimates.

Mortality rates of 50% for trawls and gill nets and 5% for dredges were applied to the estimated numbers of horseshoe crabs discarded to get estimated number of dead horseshoe crabs attributed to discards in the Delaware Bay region. The number of dead horseshoe crabs from discards was 101,100 on average and ranged from a low of 21,937 in 2005 to a high of 216,518 in 2013 (Figure 20). In order to be used in the CSA model, discard estimates need to be proportioned by sex. Few horseshoe crabs were sexed throughout the time series (n=209) and those that were sexed were collected primarily from the trawl fisheries. The SAS instead referred to sex data from commercial sampling programs in the Delaware Bay states to derive a sex ratio of 48% female. Applying that percentage to all years of discards data resulted in an average of 48,527 female horseshoe crabs dead from discards in all gears, ranging from 10,530 in 2005 to 103,928 in 2013 (Figure 21).

4.4 Recreational

There is no recreational fishery for horseshoe crabs. Some states allow a minimal number of crabs to be retained for personal use. Landings of this type are not quantified.

5 INDEPENDENT DATA SOURCES

5.1 Stock Assessment Subcommittee Criteria

The SAS established the following set of criteria for evaluating data sets and developing indices of relative abundance for horseshoe crab:

1. Time series: Ideally, the time series should be 20 years long to account for the lifespan of horseshoe crab. Recognizing that would eliminate many surveys, the SAS recommended at least 10 years of data be available in a survey.
2. Survey design: Surveys with statistical designs are preferred, such as surveys with random stratified sampling.
3. Gear: Surveys should operate with gear that is capable of catching horseshoe crabs and to which horseshoe crabs are available.
4. Temporal and spatial coverage: Only surveys that operate during a time and place where horseshoe crab are available for capture should be considered. Examining the precision or proportion of zero catches of horseshoe crabs in a survey can be tools for evaluating this.
5. Methodology: Survey methodology should be consistent throughout the time series or changes should be able to be accounted for in the standardization process.

The SAS evaluated several data sets for developing indices of abundance for horseshoe crab. After some preliminary analysis, nine were rejected for various reasons as indicated in Table 33 and abundance indices were developed from the remaining surveys. When possible, indices of abundance were developed by season and sex. There were also efforts to develop surveys by stage to support modelling approaches; however, stage-based indices were not able to be developed due to insufficient data. The SAS explored using nominal and GLM standardized indices, but encountered issues with these methods due to the high proportion of zero catches in many of the tows in the surveys. Therefore, all indices were developed using the delta distribution for the mean and variance for each year of a survey to specifically take into account the number of zero catches (Pennington 1983). Maps of the surveys were included when they were supplied from the data provider. A summary of the gear used and size range of horseshoe crabs caught for the surveys included in this assessment can be found in Table 34 and Figure 22, as requested by the Peer Review Panel.

5.2 Surveys

5.2.1 New Hampshire Spawning Beach Survey

5.2.1.1 Survey Design and Methods

The New Hampshire spawning survey operated for 11 years from 2002 to 2012. During the months of May through September five beach locations were surveyed in 150, 300, or 450 meter transects.

5.2.1.2 Biological and Environmental Sampling

All horseshoe crabs visible in the transects were counted and sexed. Prosomal widths were taken when possible. Eggs were recorded using a presence/absence description. Temperature, weather, cloud cover, wave action, moon stage, and salinity were recorded for environmental factors.

5.2.1.3 Evaluation of Survey Data

A spring (May and June) index was developed from this survey. Male and female indices were calculated separately for this survey because 100% of the individuals recorded were sexed. July, August, and September were dropped due to high occurrences of zero sightings. The subset data resulted in 57% zero sightings over the entire time series.

5.2.1.4 Abundance Index Trends

Abundance peaked for both male and female horseshoe crabs in 2004. Between 2005 and 2012 abundance remained relatively low (Figure 23 and Figure 24).

5.2.2 Massachusetts Resource Assessment Trawl

5.2.2.1 Survey Design and Methods

The Massachusetts Resource Assessment Trawl is an otter trawl survey which began operating annually during the months of May and September in 1978. The study area is stratified based on five bio-geographic regions and six depth zones (Figure 25). Sampling intensity is approximately 1 station per 19 square nautical miles. A minimum of two stations are assigned to each stratum. A standard tow of 20-minute duration at 2.5 knots is attempted at each station during daylight hours.

5.2.2.2 Biological and Environmental Sampling
The total weight and length-frequency of each species are recorded directly into Fisheries Scientific Computer System (FSCS) data tables. Horseshoe crab sex identification and prosomal width measurements began in 1982. Temperature and depth are recorded for each tow.

5.2.2.3 Evaluation of Survey Data
Two fall (September-October) indices were developed from this survey to reflect the differences in the horseshoe crab populations north and south of Cape Cod. The data was split into north and south based on strata so that the north was zones 4-5 and the south was zones 1-3 (Figure 25) and subset to include only tows occurring at depths between 6-14 meters where horseshoe crabs were predominantly encountered. Tows that occurred outside of these parameters had very low frequencies of horseshoe crab catch. Throughout the time series and strata, fall tows were 10% positive for horseshoe crab presence. Nearly all crabs were sexed after 1982, however the sample sizes were still small and the SAS could not justify using such small numbers to calculate a sex based index from this survey.

5.2.2.4 Abundance Index Trends
Horseshoe crab abundance varied by region. In the North Cape index (Figure 26), abundance peaked in 1980 and declined since then although the last four years exhibited mid-range abundance. There were multiple years in the survey that did not encounter any horseshoe crabs. The South Cape index shows a different pattern from the North Cape index where it begins relatively low and then experiences high abundance in 2016-2017 (Figure 27).

5.2.3 Rhode Island Costal Trawl Survey (monthly segment)

5.2.3.1 Survey Design and Methods
The Rhode Island Coastal Trawl Survey began operating in 1990. The monthly segment of the survey samples 13 fixed stations, 12 inside Narragansett Bay and 1 in Rhode Island Sound (Figure 28). At each station, an otter trawl is towed for twenty minutes.

5.2.3.2 Biological and Environmental Sampling
All catch is identified by species then measured and weighed. Horseshoe crab sex and prosomal width recordings began in 1998. Temperature, depth, salinity, and weather conditions are all recorded for environmental factors.

5.2.3.3 Evaluation of Survey Data
A spring (April - July) and fall (August – October) index was developed from this survey. The data was subset to include only tows with recorded bottom temperatures greater than 10.1℃ thus eliminating a large proportion of zero catch tows. Ultimately, the SAS decided to use only the fall index due to a higher rate of percent positive tows. Throughout the time series, fall tows were 22% positive while spring tows were 13% positive. Sexes were kept combined as there are not enough crabs caught in this survey to support sex specific indices.

5.2.3.4 Abundance Index Trends
Horseshoe crab abundance has remained relatively steady according to this survey. Throughout the time series, abundance remains relatively low between 0.5 and 1.5 crabs per tow (Figure 29).

5.2.4 Connecticut DEEP Long Island Sound Trawl Survey

5.2.4.1 Survey Design and Methods
This survey began operation in 1984 and continues to sample Connecticut and New York waters during the spring (April – June) and fall (September – October) seasons. The sampling area is divided into 1x2 nautical mile sites with each site assigned to one of 12 strata defined by depth interval (0-9.0 m, 9.1-18.2 m, 18.3- 27.3 m, or 27.4+ m) and bottom type (mud, sand, or transitional) (Figure 30). Forty samples are collected each month resulting in 200 sites annually. It should be noted that this survey did not operate in the fall of 2010.

5.2.4.2 Biological and Environmental Sampling
All catch is identified by species and weighed in aggregate by species. Horseshoe crab counts began in fall 1997 while lengths and sex records began in fall 1998. Depth, salinity, temperature, and sediment type are recorded for environmental factors.

5.2.4.3 Evaluation of Survey Data
A spring (April – June) and fall (September – October) index were developed from this survey. The data was subset to include only tows with depths less than 43.5m and bottom temperatures greater than 4.3℃ thus eliminating a large proportion of zero catch tows. Ultimately, the SAS decided to use only the fall index due to a higher rate of percent positive tows. Throughout the time series, fall tows were 39% positive while spring tows were 29% positive. Sexes were kept combined as there were not enough sexed crabs to support separate indices.

5.2.4.4 Abundance Index Trends
Abundance of horseshoe crabs in this survey is relatively high compared to surveys operating with similar gears. Horseshoe crabs caught per tow remained fairly steady between two and four individuals until 2010 when numbers dropped to consistently catching between one and two horseshoe crabs per tow (Figure 31).

5.2.5 New York DEC Peconic Small Mesh Trawl Survey

5.2.5.1 Survey Design and Methods
This survey began operating in 1987 and continues to sample 16 randomly selected stations in the Peconic Bay on a weekly basis from May through October. The survey area was divided into 77 sampling blocks with each block measuring 1’ latitude and 1’ longitude (Figure 32). The 4.8 meter semi-balloon shrimp trawl net is towed for 10 minutes at approximately 2.5 knots using a 10.7 meter lobster style workboat.

5.2.5.2 Biological and Environmental Sampling

All catch is identified by species and counted. Horseshoe crab sex and prosomal width have been recorded since 1997. Temperature, salinity, depth, dissolved oxygen, and secchi disc readings are recorded for environmental factors.

5.2.5.3 Evaluation of Survey Data

Spring (May-July) and fall (August-October) indices were developed from this survey. Tows with missing salinity, salinity greater than 32.12 (unit), missing temperature, and temperatures less than 11℃ were eliminated in attempts to use only data points with complete environmental information and a higher likelihood of catching horseshoe crabs. Both seasons of the survey were fairly similar in regard to total horseshoe crabs caught and percent zeros. Throughout the entire time series, the spring survey caught 7,270 crabs with 57% of tows catching zero horseshoe crabs. The fall survey caught 7,200 crabs with a 60% zero catch rate. The SAS decided to use the fall portion of the survey to remain consistent with regional time series usage of fall inclusion only. Sexes were kept combined as there were not enough sexed crabs to support separate indices. Throughout the entire time series only 34% of crabs were sexed.

5.2.5.4 Abundance Index Trends

Horseshoe crab abundance peaked in 1991 after which numbers have been steadily decreasing. Since 2004, horseshoe crab catch per tow has been consistently below one (Figure 33).

5.2.6 New York DEC Western Long Island Beach Seine Survey

5.2.6.1 Survey Design and Methods

The New York Seine Survey began operation in 1984 in Jamaica Bay (Figure 34), Manhasset Bay (Figure 35), and Little Neck Bay (Figure 36). Pre-2000 sampling was conducted 2 times per month during May and June, once a month July through October and then 2 times per month from May through October for 2000 – 2002. Currently, 5-10 seine sites are sampled in each bay on each sampling trip. From 1984 – 1998 a 500 ft x 12 ft seine with stretch mesh in the wings and stretch mesh in the bag was used for one sampling round generally in the spring. Currently a 200 ft x 10 ft beach seine with ¼ inch square mesh in the wings, and 3/16 inch square mesh in the bunt is being used. The seine is set by boat in a “U” shape along the beach and pulled in by hand.

5.2.6.2 Biological and Environmental Sampling

All finfish species are identified and counted. Starting in 1987, invertebrates were consistently counted. Since 1998, horseshoe crabs have been counted, measured, and sex has been identified. Environmental information (air and water temperature, salinity, dissolved oxygen, tide stage, wind speed and direction, and wave height) has been recorded at each station. Bottom type, vegetation type, and percent cover have been recorded qualitatively since 1988.

5.2.6.3 Evaluation of Survey Data

Two indices of abundance were developed from this survey based on geographic location: a Jamaica Bay index and a Manhasset and Little Bays index. The latter two Bays were combined due to proximity to each other. Horseshoe crabs were most reliably caught in all three regions in May and June, although the survey runs from April through November. Without subsetting, the survey had on average 30% positive tows but when restricted to the spring months the proportion positive tows increased to 45%.

5.2.6.4 Abundance Index Trends

The Jamaica Bay index of horseshoe crab abundance shows variable abundance through the 1990s with a lot of fluctuation between high peaks and low values in the 2000s (Figure 37). From 2006 through the terminal year, the index exhibits lower abundances of horseshoe crabs in this region. For the Manhasset and Little Neck Bays index, abundance was variable with some high values from 1987-2003 (Figure 38). After 2003, the index decreased dramatically and has remained low through 2017.

5.2.7 Northeast Area Monitoring and Assessment Program Trawl Survey

5.2.7.1 Survey Design and Methods

The Northeast Area Monitoring and Assessment Program (NEAMAP) Trawl Survey began sampling the coastal ocean from Martha's Vineyard, MA to Cape Hatteras, NC since the fall of 2007 (Figure 39). The survey area is stratified by both latitudinal/longitudinal region and depth. A four-seam, three-bridle, 400x12 cm bottom trawl is towed for 20 minutes at each sampling site with a target speed-over-ground of 3.0 kts. The net is outfitted with a 2.54cm knotless nylon liner to retain the early life stages of the various fishes and invertebrates sampled by the trawl. The survey conducts two cruises a year, one in the spring (April-May) and one in the fall (September-November). A total of 150 sites are sampled per cruise, except 160 sites were sampled in the spring and fall of 2009 as part of an investigation into the adequacy of the program's stratification approach.

5.2.7.2 Biological and Environmental Sampling

For each tow, the catch is sorted by species. Horseshoe crab are measured for prosomal width and sex when possible. A number of variables (profiles of water temperature, salinity, dissolved oxygen, and photosynthetically active radiation), atmospheric data, and station identification information are recorded at each sampling site.

5.2.7.3 Evaluation of Survey Data

A spring (April- May) and a fall (October) index were developed from this survey. Horseshoe crabs were caught in the fall with 56% positive tows and in the spring when there were 72% positive tows. The SAS decided to use the fall portion of the survey to be consistent with other surveys in the region. The fall portion of the NEAMAP survey was further split to develop two indices from this data set: a New York index (strata 3-5) and a Delaware Bay index (strata 8-11). Nearly half of horseshoe crabs caught in the survey were sexed, but due to the subset data there were not enough to justify developing sex-specific indices. Based on the prosomal widths provided, this survey catches primarily adults in the fall.

5.2.7.4 Abundance Index Trends

The survey of relative abundance of horseshoe crab in the New York portion of the NEAMAP survey began with high values in 2007-2008 and the lowest value in 2010 (Figure 40). The index was variable throughout the 2010s. For the Delaware Bay index developed from the fall portion of the NEAMAP survey, horseshoe crab abundance was variable with the highest abundance in 2009 and 2015 and the lowest abundance in 2013 (Figure 41).

5.2.8 New Jersey Ocean Trawl Survey

5.2.8.1 Survey Design and Methods

New Jersey's Ocean Trawl Survey has been operating since August of 1988 and collects samples during five survey cruises per year (30 samples in January, 39 samples each in April, June, August and October) in the nearshore ocean waters of New Jersey. It uses a three-in-one design, two-seam trawl net with forward netting of 12 cm stretch mesh, rear netting of 8 cm, and a 6.4 mm bar mesh liner in the cod end. The survey incorporates a random stratified design with sampling sites selected within 15 strata (Figure 42) with longitudinal boundaries consisting of 5, 10 and 15 fathom isobaths. The latitudinal boundaries are identical with the NMFS groundfish survey except the extreme southern and northern ends of the sampling area. These strata are further divided into blocks which are 2.0 minutes longitude by 2.5 minutes latitude for the midshore and offshore strata, and 1.0 minutes longitude by 1.0 minutes latitude for the inshore strata. The standard duration of each sample is a 20-minute tow.

5.2.8.2 Biological and Environmental Sampling

Catches are sorted to species level whenever possible, enumerated, weighed (gross weight per species) and measured for length/width (cm) data. Certain species are sexed and horseshoe crabs have consistently been sexed since 1999. Environmental data include depth (m), surface and bottom water temperature (degrees Celsius), salinity (0/00) and dissolved oxygen (mg/L) along with air temperature, wind direction and speed, weather conditions, wave height, and swell direction and height.

5.2.8.3 Evaluation of Survey Data

This survey catches mainly adult horseshoe crabs, and the SAS concluded that the paucity of juvenile crabs negated development of juvenile indices from this program. A spring/summer (April and August) and a fall (October) index were developed from this survey for female adult (>= 19 cm pw), male adult (possessing male pedipalps), and all horseshoe crabs combined. The indices for all horseshoe crabs combined used the years 1989-August 2018, while the sexed indices only used the years in which the crabs were consistently sexed (1999-August 2018). Overall, horseshoe crabs were caught slightly more often in the fall (58.5% positive tows) than in the spring (51.4% positive tows). This pattern continued for female adults (46.6% positive tows in the fall, 43.7% positive tows in spring) and male adults (40.0% fall positive tows, 38.1% spring positive tows).

5.2.8.4 Abundance Index Trends

For all horseshoe crabs combined in the spring, abundance was higher in the years 1990 through 2005 peaking at 1997 and 1999, before falling between 2006 through 2010. After 2011, the abundance has been on an upward trend with a survey-high peak in 2013 (Figure 43). However, the fall index shows high abundance from 1989-1992, then fluctuations at lower levels thereafter (Figure 44). The spring index for adult female horseshoe crabs shows a trend similar to the spring index for all crabs: higher abundance in the early years followed by declines through 2010 before trending higher through 2017 with a peak during 2013 (Figure 45). This pattern is also seen in the spring indices for adult males (Figure 46). The fall indices for the sexed crabs generally followed the same patterns as for all horseshoe crabs combined but with subtle differences. While the fall indices for adult females (Figure 47) showed a peak in 2004 and adult males (Figure 48) showed peaks a year later in 2005. All of the fall indices showed fluctuating abundances with steep decreases for 2017 after a rise of varying scales in 2016. All the indices for spring and fall showed noticeable declines in 2010.

All the indices showed generally increasing trends after 2012, though the fall indices all showed steep declines for 2017. This result may have been an artifact of the timing of this survey cruise missing the fall migrations of this species.

5.2.9 New Jersey Surf Clam Dredge Survey

5.2.9.1 Survey Design and Methods

New Jersey's surf clam dredge survey has been operated by New Jersey's Bureau of Shellfisheries since 1988, with horseshoe crab catches recorded since 1998. The sample area includes the state waters component of New Jersey's ocean waters from Cape May north to the Shrewsbury Rocks off Monmouth County, NJ. The standard sample duration is a 5-minute tow. The gear type is a commercial hydraulic dredge equipped with a 72" knife and 2" X 2" steel mesh liner on the dredge floor. Through 2012, this survey collected on average 328 samples per year with the sampling conducted between June and August. In 2013, due to funding and staff shortages, the number of samples fell by more than half to 122 samples, with the subsequent years' averaging about 165 samples each. Due to this change in methodology, only the data from 1998 through 2012 were used for this assessment.

5.2.9.2 Biological and Environmental Sampling

This survey is focused on surf clam abundance and size data collection, but also records catch, sex and prosomal width (mm) information on all horseshoe crabs caught. A Peterson grab sample is taken at the end of each sample tow for bottom sediment analysis.

5.2.9.3 Evaluation of Survey Data

As this survey catches mainly adult horseshoe crabs, no juvenile indices were developed from this program. With the timing of the survey occurring mainly in the summer months of June, July and August, only one index (considered to be spring in this assessment) was developed for each of the following categories: all combined, female adult (> 180 mm pw), and male adult (possessing male pedipalps) horseshoe crabs. Positive tows for all horseshoe crabs combined made up 31.5% of all samples. The sexed indices all followed a pattern of higher positive tows for females than males: adults (21.7% female, 11.1% males).

5.2.9.4 Abundance Index Trends

For all horseshoe crabs combined, the abundance index trended upward from 2002 through 2012 after generally decreasing from 1998 to 2001 (Figure 49). The index rose above all the previous years' values in 2006 and remained above that level through 2012. The index for the adult females (Figure 50) shows fluctuations trending lower from 1998 through 2003 then rising from 2004 through 2007. There was a drop to an intermediate level of abundance in 2008 followed by another fluctuating but general trend upward through 2012. The abundance index for the adult male (Figure 51) showed generally declining fluctuations from 1998 through 2005. The index then increased through 2007, decreased to an intermediate level through 2009 before entering a general increase from 2010 through 2012.

5.2.10 Delaware Fish and Wildlife Adult Trawl Survey

5.2.10.1 Survey Design and Methods

Delaware has conducted the Adult Trawl Survey in three discrete time spans: 1966 – 1971, 1979 – 1984, and continuously since 1990. This assessment used the data from the latest time period (1990 – 2017) and was updated through 2018 for the spring portion of the survey. The survey samples 9 fixed stations monthly from March through December for an annual total of 72 samples. This survey uses a 30 foot, 2-seam otter trawl with a 3 inch stretch mesh in the wings and body and a 2 inch stretch mesh in the cod end. The sampling area includes the Delaware waters of the Delaware Bay at depths ranging from 7 – 35 m (Figure 52). The standard duration for each sample is 20 minutes at a speed of 3 knots.

5.2.10.2 Biological and Environmental Sampling

Catch is sorted to species level, enumerated, and weighed (aggregate per species) and measured for length/width to the nearest 0.5 cm. Horseshoe crabs are sexed, enumerated and measured (prosomal width). Environmental data include tide stage, water temperature (degrees Celsius), salinity (ppt), cloud cover and depth (m).

5.2.10.3 Evaluation of Survey Data

As this survey catches mainly adult horseshoe crabs. Spring (March through August) and fall (September through December) indices were developed from this survey for the following categories of horseshoe crabs: all adults combined, adult female, and adult male. Overall, the proportion positive tows varied little between the seasons with the spring showing slightly higher values than the fall (43.6% spring, 39.5% fall). A similar pattern was seen for males (36.8% spring, 36.6% fall). The pattern was reversed for females (32.6% spring, 33.0% fall). Another pattern emerged of higher respective proportion positive tows values for the males than for the females.

5.2.10.4 Abundance Index Trends

For all adult horseshoe crabs combined in the spring (Figure 53), abundance was highest in 1990 and 1991, and then a downward trend began from 1992 through 1995. It rebounded with an increase in 1996 before continuing the general trend downward through 2005. There was a moderate increase in 2006 and 2007 before dropping to low abundance levels from 2008 through 2013. Since 2014 there has been a generally upward trend with a steep increase in 2018. A similar pattern was seen for the spring indices of adult females (Figure 54) and males (Figure 55).

The fall index for all adult horseshoe crabs combined (Figure 56) showed a higher level abundance in 1990 and 1991, then dropped in 1992 and began fluctuating between low and intermediate levels through 2005. Abundance climbed steeply to a high level in 2006 before dropping again to previous low levels from 2007 through 2012. The index began a general increase from 2013 through 2015 before jumping to higher levels culminating in the time series high in 2017. A similar pattern was seen for the fall index for adult females (Figure 57) and males (Figure 58).

5.2.11 Delaware Bay Horseshoe Crab Spawning Survey

5.2.11.1 Survey Design and Methods

The ASMFC's FMP for Horseshoe crab (ASMFC 1998) required that the states of Delaware, Maryland, and New Jersey implement pilot horseshoe crab spawning surveys based on "standardized and statistically robust methodologies." In January 1999, the ASMFC convened a workshop that established a framework for such surveys in the Mid-Atlantic region. The framework built upon existing horseshoe crab spawning survey efforts by Finn et al. (1991) and Maio (1998). The survey began in 1999 and has continued through the present. Approximately 25 beaches are sampled in the Delaware Estuary during nighttime high tides in May-June. The goals are to provide an index of spawning activity and distribution in the region, increase the understanding of environmental factors on spawning activity and distribution, and promote public awareness of the role crabs play in shorebird dynamics. The survey has been shown to provide levels of spatial and temporal coverage essential for understanding trends in spawning activity (Smith and Michels 2006).

5.2.11.2 Biological and Environmental Sampling

The survey collects environmental data including water temperature, tidal height, wave height and biological data such as sex and spawning activity.

5.2.11.3 Evaluation of Survey Data

The SAS was primarily interested in this survey for the sex ratio data it provides in order to inform control rules in the Delaware Bay region. The SAS determined that this survey provides the most reliable data available for spawning beach sex ratios. For other data provided by this survey, the full annual reports are available at https://www.delawarebayhscsurvey.org/surveyreports/.

5.2.11.4 Sex Ratio Trends

Annual sex ratios from the spawning beach survey are available in Table 35. Current horseshoe crab harvest management strategies in the Delaware Bay area limit the harvest to predominantly male crabs. Concern was expressed that these strategies may cause spawning sex ratios (M:F) to drop and yet the sex ratio has increased in recent years. Annual sex ratios have ranged from 3.1:1 in 2001-2002 to 5.2:1 in 2017 over the course of the survey. M:F ratio in 2017 (5.2:1) was above the time series average (4:1).

5.2.12 Virginia Tech Horseshoe Crab Trawl Survey

5.2.12.1 Survey Design and Methods

The trawl survey conducted by Virginia Polytechnic Institute and State University (Virginia Tech) is the only survey available that is designed specifically to characterize the horseshoe crab population in coastal and lower Delaware Bay (Figure 59). The survey has operated from 2002-2011 and then again from 2016-2017 due to a lack of funding during the missing years. The survey area is stratified by distance from the shore and bottom topography. Tows are 15-minutes long and the survey only operates in the fall (mid-September-late October).

5.2.12.2 Biological and Environmental Sampling

All horseshoe crabs are counted and a subset are measured for prosomal width and identified by sex and maturity. Immature, newly mature, and mature crabs are differentiated in the data set.

5.2.12.3 Evaluation of Survey Data

This is the only survey specifically designed to catch and characterize the horseshoe crab population in its sampling region. The SAS decided to accept the indices as provided by Virginia Tech since they also used the delta distribution to model the mean and error of the annual catch.

5.2.12.4 Abundance Index Trends

The indices of abundance developed by sex and stage for horseshoe crabs in the Virginia Tech trawl survey can be found in Figure 60. Abundance varied by stage and sex, although there is a slight increase in abundance across the stages throughout the time series.

5.2.13 Maryland Coastal Bays

5.2.13.1 Survey Design and Methods

The 16’ otter trawl survey has been operating since 1989 and collects samples monthly in April through October in the coastal bays from the Delaware to the Virginia line at 20 fixed sites (Figure 61).

5.2.13.2 Biological and Environmental Sampling

All catch is identified by species and counted. Horseshoe crabs are sexed when possible and a prosomal width is measured. Tide stage, weather conditions, wind speed, depth, temperature, dissolved oxygen, and salinity are recorded for each sampling event.

5.2.13.3 Evaluation of Survey Data

A spring (April- May) and a fall (August-October) index were developed from this survey. Horseshoe crabs were more reliably caught in the spring with 14% positive tows than in the fall when there were 6% positive tows so the SAS decided to use only the spring portion of this survey in the assessment. Nearly all horseshoe crabs caught in the survey were sexed after the fall of 1993, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population in the region. Based on the prosomal widths provided, this survey catches primarily adults in the spring. The SAS abbreviated the survey to 1990-2017 due to high catches of horseshoe crabs that were not consistent with the following years and biased trend analyses. Maryland Department of Natural Resources supported the exclusion of the 1989 data point as well (S. Doctor, MD DNR, personal communication).

5.2.13.4 Abundance Index Trends

Abundance was high for 1994-1995, 2003, and 2010 and otherwise was relatively low (Figure 62).

5.2.14 North Carolina Estuarine Gill Net Survey

5.2.14.1 Survey Design and Methods

This floating gill net survey has been in operation since 2000 and samples in the Pamlico Sound and several river sites. Each region is overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (<6 feet) and deep (>6 feet) strata using bathymetric data from NOAA navigational charts and field observations (Figure 63). Gear is typically deployed within one hour of sunset and fished the next morning to keep soak times within 12 hours. Sampling initially occurred during all 12 months but was abbreviated in 2002 to no longer sample between December 15-February 14 due to low catches and unsafe working conditions.

5.2.14.2 Biological and Environmental Sampling

All horseshoe crabs caught in this survey are counted, measured for prosomal width, weighed, and sexed. Latitude, longitude, water temperature and salinity, and depth are recorded.

5.2.14.3 Evaluation of Survey Data

A spring (April- June) and a fall (August-October) index were developed from this survey. Horseshoe crabs were more reliably caught in the spring with 14% positive tows than in the fall when there were 5% positive tows, so the SAS decided to use only the spring portion of this survey in the assessment. Due to low catches of horseshoe crabs, depths over 3 m were excluded and only the Pamlico Sound region was used in this assessment. Nearly all horseshoe crabs caught in the survey were sexed, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population in the region. Based on the prosomal widths provided, this survey catches primarily adults in the spring. The survey encountered no horseshoe crab in the spring of 2000, the first year of the survey, so it was dropped from the analysis.

5.2.14.4 Abundance Index Trends
Horseshoe crab abundance was low from 2001-2007 and began to increase to the highest abundance in the time series in 2014 (Figure 64). The index began to decrease again after 2014 but still remains higher than the early part of the survey.

5.2.15 South Carolina Crustacean Research and Monitoring Survey

5.2.15.1 Survey Design and Methods
The Crustacean Research and Monitoring Survey (CRMS) has been operating in the Charleston Harbor and St. Helena, Port Royal, and Calibogue Sounds and since 1995. It samples monthly in the Harbor and in April, May, August, and December in the Sounds. The survey consists of 15 minutes trawls at each station. There was a vessel change in 2002 but the data was calibrated to accommodate that change.

5.2.15.2 Biological and Environmental Sampling
All catch for this survey is sorted and horseshoe crabs are counted, weighed, sexed, and measured for prosomal widths. The survey collects and reports latitude, longitude, water temperature, salinity, depth, and air temperature although not all variables are recorded consistently throughout the time series.

5.2.15.3 Evaluation of Survey Data
A spring (March-April) and a fall (August-December) index were developed from this survey. Horseshoe crabs were more reliably caught in the spring with 34% positive tows than in the fall when there were 22% positive tows, so the SAS decided to use the spring portion of this survey in the assessment. Data was subset to regions that encountered horseshoe crab. Nearly all horseshoe crabs caught in the survey were sexed, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population in the region. Based on the prosomal widths provided, this survey catches primarily adults in the spring.

5.2.15.4 Abundance Index Trends
The index of relative abundance of horseshoe crab developed from the CRMS indicated high abundance throughout the 2000s with lower abundance from 2010-2017 (Figure 65).

5.2.16 South Carolina Trammel Net Survey

5.2.16.1 Survey Design and Methods
The Trammel Net Survey has been operating monthly since 1995 and covers nine lower-estuarine strata along the coast of South Carolina (Figure 66). Each month, 10- 12 stations per stratum are chosen for sampling, although this number was not always achieved due to weather, tide, or time restrictions. Monthly sites were selected at random (without replacement) from a pool of 22-30 possible sites per stratum. Occasionally it was necessary to add new sites to the pool as others were lost due to changing coastal features (e.g., erosion, new docks).

5.2.16.2 Biological and Environmental Sampling
All catch for this survey is sorted and horseshoe crabs are counted, weighed, sexed, and measured for prosomal widths. The survey collects and reports depth, air temperature, water temperature, salinity, DO (1998 onwards), set duration, and tide.

5.2.16.3 Evaluation of Survey Data
A spring (March-May) and a fall (July-September) index were developed from this survey. Horseshoe crabs were more reliably caught in the spring with 13% positive tows than in the fall when there were 6% positive tows, so the SAS decided to use the spring portion of this survey in the assessment. Due to low catches of horseshoe crabs, depths over 2.2 m were excluded and data was subset to waterbodies that encountered horseshoe crab. Nearly all horseshoe crabs caught in the survey were sexed, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population in the region. Based on the prosomal widths provided, this survey catches primarily adults in the spring.

5.2.16.4 Abundance Index Trends
The index of abundance began relatively low in 1995 and began to increase in the late-2000s (Figure 67). The index reached its highest value in 2012 and decreased to another low in the terminal year of 2017.

5.2.17 Southeast Area Monitoring and Assessment Program

5.2.17.1 Survey Design and Methods
The Southeast Area Monitoring and Assessment Program (SEAMAP) South Atlantic Coastal Trawl Survey has been sampling from Cape Hatteras, North Carolina, to Cape Canaveral, Florida since 2001 (Figure 68). Trawls operate in the spring (early April-mid-May), summer (mid-July-early August), fall (October-mid-November). Stations are randomly selected from a pool of stations within each of 24 strata. The number of stations sampled in each stratum is determined by optimal allocation. A total of 102-112 stations are sampled each season (306-336 stations/year).

5.2.17.2 Biological and Environmental Sampling
Contents of each net are sorted separately to species and counted. Only total biomass is recorded for all other miscellaneous invertebrates (excluding cannonball jellies) and algae, which are treated as two separate taxonomic groups. Measurements of finfish are recorded as total length or fork length, measured to the nearest centimeter. Additional data are collected on individual specimens of priority species including horseshoe crabs (prosomal width in mm, individual weight, and sex). Latitude, longitude, water and air temperature, salinity, tow duration, and depth are recorded on each tow.

5.2.17.3 Evaluation of Survey Data
A spring (April-July) and a fall (October-November) index were developed from this survey. Horseshoe crabs were caught in the spring with 19% positive tows and in the fall when there were 25% positive tows. The SAS decided to use the fall-portion of the SEAMAP data. Depth

was subset to 5-11 m due to low catches of horseshoe crab outside of those depths. The SAS split the data set further to develop two indices from SEAMAP: a South Carolina index and a Georgia-Florida index. A high proportion of horseshoe crabs caught in the survey were sexed, especially in the later years, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population when the survey was split by state. Based on the prosomal widths provided, this survey catches primarily adults in the fall.

5.2.17.4 Abundance Index Trends
The index of horseshoe crab abundance for South Carolina developed from the SEAMAP survey indicated low abundance at the beginning of the time series, an increase from 2009-2012, and a decreased abundance from 2013 through the terminal year (Figure 69). The index developed from the fall portion of the Georgia-Florida data indicates a low abundance of horseshoe crab with increased abundance in 2011, 2012, and 2016 with otherwise low abundance including in the terminal year (Figure 70).

5.2.18 Georgia Ecological Monitoring Trawl Survey

5.2.18.1 Survey Design and Methods
The Ecological Monitoring Trawl Survey (Georgia Trawl) conducted by GA DNR has operated along the Georgia coastline since 1999 (Figure 71). The survey operates monthly in creek, sound, and beach stations. There are 36 fixed stations that are sampled monthly.

5.2.18.2 Biological and Environmental Sampling
Catch is sorted by species and total number and weight are recorded. Selected finfish, shrimp and crabs are measured. Horseshoe crab counts, weights, sex are recorded. Tow duration, latitude, longitude, tide stage, water and air temperature, and salinity are recorded.

5.2.18.3 Evaluation of Survey Data
A spring (March-May) and a fall (September-November) index were developed from this survey. Horseshoe crabs were caught in the spring with 42% positive tows and in the fall with 38% positive tows. The SAS decided to use the spring-portion of the Georgia Trawl data. Depth was subset to 5-14 m due to low catches of horseshoe crab outside of those depths. All of horseshoe crabs caught in the survey were sexed, but the SAS concluded that too few horseshoe crabs were collected in total to justify using the sex ratio from the catch as representative of the population. Based on the prosomal widths provided, this survey catches primarily adults in the fall.

5.2.18.4 Abundance Index Trends
For the spring index developed from the Georgia Trawl data, abundance of horseshoe crabs varied but appeared to be increasing in recent years (Figure 72).

5.3 Index Correlations

Association of abundance indices for horseshoe crab was evaluated with Spearman's rank correlation coefficient, or Spearman's rho (ρ). This is a nonparametric test to evaluate association of two ranked variables over time (i.e., indices of abundance). Associations were evaluated between indices by region.

5.3.1 Northeast Region

There were three indices developed for the Northeast region: Massachusetts's Trawl North Cape, Massachusetts's Trawl South Cape, and the Rhode Island Monthly Trawl. The North and South Cape indices were positively correlated with each other but negatively correlated with the Rhode Island Trawl (Figure 73) although all of the correlations were insignificant ($P>0.05$).

5.3.2 New York Region

Five indices of horseshoe crab abundance were developed for the New York Region for this assessment: Connecticut Long Island Sound Trawl Survey, New York's Peconic Bays, Seine Jamaica Bay, and Little Neck and Manhasset Bays, and NEAMAP New York portion. All surveys were positively correlated with each other (Figure 74) although all were insignificant ($P>0.05$) except for the positive correlation between the Connecticut Long Island Sound Trawl Survey and New York's Peconic Bays ($\rho=0.59$, $P=0.020$) and New York's NEAMAP portion and the New York Seine Jamaica Bay ($\rho=0.52$, $P=0.026$).

5.3.3 Delaware Bay Region

Eight indices of horseshoe crab abundance were developed for the Delaware Bay region. For the correlation analysis, only the following combined sexes and adult surveys were tested: Delaware's Adult Trawl spring and fall indices, New Jersey's Ocean Trawl spring and fall indices, New Jersey Surf Clam, Maryland Coastal Bays, NEAMAP portion that operates in the Delaware Bay, and the Virginia Tech Trawl Survey. All correlations are insignificant ($P>0.05$) except for the correlations between the Delaware Adult Trawl spring and fall indices ($\rho=0.69$, $p<0.001$), Delaware Adult Trawl spring and New Jersey Ocean Trawl fall ($\rho=0.28$, $P<0.001$), New Jersey Ocean Trawl spring and Surf Clam surveys ($\rho=-0.77$, $P=0.011$), and NEAMAP and the Virginia Tech Trawl ($\rho=0.36$, $P=0.020$) (Figure 75).

5.3.4 Southeast Region

Six surveys were developed into abundance indices for horseshoe crab for the Southeast region: South Carolina's Trammel, CRMS, and SEAMAP (South Carolina portion), North Carolina's Gill Net Survey, Georgia Trawl Survey, and SEAMAP (Georgia-Florida portion). There were both positive and negative correlations among the surveys in this region (Figure 76) but all were insignificant ($P>0.05$) except for the correlations between the North Carolina Gill Net and South Carolina Trammel indices ($\rho=0.53$, $P=0.036$), the North Carolina Gill Net and South Carolina CRMS indices ($\rho=-0.62$, $P=0.010$), and SEAMAP's South Carolina and Georgia-Florida indices ($\rho=0.81$, $P<0.001$).

6 METHODS

6.1 Power Analysis

6.1.1 Background of Analysis and Model Description

Power analysis was used to calculate the probability of detecting trends in the abundance indices developed from fishery-independent data using the methods of Gerrodette (1987). Using this approach, changes in abundance can take place due to constant increments (linear model) or at a constant rate (exponential model). Linear trends were modeled as $A_i=A_1[1+r(i-1)]$ where A_i represents the abundance as a function of an index of time (i) and r is a constant increment of changes as a fraction of the starting abundance index (A_1). Exponential trends were modeled as $A_i=A_1(1+r)^{i-1}$. For a linear change, r=R/(n-1) where R is the overall fraction change in abundance. For an exponential change, $r=(R+1)^{1/(n-1)} - 1$. For each survey, the median CV can be calculated as the median proportional standard error or ($SE(A_i)/A_i$). The SAS established a reference point of a power of 0.80 for surveys to detect an increasing trend.

6.1.2 Model Configuration

All fishery-independent surveys that were developed into abundance indices were tested in the power analysis including any season or sex specific variants. Variability in abundance as a function of both linear and exponential change was tested using a one-tailed test. Power was calculated for a change (R) of ±50% over a 20-year time period for both a linear and exponential trend.

6.1.3 Model Results

Median CVs, or proportional standard error, ranged from 0.132-0.817 for the surveys analyzed and power values ranged from 0.18 to 1.0 (Table 36). Surveys with low CVs had higher power and those with high CVs had lower power as was expected. Exponential trends indicated slightly higher power than linear trends. For both linear and exponential trends, the ability to detect decreasing trends was higher than that of increasing trends. The surveys with greater than a 0.80 power of being able to detect a 50% increase in abundance were Connecticut LISTS, New York Peconic Bay and Seine Survey for Little Neck and Manhasset Bays, Delaware Adult Trawl (spring portions), NEAMAP, portions of the New Jersey Ocean Trawl, New Jersey Surf Clam, Virginia Tech Trawl, North Carolina Gill Net, South Carolina CRMS, and Georgia Trawl. The remaining surveys all fell below the desired power of 0.80 and therefore the ability to detect trends in the past 20 years is limited for many of the surveys used in this assessment.

6.2 Conn Method

6.2.1 Background of Analysis and Model Description

When several population abundance indices provide conflicting signals, hierarchical analysis can be used to estimate a single population trend. The abundance indices for horseshoe crab were combined into regional composite indices using hierarchical modeling as described in Conn (2009). This method assumes each index samples a relative abundance but that the abundance is subject to sampling and process errors. It can be used on surveys with different time series, but it does assume that indices are measuring the same relative abundance.

6.2.2 Model Configuration

Abundance indices for horseshoe crabs from each region were standardized to their means. Indices were combined using the methods of Conn in R and WinBUGS. The Massachusetts Trawl North Cape, Massachusett's Trawl South Cape, and Rhode Island Monthly Trawl were combined to form a northeast region composite index for 1978-2017. For the New York Region, the Connecticut LISTS, New York Peconic, NEAMAP (New York strata only), New York Seine Jamaica Bay, and New York Seine Little Neck and Manhasset Bay indices were combined for a New York region composite index for 1987-2016. For the Delaware Bay Region, several Conn indices were developed in order to support the models for that area. An adult composite was developed from the spring and fall components of the New Jersey OT and Delaware Adult Trawl, the NJ Surf Clam, NEAMAP (Delaware Bay strata only), VT Tech Trawl, and Maryland Coastal Bays surveys. Additionally, female-only and male-only indices were developed using the sex-specific indices developed from the New Jersey OT and Surf Clam, VT Tech Trawl, and Delaware Adult Trawl surveys. A southeast region Conn for 1995-2017 was developed from the North Carolina Gill Net, South Carolina Trammel, CRMS, and SEAMAP (South Carolina strata only), Georgia Trawl, and SEAMAP (Georgia-Florida strata only).

The estimates of process error variance for each of the indices were also examined. High sigma (σ^p) values, or the standard deviation of the process errors, suggest that the index may be a poor index for tracking abundance or may be measuring a different subpopulation whereas lower values indicate indices that may be better tracking the population or are consistent with the other indices included.

6.2.3 Model Results

The hierarchical index developed for the Northeast region predicted variable but stable abundance from 1978-2017, with moderate peaks in the terminal year estimates (Figure 77). The standard deviation of the process errors for the surveys used in the Northeast region Conn were higher for the Massachusetts Trawl, both the North and South Cape indices, than those of the Rhode Island Monthly Trawl (Table 37), indicating that the surveys may be tracking different populations or it may be reflecting differences in sampling programs (see Conn 2009 for a more thorough discussion).

The hierarchical index developed for the New York region predicted stable abundance throughout the time series with a slight increase in recent years (Figure 78). The standard deviation of the process errors for the surveys used in the New York region Conn had similar sigma values with the New York portion of NEAMAP being slightly higher (Table 37). This may indicate that the offshore NEAMAP trawl may be slightly out of line with the other more inshore surveys, but the sigma is still within an acceptable range.

The hierarchical indices developed for the Delaware Bay region for males and females combined, males-only, and females-only followed similar trends (Figure 79 - Figure 81). The indices predicted high abundance in the 1990s decreasing to a stable but low abundance in the early 2000s. The index is variable from 2005 through the terminal year but appears to have a slight increase from 2014-2016. The standard deviation of the process errors for the surveys used in the Delaware Bay region Conn ranged from 0.171 to 0.948 with the Virginia Tech Trawl survey having the lowest sigma values and the Delaware Adult Trawl having the highest (Table 37). The Virginia Tech Trawl survey is the only non-spawning beach survey that is specifically designed to monitor horseshoe crab and its low sigma value indicates that it is the most informative survey available.

The hierarchical index developed for the Southeast region predicted low abundance from the mid-1990s through the late 2000s when abundance starts increasing until a slight downtick in the terminal years (Figure 82). The standard deviation of the process errors for the surveys used in the Southeast region Conn had similar sigma values except for both SEAMAP indices, which had very high sigma values (Table 37). These indices may not be a good measure of horseshoe crab abundance in the region, or they may be measuring something else such as an offshore population (see Conn 2009 for a more thorough discussion).

6.3 Autoregressive Integrative Moving Average (ARIMA)

6.3.1 Background of Analysis and Model Description

Fishery independent surveys for horseshoe crabs can be quite variable, making inferences about population trends uncertain. Observed time series of abundance indices represent true changes in abundance, within survey sampling error, and varying catchability over time. One approach to minimize measurement error in the survey estimates is by using autoregressive integrated moving average models (ARIMA, Box and Jenkins 1976). The ARIMA approach derives fitted estimates of abundance over the entire time series whose variance is less than the variance of the observed series (Pennington 1986). This approach is commonly used to gain insight in stock assessments where enough data for size or age-structured assessments (e.g. yield per recruit, catch at age) are not yet available.

Helser and Hayes (1995) extended Pennington's (1986) application of ARIMA models to fisheries survey data to infer population status relative to an index-based reference point. This methodology yields a probability of the fitted index value of a particular year being less than the reference point [P(indext<reference)]. Helser et al. (2002) suggested using a two-tiered approach when evaluating reference points whereby not only is the probability of being below (or above) the reference point is estimated, the statistical level of confidence is also specified. The confidence level can be thought of as a one-tailed a-probability from typical statistical hypothesis testing. For example, if the P(indext<reference) = 0.90 at an 80% confidence level, there is strong evidence that the index of the year in question is less than the reference point. This methodology characterizes both the uncertainty in the index of abundance and in the chosen reference point. Helser and Hayes (1995) suggested the lower quartile (25th percentile) of the fitted abundance index as the reference point in an analysis of Atlantic wolfish (*Anarhichas lupus*) data. The use of the lower quartile as a reference point is arbitrary but does

provide a reasonable reference point for comparison for data with relatively high and low abundance over a range of years.

The purpose of this analysis was to fit ARIMA models to time series of horseshoe crab abundance indices to infer the status of the population(s).

6.3.2 Model Configuration

Relative abundance indices included in this analysis are shown in Table 38. The ARIMA model fitting procedure of Pennington (1986) and bootstrapped estimates of the probability of being less than an index-based reference point (Helser and Hayes 1995) and corresponding levels of confidence (Helser et al. 2002) were coded in R (R code developed by Gary Nelson, Massachusetts Division of Marine Fisheries). ARIMA models were fit to ln transformed index values in the majority of surveys but were fit to ln+0.01 transformed index values for surveys that had an index value of 0 in one or more years. An 80% confidence level was chosen for evaluating P(indext<reference). Two index-based reference points were considered: 1) the lower quartile of the fitted abundance index (Q_{25}) as proposed by Helser and Hayes (1995); and 2) the fitted abundance index from 1998 – the time of development of the ASMFC Interstate Management Plan for horseshoe crabs. The use of two reference points allowed evaluation of the status of the horseshoe crabs with respect to historic levels, and just prior to the implementation of harvest restrictions to determine if such restrictions have resulted in an increase in abundance.

6.3.3 Model Results

The ARIMA models provided adequate fits to nearly all of the horseshoe crab indices. In two cases (Table 38), residuals from the ARIMA model fits were not normally distributed and subsequent bootstrapped probabilities of being below reference point values should be considered with caution. The survey whose residuals were not normally distributed were MA DMF Trawl survey north of Cape Cod and the GA Spring Trawl survey.

Trends in fitted abundance indices from ARIMA models showed much variation among surveys (Figure 83-Figure 89) both between and within regions. In the Northeast Region (Figure 83), indices generally displayed a decreasing trend with the exception of the MA DMF Trawl which showed an increasing trend after 2013 south of Cape Cod. All indices in the New York Region showed a decreasing trend (Figure 84) with the Peconic Trawl survey showing the greatest relative decrease. Trends in the Mid-Atlantic region (Figure 85–Figure 88) were either increasing in recent years (e.g. DE 30 ft. Trawl survey, NJ Surf Clam Dredge, NJ Spring Ocean Trawl) or stable (e.g. MD Coastal Bays Trawl). The Virginia Tech Trawl Survey (Figure 88) showed relatively large fluctuations prior to its interruption after 2011. Once it resumed in 2016, index values increased over those observed in 2011 and 2016 and 2017 values were similar. Indices in the Southeast Region were generally increasing prior to 2010 across all surveys (Figure 89), but since then have fluctuated or showed a slight decreasing trend in recent years.

Bootstrapped probabilities that the terminal year of indices were below reference points also varied greatly among surveys (Table 39). To generalize the probabilities of terminal year being below reference points, the SAS considered a probability of ≥0.50 as being "likely" to be below reference points (Table 40). Only those surveys whose residuals from fitted ARIMA indices were normally distributed, were overall combined-sex surveys (i.e. not double counting surveys who separated sexes), and whose terminal year was either 2016 or 2017 were considered. In the Northeast Region, 1 out of 2 surveys were likely less than the 1998 reference point and 1 out of 2 surveys were likely less than the Q_{25} reference point. In the New York Region, 4 out of 4 surveys were likely less than the 1998 reference point and 4 out of 5 surveys were likely less than the Q_{25} reference point. In the Mid-Atlantic Region, 2 out of 5 surveys were likely less than the 1998 reference point and no survey was likely less than the Q_{25} reference point. Finally, in the Southeast Region, no survey was below either the 1998 or the Q_{25} reference point. Coastwide, 7 out of 13 surveys were likely less than the 1998 reference point and 5 out of 19 surveys were likely less than the Q_{25} reference point.

6.4 Horseshoe Crab Operating Model

6.4.1 Background of analysis and Model Description

The horseshoe crab is a long-lived species with females reaching sexual maturity at approximately ten years of age (Sweka et al. 2007). A major difficulty in stock assessments of horseshoe crabs is that individuals in the catch and in fishery-independent surveys cannot be aged, thus negating the application of age-structured assessment models. Application of surplus production models to horseshoe crabs has been questioned due to their long age to maturity. Following the 2009 ASMFC horseshoe crab benchmark stock assessment, the peer-review panel recommended the development of an operating model of horseshoe crab population dynamics to generate known data sets of catch and fishery-independent surveys which could then be used as input data to a surplus production model to test if such a simple model could accurately estimate fishing mortality, biological reference points, and be used to determine stock status (i.e., overfishing, overfished). Also, attempts were made in this assessment to apply an index method (Rago and Legault *unpublished manuscript,* https://www.nefsc.noaa.gov/nft/AIM.html) and a catch survey model (Collie and Sissenwine 1983) in some areas and an operating model would also be useful in evaluating the merits of these models as well.

6.4.2 Model Configuration

An operating model for horseshoe crab population dynamics was developed largely from the model described by Sweka et al. (2007). This was an age-structured model and only modeled female crabs. Life history parameters are provided in Table 41. The maximum age of crabs in the model was set to 20 years. Natural mortality (M) varied with age and crabs began maturing at age 10 and were fully mature by age 12. For individuals in maturing age classes (ages 10 and 11), natural mortality was lower for immature individuals compared to mature individuals. Partial recruitment to the fishery followed the same schedule as maturity. Fecundity of mature crabs was 80,300 eggs.

The number (*N*) of age class *i* at time *t* was:

$$N_{i,t} = N_{i-1,t-1}e^{(M_i+R_i \cdot F)}$$

where *R* is the age-specific partial recruitment to the fishery and *F* is the fishing mortality. Because natural mortality differed between mature and immature individuals within an age class, the model separated age 10, 11, and 12 into immature, primiparous (first time spawners), and multiparous (spawing at least once before) individuals.

$$N_{10imm,t} = N_{9,t-1}e^{(M_9+R_9 \cdot F)}(1 - m_{10})$$

$$N_{10primi,t} = N_{9,t-1}e^{(M_9+R_9 \cdot F)}(m_{10})$$

$$N_{11imm,t} = N_{10,t-1}e^{(M_{10imm}+R_{10imm} \cdot F)}(1 - m_{11})$$

$$N_{11primi,t} = N_{10imm,t-1}e^{(M_{10imm}+R_{10imm} \cdot F)}(m_{11})$$

$$N_{11multi,t} = N_{10primi,t-1}e^{\left(M_{10primi}+R_{10primi} \cdot F\right)}$$

$$N_{12primi,t} = N_{11imm,t-1}e^{(M_{11imm}+R_{11imm} \cdot F)}(m_{12})$$

$$N_{12multi,t} = N_{11primi,t-1}e^{\left(M_{11primi}+R_{11primi} \cdot F\right)} + N_{11multi,t-1}e^{(M_{11multi}+R_{11multi} \cdot F)}$$

Age-specific catch was calculated using Baranov's catch equation:

$$C_{i,t} = \left(\frac{R_i \cdot F}{M_i + R_i \cdot F}\right) \cdot (1 - e^{M_i+R_i \cdot F}) \cdot N_{i,t}$$

The number of female eggs produced in a year was equal to the number of sexually mature individuals multiplied by fecundity and divided by 2.

$$E_t = \left(\sum N_{i,mature,t} \cdot f\right)/2$$

Density-dependence was incorporated into the model through density-dependent egg mortality as described in Sweka et al. (2007) and Smith (2007) and depended on the number of mature crabs. As the number of spawning crabs increases, nest disturbance increases, thus bringing more eggs to the surface which do not survive and more female crabs spawn in less optimal habitat with lower egg survival. Survival of eggs to hatching as age 0 crabs was described by the function:

$$S_{egg,t} = 1 - \left(0.0957 \cdot \ln\left(\sum N_{i,mature,t} \cdot m_i\right) - 0.995\right)$$

The number of age 0 female crabs at the beginning of the year was:

$$N_{0,t} = E_t \cdot S_{egg,t}$$

The model was coded in a MS Excel spreadsheet and the carrying capacity (*K*) of the simulated population was determined by allowing the population to grow under no fishing mortality until the number of mature females reached an asymptote. To determine the maximum sustainable yield of this simulated population, the population started at *K* and was projected 400 years into the future. The fishing mortality associated with maximum sustainable yield (F_{msy}) was solved for by maximizing the total catch in year 400 and the associated biomass at maximum sustainable yield (B_{msy}) was equal to the total number of mature female crabs in year 400 when catch was maximized.

Given the life history parameters of this simulated population, the carrying capacity was determined to be 14,569,967 mature female crabs. Maximum sustainable yield was determined to be 647,609 female crabs which corresponded to an F_{msy} of 0.1613 and a B_{msy} of 5,433,439 crabs (Figure 90).

6.4.3 Simulated Data

Following development of the operating model, four data sets were simulated to examine how accurately a surplus production model (ASPIC; Prager 1994) and a catch survey model could estimate population parameters. In each of these scenarios, the model started with the population at equilibrium at the carrying capacity. Fishing mortality, F, was then allowed to vary annually according to a uniform distribution with bounds described in Table 42. The data time series used in the surplus production and catch survey models started 10 years after harvesting of the population began and ran for a total of 50 years. The harvest scenarios simulated were:

1) Constant F and a “one-way trip” of a declining population

2) Decreasing F through time

3) Very low F after initial harvest followed by a period of increased F

4) Decreasing F followed by very low F. Age-specific natural mortality was allowed to slightly vary according to a normal distribution with a CV = 0.01.

Fishery-independent surveys were generated for the surplus production and catch survey models by assuming values of the catchability coefficient (q) equaled 0.00012. Simulations for testing the surplus production applied q to total number of mature females while simulations for the catch survey model applied q separately for primiparous and multiparous individuals in order to generate an index for newly recruited individuals and previously recruited individuals, respectively. A fifty-year time series of each scenario’s catch and fishery-independent indices were then used as input data to an index method, surplus production model, and catch survey model to evaluate model performance.

6.5 Application of an Index Method for Horseshoe Crab

The SAS attempted to apply An Index Method (AIM) model to horseshoe crabs in each region along the coast. This method was developed by Rago and Legault (unpublished manuscript) and is available in the NOAA Fisheries Toolbox (https://www.nefsc.noaa.gov/nft/AIM.html). This is a data poor stock assessment model that only requires a time series of catch data and a corresponding index of abundance and is typical of the situation in all regions of the coast other than the Delaware Bay for horseshoe crabs. AIM fits a linear relationship between the replacement ratio derived from a smoothed index of abundance and relative F (catch/abundance index) and characterizes the population response to varying levels of fishing mortality. If the relationship between the replacement ratio and relative F is valid, AIM can be used to estimate the level of relative F at which point the population is likely to be stable and catch recommendations can be made.

Although the minimal data requirements of AIM were attractive to use in the assessment of horseshoe crabs, the SAS abandoned its application for multiple reasons. In the New York region, AIM was not a suitable stock assessment model because of the general continuous decline in abundance indices despite changes in catch (i.e., a “one-way trip” situation). There are no general guidelines on the number of years to smooth the abundance index when calculating the replacement ratio, and the SAS attempted different numbers of years in smoothing. The significance of the linear relationship between the replacement ratio and relative F varied greatly depending on both the number of years used in smoothing and the fishery-independent surveys used in the model even when those surveys all assessed the same population of horseshoe crabs. It made intuitive sense that the number of smoothing years should reflect the life history of the horseshoe crabs with a long time to maturity and a 10-year smoothing was tested with simulated data from the operating model. Results of this testing were very inconsistent between simulated data series and the SAS determined that AIM did not adequately capture the dynamics of a long-lived species such as horseshoe crab and further application of this model was dropped from this assessment.

6.6 Testing of Surplus Production Model with the Operating Model

6.6.1 Background of Analysis and Model Description

The surplus production model was developed for horseshoe crabs in the Delaware Bay region because of its relatively simple modeling approach. Surplus production models combine the effects of recruitment, growth, and mortality into a single function and assume no size or age structure in the population. It requires a time-series of fishery removals and one or more time-series of catch-per-unit effort from a survey. The model assumes that the population is closed, the environment is constant, abundance indices are proportional to the true population abundance, total catch is known without error, the stock responds instantaneously to changes, and that the intrinsic rate of increase (r) and carrying capacity (K) remain constant.

The 2009 benchmark stock assessment included the application of a surplus production model for the Delaware Bay region (ASMFC 2009a). The model was not included in the 2013 stock assessment update because the benchmark did not include mortality due to the biomedical industry which was considered an oversight. Additionally, in 2009, the Peer Review Panel expressed concern about the long time period (~9 years) horseshoe crabs spend before they recruit to the fishery and questioned if this is a suitable model for the species. They suggested that the SAS further evaluate the violation of the assumption that “the stock reacts instantaneously to changes in conditions” given only mature crabs are included in the model and it takes the species 9-11 years to mature. Additionally, the Panel stated that the potential for this model to provide good estimates of stock status relative to reference points (e.g., FMSY) in regions outside the Delaware Bay would be challenging due to lack of contrast in the time series that were available for those regions.

The Panel made several suggestions for testing the surplus production model for horseshoe crab before using it to assess the stock. They recommended that an operating model for evaluating the performance of the surplus production model should be explored such as the simple age-structured operating model similar to Sweka et al. (2007). They suggested the development of an operating model of horseshoe crab population dynamics to generate known data sets of catch and fishery-independent surveys which could then be used as input data to a surplus production model to test if such a simple model could accurately estimate fishing mortality, biological reference points, and be used to determine stock status (i.e., overfishing, overfished).

6.6.2 Model Configuration

The SAS tested the application of the surplus production model with an age-structured operating model adapted from Sweka et al. (2007), described in Section 6.3, before developing it for horseshoe crab by region for this assessment.

All four simulated data sets were analyzed with the surplus production model in ASPIC (Prager 1994). The non-equilibrium Graham-Schaefer, or logistic, form was used to test this model for horseshoe crab. For inputs into the model, the simulated catch and abundance index were used. The starting values for the model were calculated as follows:

1) B_1/K =0.05

2) MSY=1/2*Maximum Catch

3) K=10*Maximum Catch

4) q=Average Index Value/(2*Maximum Catch)

Both MSY and K had minimum and maximum constraints of 1/8 and 8 times their values. The surplus production model estimates MSY and the associated MSY-based references points of B_{MSY}, the stock biomass associated with MSY, and F_{MSY}, the fishing mortality that maximizes the yield from the population. These absolute values are usually imprecise (Prager 1994) since they require good estimates of catchability (q). Relative biomass (B/B_{MSY}) and relative fishing mortality (F/F_{MSY}) can be used to determine overfishing and overfished status. All of the calculations for horseshoe crab were done in numbers, not weight, although "biomass" will still be referenced in the model outputs.

6.6.3 Model Results

6.6.3.1 Simulation 1

The first simulation represented a constant *F* and a "one-way trip" of a declining population. The pattern of the true F and the ASPIC-estimated *F* followed similar patterns but were on different scales with the true *F* being higher than the surplus production estimated *F* (Figure 91). True population numbers and ASPIC-estimated numbers had a similar result where the patterns were alike, but the scales were different with the estimated population numbers being higher than the true numbers. The application of a surplus production model often results in imprecise absolute values of fishing mortality and biomass, but relative fishing mortality and biomass usually can be used to determine overfishing and overfished status. Both the relative fishing mortality and biomass followed similar patterns throughout the time series when comparing the true values to the ASPIC-estimated values. Both relative *F*'s indicated overfishing (F/F_{MSY} >1) but the true values indicated that the stock was not overfished (B/B_{MSY}>1) whereas ASPIC determined the stock was overfished for most years (B/B_{MSY}<1). The difference in overfished status between ASPIC and true values from the operating model is a concern for the application of the surplus production model for horseshoe crab.

6.6.3.2 Simulation 2

The second simulation represented a decreasing *F* through time. The pattern of the true *F* and the ASPIC-estimated F followed similar patterns but were on different scales with the true *F* being higher than the surplus production estimated *F* (Figure 92). True population numbers and ASPIC-estimated numbers had a similar result where the patterns were alike, but the scales were different with the ASPIC-estimated population numbers being higher. The application of a surplus production model often results in imprecise absolute values of fishing mortality and biomass, but relative fishing mortality and biomass usually can be used to determine overfishing and overfished status. Both the relative fishing mortality and biomass followed similar patterns throughout the time series when comparing the true values to the ASPIC-estimated values, but true relative *F* indicated some overfishing in the early years (F/F_{MSY} >1) whereas ASPIC indicated no overfishing. True and ASPIC-estimated relative biomass were similar in pattern and values with both indicating that the stock was not overfished (B/B_{MSY} >1).The difference in overfishing status is a concern for the application of the surplus production model for horseshoe crab.

6.6.3.3 Simulation 3

The third simulation represented an institution of a moratorium followed by a low *F*. The pattern of the true *F* and the ASPIC-estimated *F* followed similar patterns but were on different scales with the true *F* being higher than the surplus production estimated *F* (Figure 93). True population numbers and ASPIC-estimated numbers had a similar result where the patterns were alike, but the scales were different with the ASPIC-estimated population numbers being higher. The application of a surplus production model often results in imprecise absolute values of fishing mortality and biomass, but relative fishing mortality and biomass usually can be used to determine overfishing and overfished status. Both the relative fishing mortality and biomass followed similar patterns throughout the time series when comparing the true values to the ASPIC-estimated values, but true relative *F* indicated some overfishing in the early years (F/F_{MSY} >1) whereas ASPIC indicated no overfishing. True and ASPIC-estimated relative biomass were similar in pattern and values with both indicating that the stock was not overfished (B/B_{MSY}>1).The difference in overfishing status is a concern for the application of the surplus production model for horseshoe crab.

6.6.3.4 Simulation 4

The fourth simulation represented a high *F* flowed by a moratorium. The pattern of the true *F* and the ASPIC-estimated *F* followed similar patterns but were on different scales with the true *F* being higher than the surplus production estimated *F* (Figure 94). True population numbers and ASPIC-estimated numbers had a similar result where the patterns were alike, but the scales were different with the ASPIC-estimated population numbers being higher. The application of a surplus production model often results in imprecise absolute values of fishing mortality and biomass, but relative fishing mortality and biomass usually can be used to determine overfishing and overfished status. Both the relative fishing mortality and biomass followed similar patterns throughout the time series when comparing the true values to the ASPIC-estimated values, but true relative *F* indicated some overfishing in the early years (F/F_{MSY} >1) whereas ASPIC indicated no overfishing. True and ASPIC-estimated relative biomass were similar in pattern and values with both indicating that the stock was not overfished (B/B_{MSY}>1). The difference in overfishing status is a concern for the application of the surplus production model for horseshoe crab.

6.6.3.5 Summary of Model Results

The application of the surplus production model for assessing the status of horseshoe crabs was tested using simulated data from an operating model as suggested by the 2009 Peer Review Panel. The simulated data results indicated that the surplus production model is poor at estimating absolute values of horseshoe crab population numbers and fishing mortality. In all four scenarios, ASPIC overestimated population numbers and underestimated *F*. For relative fishing mortality and biomass, ASPIC suggested a different overfishing or overfished status from the true simulated values for all four scenarios. For simulation 1 where *F* was variable but stable and population numbers were decreasing, ASPIC results suggested the stock was overfished when the true values from the operating model did not. Conversely, for simulations 2-4 where *F* decreased throughout the time series in different ways, ASPIC underestimated relative fishing mortality and failed to show overfishing in the first decade of the simulation. Ultimately, when comparing the true values and the estimated values, the surplus production model did not successfully estimate relative quantities compared to the true quantities. The simulation work confirms the suspicions of the 2009 Peer Review Panel and indicates that the application of the surplus production model for horseshoe crab is not appropriate. The results are likely due to the violation of the assumption that “the stock reacts instantaneously to changes in conditions” given only mature crabs are included in the model and it takes the species 9-11 years to mature. Therefore, the surplus production model was not further developed for horseshoe crab in this assessment.

6.7 Catch Survey Analysis

6.7.1 Background of Analysis

Initial attempts at modeling Delaware Bay horseshoe crab stock dynamics using a catch-survey analysis (CSA) began in 2008 (ASMFC 2009a) adhering largely to the methods described in Collie and Sissenwine (1983). The horseshoe crab's unique life history was well-suited to the two-stage modeling approach, as newly mature horseshoe crabs (termed 'primiparous') exhibit readily-identifiable secondary sexual characteristics, cease molting, and recruit into the spawning population in the ensuing year (Schuster and Sekiguchi 2003). Horseshoe crabs that have spawned at least once (termed 'multiparous') bear identifiable, permanent, mating abrasions (Hata and Hallerman 2009b, 2009c). Relative abundances of primiparous and multiparous crabs are measured in the Virginia Tech horseshoe crab trawl survey (VT survey) in the fall directly outside of the population's major spawning grounds (Hata and Hallerman 2018). Primiparous and multiparous females were used as indices of pre-recruits and full-recruits in the CSA model. The original model contained a limited survey time series (8 years) and lacked some sources of harvest information (most notably biomedical mortalities). Realistic outputs were producible, although model instability was an issue (due to the shortened time series and survey variability) that could be overcome by allowing a freely-estimable primiparous catchability parameter (R. Wong, unpublished). Given the favorable horseshoe crab life history and early modeling work, the 2009 Stock Assessment Peer Review Panel encouraged the continued development of the CSA in future assessments (ASMFC 2009a).

6.7.2 Model Description

A catch multiple survey analysis (CMSA) was developed for this stock assessment tailored to available horseshoe crab survey and harvest information in order to produce estimates of Delaware Bay adult female abundance and fishing mortality rates (poor fit to survey indices prevented the development of male-only and combined split-sex models.). The CMSA contains a similar, simplified model structure to the Chesapeake Bay Blue Crab sex-specific catch multiple survey analysis by Miller et al. (2011). The model tracks the dynamics between two horseshoe crab stages: a) primiparous (newly mature yet spawning-naive) females; and b) multiparous (spawning-experienced) females. The broad assertion is that all primiparous females will participate in the proceeding spring spawning event, thus fully entering the multiparous stage within a single year (12-month period). It is also widely accepted that horseshoe crabs undergo a terminal molt at maturity (Shuster and Sekiguchi 2003). Therefore, multiparous abundance in a given year is a direct function of the primiparous and multiparous abundance in the previous year minus harvest and natural mortality. These adjacent reproductive stages are readily-identifiable in the field (Hata and Hallerman 2009b, 2009c), making horseshoe crabs well-suited to the catch-survey model dynamics.

The catch multiple survey model is based on the first order difference equation:

$$N_{y+1} = \left((N_y + R_y)e^{-Mt} - C_y \right) e^{-M(1-t)} \quad (1)$$

which relates the fully-recruited abundance at the beginning of the year (N_{y+1}), to the fully-recruited abundance at the beginning of the previous year (N_y), plus pre-recruit abundance in the previous year(R_y), minus catch (C_y), all decremented by natural mortality, M, with t representing the fraction of the year corresponding to the harvest midpoint.

Minimum data requirements for the model include: i) annual indices of relative abundance for each size stage; ii) relative selectivities of size stages to the survey gear; iii) annual harvest; and iv) an estimate of instantaneous natural mortality rate.

Survey indices of abundance are assumed proportional to absolute stock sizes and are described by

$$r_{i,y} = s_i q_i R_y e_i^{\delta y} \qquad (2)$$

and

$$n_{i,y} = q_i N_y e_i^{\eta y} \qquad (3)$$

where $r_{i,}$ and $n_{i,}$ are the observed indices of pre-recruit and fully-recruited horseshoe crabs from survey *i*, q_i is the survey catchability coefficient, and $e^{\eta y}$ and $e^{\delta y}$ are lognormally distributed random variables, which represent survey measurement errors. The term *s* relates the pre-recruit catchability to the full-recruit catchability expressed as the ratio of q_r/q_n (Conser 1994).

$$s = q_r/q_n \qquad (4)$$

Annual exploitation rates μ were calculated as

$$\mu_y = {C_y}\Big/{(R+N)_y} \qquad (5)$$

Instantaneous fishing mortality rates F were calculated from relationships between μ, instantaneous total mortality rate Z, and annual mortality rate A.

$$Z_{y+1} = \ln\left(\frac{(R_y + N_y)}{N_{y+1}}\right) \qquad (6)$$

$$A_y = 1 - e^{-Z_y} \qquad (7)$$

$$F_y = \mu_y \frac{Z_y}{A_y} \qquad (8)$$

Parameters are estimated by minimizing the objective function, which is the sum of the likelihood components for each data source. Each likelihood component consists of

$$L_i = k_i + \frac{1}{2}\sum_{y\in i}\left(\left(\ln O_{i,y} - \ln P_{i,y}\right)^2 / cv_{i,y}\right) \qquad (9)$$

where *O* and *P* are observed and predicted values of the indices of abundance for each survey *i*. Constants *k* were ignored to simplify the equations. Empirical survey *cv* (coefficient of variations) were used for each year of the index *i,y*. Likelihood weightings λ were employed to best use available horseshoe crab data sources.

6.7.3 Model Configuration

The unit stock being modeled in the CMSA was the Delaware Bay horseshoe crab population. The region, for purposes of defining the boundaries of this unit stock, included states from New Jersey to Virginia. All horseshoe crabs found in Delaware Bay and ocean waters of New Jersey and Delaware are considered part of the Delaware Bay stock. A significant proportion of horseshoe crabs found in ocean areas of Maryland and Virginia also belong to this unit stock. After a review of genetics and tagging work, the Delaware Bay Ecosystem Technical Committee of the ASMFC concluded that 51% and 35% of horseshoe crabs found in the ocean areas of Maryland and Virginia are likely of Delaware Bay origin, as necessary to determine quota allocations across the region (ASMFC 2012). This assessment operated under this allocation arrangement for purposes of defining the unit stock and its harvest removals from across States within this region.

A one-year model time step based on the January to December calendar year was used. All model parameters were estimated in the log scale.

The CMSA model was implemented in ADMB version 12.0. Log-scale standard deviations of parameters and derived values were generated in ADMB as described in Fournier et al. (2012).

Three fishery-independent surveys provided information about Delaware Bay adult female abundance: the VT survey (see 5.2.12), Delaware Fish and Wildlife Adult Trawl Survey (see 5.2.10), and New Jersey Ocean Trawl Survey (see 5.2.8) (Figure 95 and Figure 96). Stage-specific, swept-area abundance estimates of primiparous and multiparous females from the VT survey (Hata and Hallerman 2018) were used as pre-recruit (*r*) and full-recruit (*n*) indices (Table 43). VT swept-area estimates were based on mean crab densities (assuming a lognormal delta-distribution) expanded to the Delaware Bay survey area, 5,127 km^2. The ratio *s* was set to unity, given no evidence to support differences in catchability between stages of similar size and, ostensibly, distribution. Since VT collections occur in October, these indices were lagged forward to represent *n* and *r* at the start of the ensuing calendar year (January). The VT survey did not operate from 2012 to 2015 due to funding limitations. Aggregate stage (*r*+*n*) indices were constructed from the DE and NJ trawl surveys, since mature animals were not specifically categorized as primiparous or multiparous in the field. Aggregate stage indices were based on spring trawl collections and were assumed to reflect abundance at the start of the model time-step. Empirical annual survey CVs were incorporated into the modeling framework.

Three sources of harvest were included in the CMSA model: i) commercial bait landings (see 4.1.2); ii) commercial discard mortalities (see 4.3.1.3); and iii) biomedical mortalities (see 4.2.6). All harvest data were partitioned to only adult female horseshoe crabs of Delaware Bay origin (Figure 97). Data collection and harvest quantification methods are described in detail in section 4. Discard data were unavailable for 2003, so it was assumed that discard mortalities equaled the 3-year average value estimated in 2004-2006.

Instantaneous natural mortality rate (*M*) on adult females was assumed to be *M*=0.274 based from empirical estimates of survival rates (mean =0.76) of tagged adult Delaware Bay horseshoe crabs from 2009-2017 (D.R. Smith, unpublished; see 2.1.3 and 2.6) and also on aligning mortality rate with long-held assumptions about maturity and longevity (see 2.6). *M* was assumed constant across years and equal for primiparous and multiparous females since both stages will experience spawning-related mortality, the primary source of adult natural mortality. A comprehensive review of natural mortality is provided in 2.6.

6.7.4 Testing of CMSA with the Operating Model

The SAS tested the application of the CMSA with an age-structured operating model adapted from Sweka et al. (2007), described in Section 6.3, before developing it for horseshoe crab for this assessment. Four simulated data sets were analyzed using CMSA in ADMB version 12.0 and the results are described below. To match the development of the operating model, the CSA used *M*=0.47 for simulation testing. Simulated primiparous and multiparous indices were provided along with catch values as inputs to the model. Comparisons were made between true population size and *F* and the estimated values calculated by the CMSA.

After reviewing the testing of the CMSA with the operating model, the SAS was satisfied with its performance and found it to be appropriate for further development and use in this assessment.

6.7.4.1 Simulation 1

The first simulation represented a constant *F* that ranged from 0.18-0.22 and a “one-way trip” of a declining population. The pattern of true and CMSA-estimated *F*, population estimates, and index estimates were nearly identical throughout the time series (Figure 98). To get total horseshoe crab numbers, the estimated primiparous and multiparous numbers were added together for the CMSA-estimated values and compared to the true values from the operating model.

6.7.4.2 Simulation 2

The second simulation represented a decreasing *F* through time. The pattern of true and CMSA-estimated *F* was nearly identical, with the CMSA slightly overestimating *F* in the beginning of the time series but otherwise predicting *F* to be similar to the true values (Figure 99). To get total horseshoe crab numbers, the estimated primiparous and multiparous numbers were added together for the CMSA-estimated values and compared to the true values from the operating model. The CMSA slightly underestimated the population but was very close to the true numbers. The index fits were very close to the true values.

6.7.4.3 Simulation 3

The third simulation represented an institution of a moratorium followed by a low *F*. The pattern of true and CMSA-estimated *F* was nearly identical, with the CMSA slightly overestimating *F* in the beginning of the time series but otherwise predicting *F* to be similar to the true values (Figure 100). To get total horseshoe crab numbers, the estimated primiparous and multiparous numbers were added together for the CMSA-estimated values and compared to the true values from the operating model. The CMSA slightly underestimated the population but was very close to the true numbers. The model fits to the indices were very close to the true values as well.

6.7.4.4 Simulation 4

The fourth simulation represented a high *F* followed by a moratorium. The pattern of true and CMSA-estimated *F* was nearly identical, with the CMSA slightly overestimating *F* in the beginning of the time series but otherwise predicting *F* to be similar to the true values (Figure 101). To get total horseshoe crab numbers, the estimated primiparous and multiparous numbers were added together for the CMSA-estimated values and compared to the true values from the operating model. The CMSA slightly underestimated the population but was very close to the true numbers. The model fits to the indices were very close to the true values as well.

6.7.5 Base Model Run

A base model was selected from extensive model building and testing of inputs, starting values, bounds, and choice of CVs and likelihood weights λ (Table 43).

The use of swept-area abundance estimates as inputs for r and n in lieu of mean catch-per-tow or densities was highly influential in the evolution of the base model. Given the artifact of unusually low magnitudes of annual landings, the use of swept area, scaled-up primiparous and multiparous estimates was needed in order to properly scale model-estimated population size. Catch is the critical input in model equation eq. (1) for scaling the population size. The CMSA time series occurs during a period of severe landings restrictions relative to historic levels and commercial moratoria (2007-present) on female harvest, which has resulted in marginal commercial landings (and elevated commercial discard rates). Given the use of swept-area estimates, a catchability coefficient was not estimated for the VT survey.

Survey indices and annual CVs from 2003--2018 were used in the base model (except 2013-2016 for the VT survey) (Table 43, Figure 95, Figure 96). The VT survey was not conducted in 2013-2016.

Model catch consisted of all commercial bait landings, commercial discard mortalities, and biomedical mortalities of Delaware Bay adult female horseshoe crabs from the unit region from 2003-2017 (Table 43, Figure 97). A 15% mortality rate was used for bled females reported by the biomedical industry based on a comprehensive literature review and analysis (Section 4.2.1).

Likelihood weights λ_i were based on results of a hierarchical analysis of adult female indices from the VT, DE, and NJ trawl surveys (Conn 2009). The Conn (2009) hierarchical analysis produces a composite index from multiple indices, whereby process error variances (σ^p) generated for each index can be used as an inverse measure of how well the index contributes to the composite (Conn 2009). The inverse Conn variances $(\sigma^p)^{-1}$ for VT, DE, and NJ survey indices (viz. 4.3, 1.12, and 1.8) were proportioned to sum to 1 (viz. 0.59, 0.16, 0.25) and used as λ_i for each likelihood component in the base model (Table 43). Twenty parameters were estimated: median primiparous abundance (1); primiparous abundance for each year (16); catchability coefficients (2) for the Delaware and New Jersey surveys; and multiparous abundance for the start of time series (1), summarized in Table 44.

6.7.6 Model Results

The base model produced excellent convergence criteria and was highly stable and robust to a wide range of starting parameter input values and bounds. Model predictions fit indices well, with excellent agreement with the primiparous index and well-behaved fits through observed multiparous indices (Figure 102-Figure 105).

Estimated primiparous abundance is fairly stable through the time series (Table 45, Figure 106). Rising multiparous abundance is evident and reflects some of the large increases seen in the multiparous trawl indices in later years (Table 45, Figure 107, Figure 108). Fishing mortality rates are very low (average F=**CONFIDENTIAL**[1]), seemingly properly reflecting the current period of highly protective fishery restrictions and moratoria (Figure 109).

6.7.7 Retrospective Analysis

Minor retrospective error or bias was detected from a data peel to 2009 (Figure 110-Figure 112). Mohn's (1999) ρ statistic for total, multiparous, and primiparous abundance was **CONFIDENTIAL** (Table 46). This is consistent with very little retrospective error seen in CSA estimates using simulated population data (Mesnil 2003).

6.7.8 Sensitivity Runs

Several sensitivity runs of the CMSA were conducted to evaluate effects of assumptions on natural mortality, harvest, λ, CVs, q, and starting values (Table 47, Figure 113).

A likelihood profile of M sensitivity runs showed best fit to data between $0.15 \leq M \leq 0.25$, much lower than the previously assumed M=0.47 for adults and supporting the base model M=0.274 (Figure 114). This lower level of M is in better agreement with the understanding of the horseshoe crab's extended longevity (>20y) and late maturity.

Varying catch inputs had little effect on model outputs given the low overall magnitude of removals. Model outputs of terminal F ranged from 0.007 when excluding biomedical data to

[1] Benchmark base run values are CONFIDENTIAL because they are based on harvest that includes numbers of horseshoe crabs attributed the biomedical industry. Values without biomedical data are F_{2017}=0.007 and B_{2018}=8,718,040. The benchmark values of F_{2017} and B_{2018} with the biomedical data, although minimally different, represent the best data but are CONFIDENTIAL.

CONFIDENTIAL when testing different assumed mortality rates of bled biomedical harvest ranging from 4%, 15%, and 30% (Table 47).

Commercial discard mortalities were a newly added source of harvest in this assessment. Beginning in 2007, discard mortalities have consistently been the biggest source of removals on the stock following the implementation of a commercial moratorium on female harvest in Delaware Bay. When discard mortalities were removed from the base model, terminal year fishing mortality was *F*= **CONFIDENTIAL**, a **CONFIDENTIAL** % reduction from the base model *F* (Table 47).

An equal weight λ_i =1 model produced considerably higher terminal stock size estimates since greater emphasis on the VT survey was no longer specified, allowing the model to more closely fit the sharply rising DE and NJ trawl indices. A base model using the unproportionalized Conn weights (4.3, 1.16, 1.8; VT, DE, NJ) predictably had little impact on outputs (Table 47).

Using fixed survey-wide CVs rather than annual CVs for each year of the index was tested. Survey-wide CVs [0.35, 0.258, 0.353, 0.258; VT_r, VT_n, DE, NJ] based on empirical average annual CVs produced slightly higher terminal N estimates (Table 47). Implementing survey-wide CVs reflecting the group's subjective confidence in each survey [0.25, 0.5, 0.5; VT, DE, NJ] resulted in similar outputs to the base model run (Table 47).

Allowing the base model to freely estimate the VT survey catchability coefficient resulted in inflated (roughly 3X) stock size estimates (Table 47). This is an interesting result as the model is seeking a larger stock size in relation to catch, beyond the credible range of expected values. Excessive observation error in surveys, over-specified harvest, or over-specified *M* in the base model could contribute to this situation.

Model runs that excluded parameter estimations in 2013-2016 due to the missing VT survey years were explored. Terminal year outputs were nearly identical to base model outputs.

The base model was highly robust to large variations in starting values of R, N, and q. Model convergence and parameter estimations were unchanged from changes in starting values ranging by more than an order of magnitude (Table 47).

6.7.9 Discussion

Rising adult abundance is evident in model outputs. Stock rebuilding is not surprising given an extended period of significantly reduced commercial landings and tight management controls on the fishery beginning in the early 2000s. Delaware Bay female commercial bait landings in the late 1990s easily exceeded 500,000 per year (see 4.1.2), while bait landings during the model period have averaged 78,000 crabs. Estimated multiparous abundance is stable from 2003 to 2012 and then rises considerably by 2017 (Figure 103). A delayed rebuilding response in multiparous abundance is consistent with slow maturity, long life span, and density-dependent recruitment.

Estimated primiparous abundance occurs in a fairly narrow range around **CONFIDENTIAL** crabs in years with available primiparous and multiparous indices (2003-2012; Figure 106). Although aggregate survey indices are available in 2013-2016, estimates of primiparous and multiparous abundance during this time block (2013-2016) are highly uncertain given the lack of survey indices to allocate abundance between stages. This generally stable recruitment is consistent with a life history dependent on relatively finite amounts of beach habitat for yearly egg burial and incubation. As Sweka et al. (2007) demonstrate, there is an upper cap on the amount of egg production in the population due in part to the maximum capacity of spawning habitat and density-dependent egg mortality. Fairly stable primiparous recruitment with incrementally expanding multiparous abundance would be expected from a species in the mid to later-stages of rebuilding, due to capped recruitment potential, slow growth, low mortality, and long lifespan.

6.7.10 Caveats

The CMSA model is understandably highly levered on the VT survey, as this survey is the only source of information about primiparous and multiparous stages. The magnitude of the VT swept area estimates is assumed to be representative of the Delaware Bay population size, R, N. This assumption was critical in informing the model about population scale. Although q_vt is input to 1, the model can freely estimate R, N above or below r_vt and n_vt in order to best fit all available data. As seen in sensitivity runs, R and N become more inflated as less weight is given to the VT survey (i.e. equal λs) or when the model is allowed to freely estimate q_vt. In reality, the VT swept area estimates are likely minimum estimates of abundance given: 1) the VT trawl gear efficiency is less than 100%; and 2) the VT survey spatial area may be a low estimate of Delaware Bay unit stock spatial area (excludes inside waters of Delaware Bay).

Natural mortality *M* is a critical input in the CMSA model. Although *M* is generally specified well according to sensitivity runs, and is supported by empirical survival estimates, there is some evidence *M* could still be over-specified given the mean ratio of 3.48 multiparous to primiparous females observed in the VT survey along with long-held assumptions about maturity and longevity. For example, assuming maturity starts at 10 years and lifespan ends at 20 years, the *M* needed to achieve this ratio is M=0.23 (closer to the preferred *M* in the likelihood profile). Another possible caveat is the assumption of a constant *M* for both stages, since *M* may increase with age to some extent given higher spawning mortality associated with declining condition as horseshoe crabs age (Penn and Brockmann 1995).

Model catch is assumed known with no error. The biggest source of uncertainty in harvest inputs was associated with discard mortalities. Annual discard mortalities were the products of observer discard rates and reported fishery trips, further proportioned by sex using fishery-independent sex-ratios. It was assumed that 100% of discards were adult stage horseshoe crabs, although this almost certainly is an overestimation. It was also required to make broad assumptions about discard mortality rates, basing mortality rates (i.e. 50% trawl, 5% dredge) on the SAS's collective experience in managing Mid-Atlantic fisheries combined with an understanding of horseshoe crab biology. Since data were unavailable, it was assumed 2003 discard mortalities were equal to the average of the next three years of estimates (2004-2006).

High variability in discard rates, use of external sex ratios, and judgment-based mortality rates are clear caveats to consider and warrant study to refine future estimates. Whereas estimates of discard mortalities may be biased high from assuming 100% adult status, commercial bait harvest may be underestimated from undocumented illegal horseshoe crab harvest caused by the short commercial quota seasons and the high value of adult females as bait in eel and whelk fisheries.

The missing time block (2013-2016) of VT survey information in the model is not ideal, but it isn't as problematic as it could be since the model only tracks two stages rather than multiple cohorts through a time-age matrix. The most obvious problem it presents is that the 2017 estimate of multiparous abundance is based only on the three observed survey indices without the aid of information about R and N from the previous year, 2016. Ultimately, these missing years deprive a fuller understanding of the observed rising population trajectory, since a large increase occurs between 2012 and 2017. This multiparous increase is observed in both aggregate survey indices and male horseshoe crab indices in Delaware Bay, and is further supported by excellent spawning beach numbers in the 2018 Delaware Spawning Beach Survey based on anecdotal observation (J. Zimmerman, personal communication).

7 STOCK STATUS

7.1 Current Overfishing, Overfished/Depleted Definitions

To date, no overfishing or overfished definitions have been adopted by the Management Board.

7.2 Development of Reference Points for Horseshoe Crab

For this assessment, biological reference points were developed for the Delaware Bay horseshoe crab population. Reference points for other populations were not developed because of insufficient information on life history and a lack of suitable stock assessment models to gauge status relative to reference points. Two general methods to develop reference points for female horseshoe crabs were used: 1) reference points derived from a population projection model for Delaware Bay female horseshoe crabs and 2) egg-per-recruit (EPR) and yield-per-recruit (YPR) models. Male horseshoe crab reference points were based on the sex ratio of male:female horseshoe crabs.

7.2.1 Methods

The projection model was based on the age-structured horseshoe crab model of Sweka et al. (2007) and used as an operating model to determine the efficacy of the stock assessment models used in this assessment. Age-0 natural mortality was equal to 10.4143 which came from an estimate of age 0 survival in Delaware Bay from Botton et al. (2003). Estimates of natural mortality at the juvenile (M_{juv}) and mature (M_{mat}) ages in the Sweka et al. (2007) model were based on a study by Carmichael et al. (2003) from Pleasant Bay, MA and may not accurately reflect those in Delaware Bay. In the present projection model, to develop reference points, M_{mat} was reduced from 0.470 in Sweka et al. (2007) to 0.274 to match the value used in the CMSA in this assessment. Justification for the use of this value comes from analysis of tagging data (Section 2.1.3).

There is no empirical estimate of the carrying capacity (*K*) for female horseshoe crabs in Delaware Bay and previous estimates of the carrying capacity (~14 million) were based on projecting the Sweka et al. (2007) model forward until an equilibrium was reached under no fishing mortality. This level was a function of both the age-specific natural mortality schedule and an assumed density-dependent egg mortality function (Smith 2007). Because M_{mat} was reduced in this current model and there are no estimates of M_{juv} specific to the Delaware Bay, the SAS was very uncertain as to what the actual female carrying capacity of the Delaware Bay is, which makes development of biological reference points difficult.

In order to derive biological reference points from the current projection model, three different levels of female horseshoe crab *K* were considered and values of M_{juv} required to stabilize the population at those levels under a situation of no fishing mortality were solved for. The lowest level of *K* was 10 million horseshoe crabs, which is a level slightly greater than the current estimate of female abundance from the CMSA model results. An intermediate level of 14 million was chosen to represent the current management of Delaware Bay horseshoe crabs under the Adaptive Resource Management (ARM) framework whereby 80% of *K* gives value to the harvest of female horseshoe crabs in the optimization routine. Finally, an upper level of 18 million was chosen to acknowledge that current management's estimate of *K* may be an underestimate. For each level of *K*, M_{juv} was determined by setting the population level at the *K* and solving for a value of M_{juv} that resulted in a finite population growth rate (λ) of 1.0 from a population projection matrix (leslie matrix).

The population projection model was coded in a MS Excel spreadsheet and began with a stable age distribution at a given level of *K*. To determine the maximum sustainable yield of this simulated population, the population was projected 400 years into the future. The fishing mortality associated with maximum sustainable yield (F_{msy}) was solved for by maximizing the total catch in year 400, and the associated number at maximum sustainable yield (N_{msy}) was equal to the total number of mature female crabs in year 400 when catch was maximized. F_{20} and F_{40} reference points were estimated by solving for the *F* that resulted in 20% or 40% of *K* in year 400, and the number associated with F_{20} and F_{40} was also estimated. This process was completed for each of three possible levels of *K* explored and resulted in three suites of biological reference points.

Life history parameters used in the projection model (Table 48) were used to generate parameters in per-recruit models (Table 49). The difference between these two tables of life history parameters was that those of the projection model separated ages 10 and 11 into immature and mature individuals while those of the per-recruit model combined them into a single age 10- and 11-year classes. Maturity in the projection model represented the probability of an individual becoming mature at age *i* if it was immature at age *i*-1 whereas maturity in the per-recruit models represented the proportion of the age class that was mature at age *i*.

Per-recruit modeling was performed according to the methods of Gabriel et al. (1989) in the R package fishmethods. It was assumed that 30% of natural mortality occurred before spawning and 0% of fishing mortality occurred before spawning. The EPR model estimated the *F* rate that preserved 20% (F_{20}) and 40% (F_{40}) of the maximum EPR of an unfished population. In the YPR model, it was assumed that individuals did not recruit to the fishery until they were sexually mature and once sexually mature, a terminal molt occurred after which the weight of individuals remained the same throughout the remainder of their life. Thus, age-specific weights were simply set to 1.0 for all ages and the YPR values could be interpreted as the number of individuals per recruit.

7.2.2 Results and Discussion

The reference points from the projection model varied with the assumed level of *K* (Table 50). F_{MSY} ranged from 0.0695 to 0.0796 and values of F_{40}, which is often used as a proxy for F_{MSY} were of similar magnitude (range = 0.0632 to 0.0724).[2]

As an additional check on the coding of the projection model, life history parameters were input into the population projection matrix (leslie matrix). The effects of the various *F* reference points on population growth rates (λ or the dominant eigenvalue from the projection matrix) were tested using the R package demogR. The population number was set at the estimated *K*, N_{msy}, N_{40}, and N_{20} to appropriately include density dependent egg mortality in the projection matrix and corresponding *F* values of 0, F_{msy}, F_{40}, and F_{20} were used. In all cases $\lambda = 1.0$ indicating a stable population at those levels of *F* and confirming the coding of the operating model was capturing the population dynamics as expected.

The EPR and YPR models were determined unsuitable in determining reference points for a species such as horseshoe crab. The EPR model estimated F_{20} ranging from 2.2508 to 2.2676 and F_{40} ranging from 0.6444 to 0.6465, depending on the juvenile natural mortality used. All of these values appeared to be excessively high given the natural mortality of the species (Table 51). When these values of *F* were input into the projection model, the population crashed to less than 1% of the carrying capacity. Also, the plot of YPR vs. *F* showed no declining trend in YPR as *F* increased (Figure 115). The life history of horseshoe crabs, with greater mortality on mature individuals compared to immature individuals, density dependent egg mortality not accounted for in a traditional EPR model, and a terminal molt and lack of increasing weight with age are responsible for these questionable per-recruit results and reference points based on traditional per-recruit models should be avoided.

Management of horseshoe crabs can call for sex specific harvest rates because sexes are easily distinguishable, and ideally, separate sex-specific reference points would be developed and used. Unfortunately, the catch survey model could not estimate the abundance and fishing mortality for male horseshoe crabs. In lieu of having male reference points which could be compared to the CMSA results, the SAS recommends using the sex ratio of male:female crabs from the Delaware Bay spawning survey as a reference point for male horseshoe crabs. This sex ratio reference point would be 2:1. If the sex ratio is >2:1 on the spawning beaches, it can safely be assumed that adequate egg fertilization is occurring, and the abundance of male horseshoe

[2] The Peer Review Panel did not endorse the use of the reference points developed for this stock assessment.

crabs is not limiting the growth of the horseshoe crab population. This assumption is consistent with current management of horseshoe crabs in the Delaware Bay area under the ARM model.

7.3 Stock Status Determination

Although reference points were developed for the Delaware Bay population as described above, the Peer Review Panel recommended that these not be used for comparison to CMSA model output and recommended status determinations be based on ARIMA analyses within each region and coastwide. The reference point from the ARIMA fits was the 1998 index-based reference point because this reference point represents the point in time when horseshoe crabs became actively managed by the ASMFC and status relative to this reference point gives an indication of the effects of management on populations. ARIMA results from surveys used to determine stock status included those surveys with combined-sex indices, residuals of ARIMA model fits were normally distributed, time series extending back to at least 1998, and terminal years were 2016 or 2017.

Stock status was based on the percentage of surveys within a region (or coastwide) having a >50% probability of their terminal year fitted value being less the 1998 index-based reference point. “Poor” status was >66% of surveys meeting this criterion, “Good” status was <33% of surveys, and “Neutral” status was 34 – 65% of surveys (Table 53). The stock status of the Northeast region was neutral; New York region was poor; Delaware Bay region was neutral; and Southeast region was good. The overall coastwide status was neutral.

Applying these stock status criteria to summary ARIMA results from the 2009 benchmark assessment and 2013 update assessment gives a general idea of how status has changed through time. The status of the Delaware Bay region and Southeast region has remained consistently neutral and good, respectively, through time. The status of the Northeast region has changed from neutral, to poor, and back to neutral. The status of the New York region has trended downward from good, to neutral, and now poor. These trends in time should be viewed with caution because the number of surveys in each region has changed in the current assessment and the index values have changed due to our use of the delta distribution for estimates of the mean and variance of each survey index. Previous assessments used index values as given to the SAS by state TC members with no standardization. Previous assessments also included all subsets of a survey (e.g., male and female indices from the same survey) which resulted in “double counting” of individual surveys.

A more detailed description of the surveys used to determine stock status is provided in Table 54. Recent trends (5 year and 10 year) were characterized for each survey by linear regression fitted ARIMA values. An alpha level of 0.10 used to determine if a significant trend occurred over these recent time periods. The Northeast region contained only two surveys meeting the criteria for use in stock determination (MA DMF trawl south of Cape Cod and the RI monthly trawl survey from the fall) and these surveys had conflicting trends. The MA DMF trawl survey south of Cape Cod showed an increasing trend in recent years while the Rhode Island monthly trawl survey continued to show a declining trend. There was consistency among New York region surveys with three out of four showing declining trends in the past five years and all showing declining trends in the past 10 years. Surveys from the Delaware Bay and Southeast regions showed either no trend or increasing trends.

Despite the aforementioned caveats when interpreting changes in regional status through time in Table 53, it is clear that the status of the New York region has declined through time. The surveys in the New York region are largely the same since the 2009 benchmark assessment and have consistently been combined-sex surveys. The difference in this assessment was that the Little Neck and Manhasset Bay surveys were combined into a single survey whereas they were considered separate surveys in previous assessments. The status of the New York survey has gone from good, to neutral, to poor. There is no mortality associated with biomedical collections in the New York region and bait harvest has been reduced from historic levels with a current NY state mandated quota of 150,000 per year. Two hypotheses for the continued decline in abundance are: 1) bait harvest remains at a level that is not sustainable in the New York region; or 2) the habitat has changed and cannot support the number of horseshoe crabs it once did.

7.3.1 Uncertainty

ARIMA results give some indication of stock status (whether the populations are increasing or decreasing) and the probability of the current state of the populations being less than an index-based reference point. However, specific reasons for continued decline, as seen in the New York region, remain elusive and it cannot be determined if these declines are a result of excessive exploitation or changes in habitat suitability.

There also remains much uncertainty about embayment and region-specific populations that could not be modelled as part of this assessment because of a lack of data. Maine, New Hampshire, and Florida were grouped into regions that may not reflect the abundance of horseshoe crabs in those areas. Additionally, the regional groupings used in this assessment reflect the SAS and TC's best efforts to reflect biology and management units but the states are encouraged to consider the embayment-specific populations of horseshoe crabs that are in their state's waters. There is evidence that there are embayment-specific populations in Maine, New Hampshire, and Florida, as well as in other states (see section 2.1), and yet there are no sufficient surveys to track abundance for these populations. These issues can persist even when there is sufficient data available for tracking abundance. For example, populations of horseshoe crab north and south of Cape Cod in Massachusetts exhibit different patterns, as does the abundance index in Rhode Island, and yet these indices were combined in this stock assessment to represent the Northeast region. The Gulf of Maine could be considered its own region in future assessments if there are any additional suitable indices from that area and the Massachusetts North Cape index may be better categorized to that region. Similar considerations could be made for Florida if there was data to support it. All of the Atlantic states are encouraged to monitor and manage the horseshoe crab populations at appropriate levels and collect additional data as needed.

7.4 Comparison of Assessment Management Advice to ARM Model

Management advice that may stem from this stock assessment versus the Adaptive Resource Management (ARM) model represents two different, and somewhat competing, management objectives (Table 55). This stock assessment can form the basis for single species management in the Delaware Bay, while the ARM model represents multi-species management with the harvest of horseshoe crabs constrained by the needs of shorebirds such as the red knot. Currently, management of horseshoe crabs in the Delaware Bay falls under Addendum VII of the fisheries management plan, which calls for the use of the ARM model when making annual harvest recommendations.

Underlying the ARM model are population models for both red knots and horseshoe crabs. The optimization routine in the ARM model determines the best choice among five potential harvest packages (numbers of male and females that can be harvested) given the current abundance of each species in order to maximize the long-term value of horseshoe crab harvest. The ARM model values female harvest only when the abundance of Red Knots reaches 81,900 birds (half of the historic abundance of red knots in the Delaware Bay) or when the abundance of female horseshoe crabs reaches 80% of their carrying capacity (11.2 million assuming a carrying capacity of 14 million). On an annual basis, the ARM model is used to select the optimum harvest package to implement for the next year given the current year's estimate of horseshoe crab abundance from the swept area estimate from the VA Tech trawl survey and a mark-resight estimate of red knot abundance.

At the present time, neither the 81,900 red knot threshold nor the 11.2 million female horseshoe crab thresholds are met. This assessment estimates there are **CONFIDENTIAL** female horseshoe crabs and the ARM workgroup estimated there were 45,221 red knots in Delaware Bay in 2018. While the Peer Review Panel did not endorse the use of the reference points developed for this stock assessment, they did suggest that the ARM Workgroup consider using the population estimates from the CMSA as the best available population estimates of horseshoe crabs in the Delaware Bay region.

8 RESEARCH RECOMMENDATIONS

The SAS identified several research recommendations that would benefit horseshoe crab and future stock assessments. Research recommendations have been categorized as future research, data collection, and assessment methodology and listed in order of priority. The SAS recommends that an update be considered in five years and a benchmark stock assessment considered in ten years given the life history of horseshoe crab and the need for more data. The SAS and TC recommend that during the years between this assessment and the next, members remain proactive about maintaining surveys and research programs and continuing to initiate or participate in activities that accomplish some of the research recommendations listed below.

Future Research

- Determine relationship between age, stage, and size for horseshoe crabs.

- Compare densities of horseshoe crabs nearshore, offshore, and in bays, compare different stages (i.e., primiparous and multiparous), and look at movements among embayments within regions (i.e., around Cape Cod, Long Island).
- Characterize the proportion of states' landings that comprise crabs of Delaware Bay origin. This can be done through a directed tag/release study, genetics/microchemistry study, or both.
- Collect more life history information, particularly for juveniles, on growth, molt timing, and distribution.
- Evaluate the effect of warming temperatures on distribution and timing of spawning for horseshoe crabs.
- Address the issue of gear saturation for spawning beach surveys and/or explore analyses that would be less sensitive to gear saturation. Explore the methodology and data collection of spawning beach surveys and the ability of these surveys to track spawning abundance.
- Determine if there is illegal take-and-use at sea, transfer at sea, and poaching from spawning areas for horseshoe crabs and estimate the amount if possible.

Data Collection

- Continue to fund and operate the full Virginia Tech Trawl Survey annually.
- Conduct a gear efficiency study of the Virginia Tech Trawl Survey given the importance of using swept-area estimates of abundance in modeling the Delaware population.
- Better characterize the discards, landings, and discard mortality by gear.
- Increase the priority of maintaining and managing horseshoe crab data in and among states, both fishery-dependent and –independent, and improve communication between data providers.
- Continue current biosampling for sex and weight and expand where possible.
- Develop a standardized biosampling protocol to cover different seasons and obtain weights, ages, stages, and widths of horseshoe crabs using a random sampling design.
- Expand or implement fishery-independent surveys (e.g., spawning, benthic trawl, tagging) to target horseshoe crabs throughout their full range including estuaries. Highest priority should be given to implementing directed surveys in the Northeast and New York regions.
- Collect sex and stage data in fishery-independent surveys. Surveys should consider using similar methods as the Virginia Tech Trawl Survey and collect biological data by sex and stage, particularly by primiparous and multiparous.
- Continue to evaluate biomedically bled crabs' mortality rates. Consider a tagging study of biomedically bled horseshoe crabs to obtain relative survival and collaborations between researchers and biomedical facilities that would result in peer-reviewed mortality estimates.
- Maintain consistent data collection and survey designs for spawning beach surveys each year and encourage spawning beach surveys to conduct the data collection for the survey and tagging resights separately.

Assessment Methodology

- The ARM working group should consider using the population estimates from the CMSA model as an input to the ARM model as well as estimated mortality from discards and the biomedical industry.
- Further develop the catch-survey analysis and apply assessment modeling beyond the Delaware Bay region, which would require more stage-based data collection.
- Develop a stage-based or length-based model specific for horseshoe crabs that addresses their life history characteristics.
- Estimate the survival of early life stages (e.g., age-zero, juveniles) and growth rates.
- Explore the possibility of using a delay-difference model for future assessments. Because of the life history of horseshoe crab, this would require 20-30 years of data before it could be developed.
- Continue to evaluate tagging data by fitting capture-recapture models that include a short-term (1 year) bleeding effect, account for spatial distribution of harvest pressure, account for capture methodology, and account for disposition of recaptured tagged individuals. Potential methodological approaches include use of time-varying individual covariates to indicate which crabs are 1 year from bleeding and use of hierarchical models to estimate interannual variation in survival within time periods defined by major regulatory changes.

9 REFERENCES

Anderson, R. L., W. H. Watson III, and C. C. Chabot. 2013. Sublethal behavioral and physiological effects of the biomedical bleeding process on the American horseshoe crab, *Limulus Polyphemus*. *Biological Bulletin* 225: 137-151.

Atlantic States Marine Fisheries Commission (ASMFC). 1998a. Interstate Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32 of the Atlantic States Marine Fisheries Commission. Washington D.C. 58pp.

_____. 1998b. Terms of Reference & Advisory Report for the Horseshoe Crab Stock Assessment Peer Review. Stock Assessment Report No. 98-01of the Atlantic States Marine Fisheries Commission. Washington D.C. 15pp.

_____. 1999. Horseshoe Crab Stock Assessment Report for Peer Review. Stock Assessment Report No. 98-01 (Supplement) of the Atlantic States Marine Fisheries Commission. Washington D.C. 47pp + Appendices.

_____. 2000a. Addendum I to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32a of the Atlantic States Marine Fisheries Commission. Washington D.C. 9pp.

_____. 2000b. Stock assessment of Atlantic coast horseshoe crabs: a proposed framework. Washington D.C. 19 99.

_____. 2001. Addendum II to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32b of the Atlantic States Marine Fisheries Commission. Washington D.C. 5pp.

_____. 2004a. Addendum III to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32c of the Atlantic States Marine Fisheries Commission. Washington D.C. 17pp.

_____. 2004b. Horseshoe Crab 2004 Stock Assessment Report. Atlantic States Marine Fisheries Commission. Washington D.C. 87pp.

_____. 2006a. Addendum IV to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32d of the Atlantic States Marine Fisheries Commission. Washington D.C. 5pp.

_____. 2006b. Terms of Reference Report for the Stock Assessment of Horseshoe Crab: A Proposed Framework. Special Report No. 86 of the Atlantic States Marine Fisheries Commission. Washington D.C. 8pp

_____. 2008a. Addendum V to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32e of the Atlantic States Marine Fisheries Commission. Washington D.C. 15pp.

_____. 2008b. Horseshoe Crab Technical Committee report. July 10, 2008. Washington, D.C. 11pp.

_____. 2009a. Horseshoe Crab Stock Assessment for Peer Review, Stock Assessment Report No. 09-02 (Supplement A) of the Atlantic States Marine Fisheries Commission. Washington D.C. 122pp.

_____. 2009b. A Framework for Adaptive Management of Horseshoe Crab Harvest in the Delaware Bay Constrained by Red Know Conservation, Stock Assessment Report No. 09-02 (Supplement B) of the Atlantic States Marine Fisheries Commission. Washington D.C. 51pp.

_____. 2009c. Terms of Reference & Advisory Report to the Horseshoe Crab Stock Assessment Peer Review, Stock Assessment Report No. 09-02 of the Atlantic States Marine Fisheries Commission. Washington D.C. 30pp.

_____. 2010. Addendum VI to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32f of the Atlantic States Marine Fisheries Commission. Washington D.C. 3pp.

_____. 2012. Addendum VII to the Fishery Management Plan for Horseshoe Crab. Fishery Management Report No. 32g of the Atlantic States Marine Fisheries Commission. Washington D.C. 10pp.

_____. 2013. 2013 Horseshoe Crab Stock Assessment Update. Arlington, VA. 72 pp.

_____. 2017. Horseshoe Crab Technical Committee Report: Bait Use Surveys of the American Eel and Channeled Whelk Fisheries. 28pp.

_____. 2018. 2018 Review of the ASMFC Fishery Management Plan for Horseshoe Crab: 2017 Fishing Year. 27pp.

Bai, J., and P. Perron. 2003. Computation and Analysis of Multiple Structural Change Models. Journal of Applied Econometrics 18: 1-22.

Baptist, J. P., O. R. Smith, and J. W. Ropes. 1957. Migrations of the horseshoe cabs, *Limulus polyphemus* in Plum Island Sound, Massachusetts. US Fish Wildlife Service Special Science Report. Fisheries No. 220: 1–15.

Barlow, R. B., M. K. Powers, H. Howard, and L. Kass. 1986. Migration of Limulus for mating: relation to lunar phase, tide height, and sunlight. The Biological Bulletin 171(2): 310–329.

Beekey, M. A., and J. H. Mattei. 2009. What long-term mark/recapture studies reveal about horseshoe crab population dynamics in Long Island Sound. Proceedings of the 2008 Biennial Long Island Sound Research Conference. Connecticut College, Groton.

_____, and J. H. Mattei. 2015. The mismanagement of *Limulus polyphemus* in Long Island Sound, U.S.A.: What are the characteristics of a population in decline. Pages 433–461 *in* Carmichael R. H., M. L. Botton, P. K. S. Shin, and S. G. Cheung, editors. Changing global perspectives on horseshoe crab biology, conservation and management, Springer, New York.

_____, J. H. Mattei, and B. J. Pierce. 2013. Horseshoe crab eggs: A rare resource for predators in Long Island Sound. Journal of Experimental Marine Biology and Ecology 439: 152–159.

Botton, M. L. 1984. Effects of Laughing Gull and Shorebird Predation on the Intertidal Fauna at Cape May, New Jersey. Estuarine, Coastal and Shelf Science (1984) 18:209-220.

_____ 2009. The ecological importance of horseshoe crabs in estuarine and coastal communities: A review and speculative summary. Pages 45–63 *in* Tanacredi J. T., M. L. Botton, and D. R. Smith, editors. Biology and Conservation of Horseshoe Crabs, Springer, New York.

_____, and H. H. Haskin. 1984. Distribution and feeding of the horseshoe crab, *Limulus polyphemus*, on the continental shelf off New Jersey. Fishery Bulletin 82(2): 383–389.

_____, and R. E. Loveland. 1989. Reproductive risk: high mortality associated with spawning by horseshoe crabs (*Limulus polyphemus*) in Delaware Bay, USA. Marine Biology 101:143-151.

_____, and R. E. Loveland. 1993. Predation by Herring Gulls and Great Black-Backed Gulls on Horseshoe Crabs. The Wilson Bulletin, Vol. 105, No. 3 (Sep., 1993), pp. 518-521. Published by: Wilson Ornithological Society.

_____, and R. E. Loveland. 2003. Abundance and dispersal potential of horseshoe crab (*Limulus polyphemus*) larvae in the Delaware estuary. Estuaries 26(6): 1472-1479.

_____, R.E. Loveland, and T.R. Jacobsen. 1988. Beach erosion and geochemical factors: influence on spawning success of horseshoe crabs (*Limulus polyphemus*) in Delaware Bay. Marine Biology 99:325-332.

_____, R. E. Loveland, and T. R. Jacobsen. 1992. Overwintering by trilobite larvae of the horseshoe crab *Limulus polyphemus* on a sandy beach of Delaware Bay (New Jersey, USA).

Marine Ecology Progress Series 88: 289–292.

_____, R.E. Loveland, and T.R. Jacobsen. 1994. Site selection by migratory shore birds in Delaware Bay, and its relationship to beach characteristics and abundance of horseshoe crab (*Limulus polyphemus*) eggs. Auk 111:605-616.

_____, R.E. Loveland, and A. Tiwari. 2003. Distribution, abundance, and survivorship of young-of-the-year in a commercially exploited population of horseshoe crabs *Limulus polyphemus*. Mar. Ecol. Prog. Ser. 265:175-184.

_____, and J. W. Ropes. 1987. Populations of horseshoe crabs, *Limulus polyphemus*, on the northwestern Atlantic continental shelf. Fishery Bulletin 85(4): 805-812.

_____, and J. W. Ropes. 1988. An indirect method for estimating longevity of the horseshoe crab (*Limulus polyphemus*) based on epifaunal slipper shells (*Crepidula fornicata*). Journal of Shellfish Resources 7:407-412.

_____, and J. W. Ropes. 1989. Feeding ecology of horseshoe crabs on the continental shelf, New Jersey to North Carolina. Bulletin of Marine Science 45(3):637–647.

_____, R. A. Tankersley, and R. E. Loveland. 2010. Developmental ecology of the American horseshoe crab *Limulus polyphemus*. Current Zoology 56(5): 550–562.

Box, G. E. and G. M. Jenkins. 1976. Time series analysis: forecasting and control, revised ed. Holden-Day, Oakland, CA.

Brady, J.T. and E.P. Schrading. 1996. Habitat suitability index models: horseshoe crab (spawning beaches) -- Delaware Bay, New Jersey and Delaware (unpublished). U.S. Army Corps of

Engineers, Philadelphia District, Philadelphia, Pennsylvania and U.S. Department of the Interior, Fish and Wildlife Service, New Jersey Field Office, Pleasantville, New Jersey. 6pp.

Brockmann, H. J. 1990. Mating behavior of horseshoe crabs, *Limulus polyphemus*. Behaviour 114(1): 206–220.

_____. 1996. Satellite male groups in horseshoe crabs, *Limulus polyphemus*. Ethology 102(1): 1–21.

_____. 2002. An experimental approach to altering mating tactics in male horseshoe crabs (*Limulus polyphemus*). Behavioral Ecology 13(2): 232–238.

_____. 2003a. Male competition and satellite behavior. Pages 50–82 *in* Shuster Jr, C. N., R. B. Barlow, and H. J. Brockmann, editors. The American horseshoe crab, Harvard University Press, Cambridge.

_____. 2003b. Nesting behavior: A shoreline phenomenon. Pages 33–49 *in* Shuster Jr, C. N., R. B. Barlow, and H. J. Brockmann, editors. The American horseshoe crab, Harvard University Press, Cambridge.

_____, T. Black, and T. L. King. 2015. Florida horseshoe crabs: populations, genetics and the marine-life harvest. Pages 97–127 *in* Carmichael, R. H., M. L. Botton, P. K. S. Shin, and S. G. Cheung, editors. Changing global perspectives on horseshoe crab biology, conservation and management, Springer, New York.

_____, T. Colson, and W. Potts. 1994. Sperm competition in horseshoe crabs (*Limulus polyphemus*). Behavioral Ecology and Sociobiology 35(3): 153–160.

_____, and S. L. Johnson. 2011. A long term study of spawning activity in a Florida Gulf Coast population of horseshoe crabs (*Limulus polyphemus*). Estuaries and Coasts

34(5): 1049–1067.

_____, C. Nguyen, and W. Potts. 2000. Paternity in horseshoe crabs when spawning in multiple-male groups. Animal Behaviour 60(6): 837–849.

_____, and D. Penn. 1992. Male mating tactics in the horseshoe crab, *Limulus polyphemus*. Animal Behaviour 44(4): 653–665.

_____, and M. D. Smith. 2009. Reproductive competition and sexual selection in horseshoe crabs. Pages 199–221 *in* Tanacredi, J. T., M. L. Botton, and D. R. Smith, editors. Biology and conservation of horseshoe crabs, Springer, New York.

Brousseau, L. J., M. Sclafani, and D. R. Smith. 2004. Acoustic-tracking and radio tracking of horseshoe crabs to assess spawning behavior and subtidal habitat use in Delaware Bay. North American Journal of Fisheries Management 24(4): 1376–1384.

Carmichael, R. H., D. Rutecki, B. Annett, E. Gaines, and I. Valiela. 2004. Position of horseshoe crabs in estuarine food webs: N and C stable isotopic study of foraging ranges and diet composition. Journal of Experimental Marine Biology and Ecology 299(2): 231–253.

_____, E. Gaines, Z. Sheller, A. Tong, A. Clapp, and I. Valiela. 2009. Diet composition of juvenile horseshoe crabs: Implications for growth and survival of natural and cultured stocks. Pages

521–534 *in* Tanacredi, J. T., M. L. Botton, D. R. Smith, editors. Biology and conservation of horseshoe crabs, Springer, New York.

_____, E. E. Hieb, G. Gauvry, C. N. and Shuster. 2015. Examination of Large Exuviae with Mating Scars: Do Female American Horseshoe Crabs, Limulus polyphemus, Molt After Sexual Maturity? In Changing Global Perspectives on Horseshoe Crab Biology, Conservation and Management(pp. 353-366). Springer, Cham.

_____, D. Rutecki, and I. Valiela. 2003. Abundance and population structure of the Atlantic horseshoe crab Limulus polyphemus in Pleasant Bay, Cape Cod. Marine Ecology Progress Series 246: 225–239.

Chabot, C. C., S. J. Skinner, and W. H. Watson III. 2008. Rhythms of locomotion expressed by *Limulus polyphemus*, the American horseshoe crab: I. synchronization by artificial tides. The Biological Bulletin 215(1): 34–45.

_____, Watson, W.H. 2010. Circatidal rhythms of locomotion in the American horseshoe crab *Limulus polyphemus*: Underlying mechanisms and cues that influence them. *Current Zoology*, 56 (19): 499-517.

_____, J. F. Yelle, C. B. O'Donnell, and W. H. Watson III. 2011. The effects of water pressure, temperature, and current cycles on circatidal rhythms expressed by the American horseshoe crab, *Limulus polyphemus*. Marine and Freshwater Behaviour and Physiology 44(1): 43–60.

Cheng, H. 2014. The environmental influences on American horseshoe crab (*Limulus polyphemus*) behavior and distribution in the Great Bay Estuary. Master's thesis. University of New Hampshire, Durham, New Hampshire, USA.

_____, C. C. Chabot, and W. H. Watson III. 2015. The life history cycle of *Limulus polyphemus* in the Great Bay Estuary, New Hampshire USA. Pages 237–253 *in* Carmichael, R. H., M. L. Botton, P. K. S. Shin, S. G. Cheung, editors. Changing global perspectives on biology, conservation, and management of horseshoe crabs, Springer, New York.

_____, C. C. Chabot, W. H. Watson III. 2016. Influence of environmental factors on spawning of the American horseshoe crab (*Limulus polyphemus*) in the Great Bay Estuary, New Hampshire, USA. Estuaries and Coasts 39(4): 1142–1153.

Cohen, J. A., and H. J. Brockmann. 1983. Breeding activity and mate selection in the horseshoe crab *Limulus polyphemus*. Bulletin of Marine Science 33(2): 274–281.

Collie, J. S., and M. P. Sissenwine. 1983. Estimating population size from relative abundance data measured with error. Canadian Journal of Fisheries and Aquatic Science 40: 1871-1879.

Conn, P. B. 2009. Hierarchical analysis of multiple noisy abundance indices. Canadian Journal of Fisheries and Aquatic Sciences 67(1): 108-120.

Conser, R.J. 1994. Stock assessment methods designed to support fishery management decisions in data-limited environments: development and application. PhD dissertation. School of Fisheries, University of Washington, Seattle, 292pp.

Cortes, E., Manire, C.A. and R.E. Hueter. 1996. Diet, feeding habits, and diel feeding chronology of the bonnethead shark Sphyrna tiburo in southwest Florida. Bull. Mar. Sci. 58:353-367.

Cushman, E., Darden, T., and Fowler, A. (*in review*). South Carolina Horseshoe Crab Population Assessment Using an Integrated Approach.

DBETC (Delaware Bay Ecosystem Technical Committee). 2011. Delaware Bay Ecosystem Technical Committee Report January 24-25, 2011. Internal memorandum of the ASMFC.

Duffy, E. E., D. J. Penn, M. L. Botton, H. J. Brockmann, and R. E. Loveland. 2006. Eye and clasper damage influence male mating tactics in the horseshoe crab *Limulus polyphemus*. Journal of Ethology 24(1): 67–74.

Ehlinger, G. S., and R. A. Tankersley. 2003. Larval hatching in the horseshoe crab, *Limulus polyphemus*: facilitation by environmental cues. Journal of Experimental Marine Biology and Ecology 292(2): 199–212.

_____, and R. A. Tankersley. 2004. Survival and Development of Horseshoe Crab (Limulus polyphemus) Embryos and Larvae in Hypersaline Conditions. Biol. Bull. 206(87-94).

_____, and R. A. Tankersley. 2007. Reproductive ecology of the American horseshoe crab *Limulus polyphemus* in the Indian River Lagoon: an overview. Florida Scientist 70: 449–463.

_____, and R. A. Tankersley. 2009. Ecology of horseshoe crabs in microtidal lagoons. Pages 149–162 *in* Tanacredi, J. T., M. L. Botton, D. R. Smith, editors. Biology and conservation of horseshoe crabs, Springer, New York.

_____, R. A. Tankersley, and M. B. Bush. 2003. Spatial and temporal patterns of spawning and larval hatching by the horseshoe crab, *Limulus polyphemus*, in a microtidal coastal lagoon. Estuaries 26(3): 631–640.

Faurby, S., T. L. King, M. Obst, E. M. Hallerman, C. Pertoldi, and P. Funch. 2010. Population dynamics of American horseshoe crabs–historic climatic events and recent demographic pressures. Molecular Ecology 19:3088-3100.

Ferguson, L., L. Chamberlin, K. Sellers, and A. Anholt (2017). reTURN the Favor Horseshoe Crab Rescue Project 2017 Season Summary Report. http://returnthefavornj.org/wp-content/uploads/2017/10/RTF-Final-Report_2017_FINAL.pdf

Finn, J.J., C.N. Shuster, Jr. and B.L. Swan. 1991. *Limulus* spawning activity on Delaware Bay shores 1990. Finn-Tech Inc., Cape May Courthouse, NJ.

French, K.A. 1979. Laboratory culture of embryonic and juvenile Limulus. In Cohen E (ed) Biomedical Applications of the Horseshoe Crab (Limulidae). Alan R. Liss, New York, pp 61–71.

Friedland, K.D., G.C. Garman, A.J. Bejda, A.L. Studholme, and B. Olla. 1988. Interannual Variation in Diet and Condition in Juvenile Bluefish during Estuarine Residency. Transactions of the American Fisheries Society, 117:5, 474-479.

Fournier, D.A., H.J. Skaug, J. Ancheta, J. Ianelli, A. Magnusson, M.N. Maunder, A. Nielsen, and J. Sibert. 2012. AD Model Builder: using automatic differentiation for statistical inference of highly parameterized complex nonlinear models. Optimization Methods and Software, 27:2, 233-249.

Gabriel, W.L., M.P. Sissenwine, and W.J. Overholtz. 1989. Analysis of spawning stock biomass per recruit: an example for Georges Bank haddock. North American Journal of Fisheries Management 9:383-391.

Gaines, E. F., R. H. Carmichael, S. P. Grady & I. Valiela. 2002. Stable isotopic evidence for changing nutritional sources of juvenile horseshoe crabs. The Biological Bulletin 203(2): 228-230.

Gerrodette, T. 1987. A power analysis for detecting trends. Ecology, 68(5): 1364-1372.

Gilbert, S., and K. B. Clark. 1981. Seasonal variation in standing crop of the seagrass *Syringodium filiforme* and associated macrophytes in the Northern Indian River, Florida. Estuaries 4(3): 223–225.

Gislason, H., N. Daan, J.C. Rice, and J.G. Pope. 2010. Size, growth, temperature and the natural mortality of marine fish. Fish and Fisheries 11:149–158.

Grady, S., P.D. Rutecki, R. Carmicael and I. Valiela. 2001. Age structure of the Pleasant Bay population of Crepidula fornicate: a possible tool for estimating horseshoe crab age. Biol. Bull. 201:296-297.

Graham, L.J., Botton, M.L., Hata, D., Loveland, R.E. and B.R. Murphy. 2009. Prosomal-width-to-weight relationships in American horseshoe crabs (*Limulus polyphemus*): examining conversion factors used to estimate landings. Fishery Bulletin 107:235–243.

Hall, W.R., Jr. 1992. The horseshoe crab - A reminder of Delaware's past. University of Delaware, Sea Grant Marine Advisory Service, Newark, Delaware. 4pp.

Haramis, M. G., W. A. Link, P. C. Osenton, D. B. Carter, R. G. Weber, N. A. Clark, N. A. Teece, and D. S. Mizrahi. 2007. Stable isotope and pen feeding trial studies confirm the value of horseshoe crab *Limulus polyphemus* eggs to spring migrant shorebirds in Delaware Bay. Journal of Avian Biology 38(3): 367–376.

Hata, D., and J.M. Berkson. 2003. Abundance of horseshoe crabs, *Limulus polyphemus*, in the Delaware Bay area. Fish. Bull. 101(4): 933-938.

_____, and E. Hallerman. 2008. Report of the 2007 horseshoe crab trawl survey. Report to the ASMSC Horseshoe Crab Technical Committee.

_____, and E. Hallerman. 2009a. Evaluation of the coastal horseshoe crab trawl survey for estimating juvenile recruitment and mortality: Supplemental report to the Atlantic States Marine Fisheries Commission Horseshoe Crab Technical Committee. Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.

_____, and E. Hallerman. 2009b. Classification of sex and maturity in the Virginia Tech coastal horseshoe crab trawl survey. A publication of the Horseshoe Crab Research Center, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University Blacksburg, Virginia.

_____, and E. Hallerman. 2009c. 2008 horseshoe crab trawl survey: Report to the Atlantic States Marine Fisheries Commission Horseshoe Crab Technical Committee. A publication of the

Horseshoe Crab Research Center, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University Blacksburg, Virginia.

_____, and E. Hallerman. 2018. 2017 horseshoe crab trawl survey: Report to the Atlantic States Marine Fisheries Commission Horseshoe Crab Technical Committee. A publication of the Horseshoe Crab Research Center, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University Blacksburg, Virginia.

Helser, T. E. and D. B. Hayes. 1995. Providing quantitative management advice from stock abundance indices based on research surveys. Fishery Bulletin 93: 290 – 298.

_____, Sharov, A. and D. M. Kahn. 2002. A stochastic decision-based approach to assessing the Delaware Bay blue crab (*Callinectes sapidus*) stock. Pages 63-82 i*n* J. M. Berkson, L. L. Kline, and D. J. Orth , *editors.* Incorporating uncertainty into fishery models. *Edited by*. American Fisheries Society, Symposium 27, Bethesda, Maryland.

Hewitt, D.A. and J.M. Hoenig. 2005. Comparison of two approaches for estimating natural mortality based on longevity. Fish. Bull. 103, 433–437.

Hoenig, J.M., 1983. Empirical use of longevity data to estimate total mortality rates. Fish. Bull. 82, 898–903.

Hummon, W.D., J.W. Fleeger, and M.R. Hummon. 1976. Meiofauna-macrofauna interactions. 1. Sand beach meiofauna affected by *Limulus* eggs. Chesapeake Science 17:297–299.

Jackson, N. L., K. F. Nordstrom, and D. R. Smith. 2002. Geomorphic – biotic interactions on beach foreshores in estuaries. Proceedings of the International Coastal Symposium (ICS 2002), Journal of Coastal Research Special Issue 36:414-424.

_____, K. F. Nordstrom, and D. R. Smith. 2005. Influence of waves and horseshoe crab spawning on beach morphology and sediment grain-size characteristics on a sandy estuarine beach. Sedimentology 52:1097–1108.

James-Pirri, M. J., K. Tuxbury, S. Marino, and S. Koch. 2005. Spawning densities, egg densities, size structure, and movement patterns of spawning horseshoe crabs, *Limulus polyphemus*, within four coastal embayments on Cape Cod, Massachusetts. Estuaries 28(2): 296–313.

Jegla, T.C. and J.D. Costlow. 1982. Temperature and salinity effects on development and early posthatch stages of *Limulus*. Pages 103-113 *In* J. Bonaventura *et al.* (eds.). Physiology and biology of horseshoe crabs: Studies on normal and environmentally stressed animals. Alan R. Liss, Inc. New York, New York.

Jensen, A.L., 1996. Beverton and Holt life history invariants result from optimal tradeoff of reproduction and survival. Can. J. Fish. Aquat. Sci. 53, 820–822.

Johnson, S. L., and H. J. Brockmann. 2010. Costs of multiple mates: an experimental study in horseshoe crabs. Animal Behaviour 80(5): 773–782.

Keinath, J. A. 2003. Predation of horseshoe crabs by loggerhead sea turtles. Pages 152–153 *in* Shuster, C. N. Jr, R. B. Barlow, H. J. Brockmann, editors. The American horseshoe crab, Harvard Press, Cambridge.

Kin, A., and B. Błażejowski. 2014. The horseshoe crab of the genus Limulus: living fossil or stabilomorph?. PLoS One 9(10): e108036.

King, T.L., M.S. Eackles, A.W. Aunins, H.J. Brockmann, E. Hallerman, B.L. Beaver. 2015. Conservation genetics of the American horseshoe crab (*Limulus polyphemus*): allelic diversity, zones of genetic discontinuity, and regional differentiation. In: Carmichael, R.H., M.L. Botton, P.K.S. Shin, S.G. Cheung (eds) Changing global perspectives on horseshoe crab biology, conservation and management. Springer, New York, pp. 65-96.

_____, M.S. Eackles, A.P. Spidle, and H.J. Brockmann. 2003. Microsatellite DNA reveals regional differentiation among populations of the horseshoe crab (*Limulus polyphemus*). Final Report to the Atlantic States Marine Fisheries Commission. 43pp.

_____, M.S. Eackles, A.P. Spidle, and H.J. Brockmann. 2005. Regional differentiation and sex-biased dispersal among populations of the horseshoe crab *Limulus polyphemus*. *Transactions of the American Fisheries Society* 134(2): 441–465.

Kraemer, G., and S. Michels. 2009 History of horseshoe crab harvest in Delaware Bay. In: Tanacredi JT, Botton ML, Smith DR (eds) Biology and Conservation of Horseshoe Crabs. Springer, New York, pp 299–313.

Kraeuter, J. N., and S. R. Fegley. 1994. Vertical disturbance of sediments by horseshoe crabs (*Limulus polyphemus*) during their spawning season. Estuaries 17(1): 288–294.

Landi, A. A., J. C. Vokoun, P. Howell, and P. Auster. 2015. Predicting use of habitat patches by spawning horseshoe crabs (*Limulus polyphemus*) along a complex coastline with field surveys and geospatial analyses. Aquatic Conservation: Marine and Freshwater Ecosystems 25(3): 380–395.

Laughlin, R. 1983. The effects of temperature and salinity on larval growth of the horseshoe crab *Limulus polyphemus*. Biol. Bull. 164: 93-103.

Lebreton, J.D., J.D. Nichols, R.J. Barker, R. Pradel, and J.A. Spendelow. 2009. Modeling individual animal histories with multistate capture–recapture models. Advances in ecological research 41: 87-173.

Leschen, A. S., S. P. Grady, and I. Valiela. 2006. Fecundity and spawning of the Atlantic horseshoe crab, *Limulus polyphemus*, in Pleasant Bay, Cape Cod, Massachusetts, USA. Marine Ecology 27(1): 54–65.

Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: A comparison of natural ecosystems and aquaculture. Journal of Fish Biology 49(4):627 – 642.

_____. 2000. Allometry of natural mortality as a basis for assessing optimal release size in fish-stocking programmes. Can. J. Fish. Aquat. Sci. 57:2374-2381.

Loveland, R. E., and M. L. Botton. 1992. Size dimorphism and the mating system in horseshoe crabs *Limulus polyphemus* L. Animal Behaviour 44(5): 907–916.

_____, M.L. Botton, and C.N. Shuster. 1996. Life history of the American horseshoe crab (*Limulus polyphemus L.*) in Delaware Bay and its importance as a commercial resource. Pages 15-22 In J. Farrell and C. Martin (eds.). Proceedings of the horseshoe crab forum: Status of the resource. University of Delaware, Sea Grant College Program. Lewes, Delaware. 60 pp.

Maio, K.J. 1998. Quantitative description of the temporal and spatial patterns in spawning activity of the horseshoe crab, *Limulus polyphemus*. Master's thesis. University of Maryland Eastern Shore, Princess Anne, Maryland.

Manion, M.M., R.A. West, and R.E. Unsworth. 2000. Economic assessment of the Atlantic coast horseshoe crab fishery. Division of Economics, United States Fish and Wildlife Service, Arlington, Virginia.

Manly, B. F. J. 2001. Statistics for environmental science and management. Chapman and Hall.

McCormick, M.E. and M.J. McCormick. 1998. The elms cliffs: characteristics of cliff erosion on the Chesapeake Bay. Johns Hopkins University, Baltimore, Maryland. 13 pp.

McElroy, W. D. 2009. Ontogeny for the sandbar shark, *Carcharhinus plumbeus*, and smooth dogfish, *Mustelus canis*, within the Delaware Bay estuary. Doctoral thesis, University of Rhode Island.

McGowan, C.P., D. R. Smith, J. D. Nichols, J. E. Lyons, J. Sweka, K. Kalasz, L. J. Niles, R. A. Wong, J. Brust, M. Davis, and B. Spear. 2015. Implementation of a framework for multi-species, multi-objective adaptive management in Delaware Bay. Biological Conservation 191(2015):759-769.

_____, D. R. Smith, J. A. Sweka, J. Martin, J. D. Nichols, R. Wong, J. E. Lyons, L. J. Niles, K. Kalasz, J. Brust, and M. Klopfer. 2011. Multispecies modeling for adaptive management of horseshoe crabs and red knots in the Delaware Bay. Natural Resource Modeling 24(1): 117-156.

McGurk, M.D. 1986. Natural mortality of marine pelagic fish eggs and larvae: role of spatial patchiness. Mar. Ecol. Prog. Ser. 34:227-242.

Mesnil, B. 2003. The catch-survey analysis (CSA) method of fish stock assessment: an evaluation using simulated data. Fisheries Research 63:193-212.

Michels, S. F., D. Smith, and S. Bennett. 2008. Horseshoe crab spawning activity in Delaware Bay: 1999–2007. Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee. Atlantic States Marine Fisheries Commission. Washington D. C., USA.

Miller, A.J., M.J. Wilberg, A.R. Colton, G.R. Davis, A. Sharov, R.N. Lipcius, G.M. Ralph, E.G. Johnson, and A.G. Kaufman. 2011. Stock Assessment of Blue Crab in Chesapeake Bay 2011. Technical Report Series No. TS-614-11 of the University of Maryland Center for Environmental Science.

Mohn, R. 1999. The retrospective problem in sequential population analysis: An investigation using cod fishery and simulated data. ICES J. Mar. Sci. 56: 473-488.

Moore, S., and S. Perrin. 2007. Seasonal movement and resource-use patterns of resident horseshoe crab (*Limulus polyphemus*) populations in a Maine, USA estuary. Estuaries and Coasts 30(6): 1016–1026.

O'Connell, C. W., S. P. Grady, A. S. Leschen, R. H. Carmichael, and I. Valiela. 2003. Stable isotopic assessment of site loyalty and relationships between size and trophic position of the Atlantic horseshoe crab, *Limulus polyphemus*, within Cape Cod estuaries. The Biological Bulletin 205(2): 254–255.

Owings, M. 2017. Effects of the Biomedical Bleeding Process on the Behavior and Physiology of the American Horseshoe Crab, *Limulus Polyphemus*. University of New Hampshire Master's Theses and Capstones. 1153. https://scholars.unh.edu/thesis/1153

Pauly, D., 1980. On the interrelationships between natural mortality, growth parameters, and mean environmental temperature in 175 stocks. J. Cons. Int. Explor. Mer. 39, 175–192.

Penn, D. and H.J. Brockmann. 1994. Nest site selection in the horseshoe crab, *Limulus polyphemus*. Biological Bulletin 187:373-384.

_____, and H.J. Brockmann. 1995. Age-biased stranding and righting in horseshoe crabs, *Limulus polyphemus*. Animal Behaviour 49:1531–1539.

Pennington, M. 1983. Efficient estimators of abundance, for fish and plankton surveys. Biometrics: 281-286.

_____. 1986. Some statistical techniques for estimating abundance indices from trawl surveys. Fishery Bulletin 84: 519 – 525.

Peterson, I. and J.S. Wroblewski. 1984. Mortality Rate of Fishes in the Pelagic Ecosystem. Canadian Journal of Fisheries and Aquatic Sciences 41(7):1117-1120.

Pierce, J.P., G. Tan, and P.M. Gaffney. 2000. Delaware Bay and Chesapeake Bay populations of the horseshoe crab (*Limulus polyphemus*) are genetically distinct. Estuaries 23: 690-698.

Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. Angler survey methods and their application in fisheries management. American Fisheries Society Special Publication.

Prager, M. H. 1994. A suite of extensions to a nonequilibrium surplus-production model. Fishery Bulletin 92:374−389.

Riska, B. 1981. Morphological variations in the horseshoe crab, *Limulus polyphemus*. Evolution. 35(4):647-658.

Ropes, J.W. 1961. Longevity of the horseshoe crab, *Limulus polyphemus* (L.). Trans. Amer. Fish. Soc. 90: 79-80.

Rudloe, A. E. 1979. Locomotor and light responses of larvae of the horseshoe crab *Limulus polyphemus* (L.). The Biological Bulletin. 157(3): 494–505.

_____. 1980. The breeding behavior and patterns of movement of horseshoe crab, *Limulus polyphemus*, in the vicinity of breeding beaches in Apalachee Bay, Florida. Estuaries 3(3): 177-183.

Rutecki, D., R. H. Carmichael, and I. Valiela 2004. Magnitude of harvest of Atlantic horseshoe crabs, *Limulus polyphemus*, in Pleasant Bay, MA. Estuaries 27:179–187.

Saunders, K. M., H. J. Brockmann, W. H. Watson, and S. H. Jury. 2010. Male horseshoe crabs *Limulus polyphemus* use multiple sensory cues to locate mates. Current Zoology: 56(5).

Saunders, N.C., L.G. Kessler and J.C. Avise. 1986. Genetic variation and gentic differentiation in mitochondrial DNA of the horseshoe crab, *Limulus polyphemus*. Genetics. 112:613- 627.

Sasson, D. A., S. L. Johnson, and H. J. Brockmann. 2012. The role of age on sperm traits in the American horseshoe crab, *Limulus polyphemus*. Animal Behaviour 84(4): 975–981.

Saunders, K.M., Brockmann, H.J., Watson, W.H., Jury, S.H. (2010) Male horseshoe crabs *Limulus polyphemus* use multiple sensory cues to locate mates. *Current Zoology*, 56(14): 485-498.

Schaller, S. Y., C. C. Chabot, and W. H. Watson III. 2010. Seasonal movements of American horseshoe crabs *Limulus polyphemus* in the Great Bay Estuary, New Hampshire (USA). Current Zoology 56(5): 587–598.

_____ and F. Dorsey. 2011. Taunton Bay horseshoe crab tagging study: the 10 year report. Friends Taunton Bay News 40: 1-3.

Selander, R.K., S.Y. Yang, R.C. Lewontin and W.E. Johnson. 1970. Genetic variation in the horseshoe crab (*Limulus polyphemus*), a polygenetic "relic." Evolution. 24(2):402-414.

Seney, E.E. and J.A. Musick. 2007. Historical Diet Analysis of Loggerhead Sea Turtles (*Caretta caretta*) in Virginia. Copeia, 2007(2), pp. 478–489.

Sekiguchi, K., and C.N. Shuster, Jr. 2009. Limits on the global distribution of horseshoe crabs (Limulacea): Lessons learned from two lifetimes of observations: Asia and America. In Tanacredi et al. (eds.) 2009. Biology and Conservation of Horseshoe Crabs. Springer. New York, NY.

_____, Y. Yamamichi, and J.D. Costlow. 1982. Horseshoe crab development studies I. Normal embryonic development of *Limulus polyphemus* compared with *Tachypleus tridentatus*. Pages 53-73 In J. Bonaventura et al. (eds.). Physiology and biology of horseshoe crabs: Studies on normal and environmentally stressed animals. Alan R. Liss, Inc. New York, New York.

Shuster, C. N. Jr. 1950. Observations on the natural history of the American horseshoe crab, *Limulus polyphemus*. Woods Hole Oceanographic Institution Contribution 564: 18-23.

_____. 1960. Distribution of horseshoe "crabs" in Delaware Bay. University of Delaware, Estuarine Bulletin 5(2):1-7.

_____. 1979. Distribution of the American horseshoe ''crab'', *Limulus polyphemus* (L.). Pages 3-26 *in* E. Cohen, editor. Biomedical applications of the horseshoe crab (*Limulidae*), Alan R. Liss, New York.

_____. 1982. A pictorial review of the natural history and ecology of the horseshoe crab *Limulus polyphemus*, with reference to other *Limulidae*. Pages 1–52 *in* Bonaventura, J., C. Bonaventura, and S. Tesh, editors. Physiology and biology of horseshoe crabs, Alan R. Liss, New York.

_____. 1996. The Delaware Bay area - an ideal habitat for horseshoe crabs. Public Service Electric and Gas Company, Hancocks Bridge, New Jersey. 26pp. + appendices.

_____, and M. L. Botton. 1985. A contribution to the population biology of horseshoe crabs, *Limulus polyphemus*, in Delaware Bay. Estuaries 8(4): 363-372.

_____, and K. Sekiguchi. 2003. Growing up takes about ten years and eighteen stages. Pages 103–132 *in* Shuster, C. N. Jr, R. B. Barlow, H. J. Brockmann, editors. The American horseshoe crab, Harvard University Press, Cambridge.

Smith, D.R. 2007. Effect of horseshoe crab spawning density on nest disturbance and exhumation of eggs: A simulation study. Estuaries and Coasts 30:287-295.

_____, L. J. Brousseau, M. T. Mandt, and M. J. Millard. 2010. Age and sex specific migration timing and frequency of horseshoe crab spawning in Delaware Bay: insights from a largescale radio telemetry array. Current Zoology 56(5): 563–574.

_____, H.J. Brockmann, M.A. Beekey, T.L. King, M.J. Millard, J. Zaldívar-Rae. 2017. Conservation status of the American horseshoe crab (*Limulus polyphemus*): a regional assessment. Reviews in Fish Biology and Fisheries 27: 135–175.

_____, M. T. Mandt, and P. D. M. Macdonald. 2009. Proximate causes of sexual dimorphism in horseshoe crabs (*Limulus polyphemus*) of the Delaware Bay. Journal Shellfish Research 28(2): 405-417.

_____, and S. F. Michels. 2006. Seeing the elephant: Importance of spatial and temporal coverage in a large-scale volunteer based program to monitor horseshoe crabs. Fisheries 31(10): 485–491.

_____, M. J. Millard, and S. Eyler 2006. Abundance of adult horseshoe crabs in Delaware Bay estimated from a large-scale mark-recapture study. Fishery Bulletin 104(3): 456–464.

_____, P. S. Pooler, R. E. Loveland, M. L. Botton, S. F. Michels, R. G. Weber, and D. B. Carter. 2002a. Horseshoe crab (*Limulus polyphemus*) reproductive activity on Delaware Bay beaches: Interactions with beach characteristics. Journal of Coastal Research 18: 730–740.

_____, P. S. Pooler, B. L. Swan, S. F. Michels, W. R. Hall, P. J. Himchak, and M. J. Millard. 2002b. Spatial and temporal distribution of horseshoe crab (Limulus polyphemus) spawning in Delaware Bay: implications for Monitoring. Estuaries 25: 115-125.

Swan, B. L. 2005. Migrations of adult horseshoe crabs, *Limulus polyphemus*, in the Middle Atlantic Bight: a 17-year tagging study. Estuaries 20(1): 28-40.

Sweka, J. A., D. R. Smith, and M. J. Millard. 2007. An age-structured population model for horseshoe crabs in the Delaware Bay area to assess harvest and egg availability for shorebirds. Estuaries and Coasts 30(2): 277-286.

Szczepanski, J. A., and D. A. Bengtson. 2014. Quantitative food habits of the bullnose ray, Myliobatis freminvillii, in Delaware Bay. Environmental biology of fishes 97(9): 981-997.

Thompson, M. 1998. Assessments of the population biology and critical habitat for the horseshoe crab, *Limulus polyphemus,* in the South Atlantic Bight. M.S. Thesis, Medical University of South Carolina, University of Charleston, Charleston, South Carolina. 50pp. + appendices.

U.S. Army Corps of Engineers. 1991. Delaware Bay coastline, New Jersey and Delaware - reconnaissance report. Department of the Army, Corps of Engineers, Philadelphia District. Philadelphia, Pennsylvania. 123 pp. + appendices.

U.S. Army Corps of Engineers. 1997. Villas and vicinity, NJ - interim feasibility study, draft feasibility report and environmental assessment. Department of the Army, Corps of Engineers, Philadelphia District. Philadelphia, Pennsylvania. 169 pp. + appendices.

Vasquez, M. C., A. Murillo, H. J. Brockmann, and D. Julian. 2015. Multiple-stressor interactions influence embryo development rate in the American horseshoe crab, *Limulus polyphemus.* Journal of Experimental Biology 218: 2355–2364.

Watson, W. H. III, S. Y. Schaller, and C. C. Chabot. 2009. The relationship between small- and large-scale movements of horseshoe crabs in the Great Bay estuary and *Limulus* behavior in the laboratory. Pages 131–147 *in* Tanacredi, J. T., M. L. Botton, and D. R. Smith, editors. Biology and conservation of horseshoe crabs, Springer, New York.

_____, and C. C. Chabot. 2010. High resolution tracking of adult horseshoe crabs *Limulus polyphemus* in a New Hampshire estuary using fixed array ultrasonic telemetry. Current Zoology 56: 599–610.

_____, S. K. Johnson, C. D. Whitworth, and C. C. Chabot. 2016. Rhythms of locomotion and seasonal changes in activity expressed by horseshoe crabs in their natural habitat. Marine Ecology Progress Series 542: 109–121.

Weber, R. G., and D. B. Carter. 2009. Distribution and development of *Limulus* egg clusters on intertidal beaches in Delaware Bay. Pages 249–266 *in* Tanacredi, J. T., M. L. Botton, and D. R. Smith, editors. Biology and conservation of horseshoe crabs, Springer, New York.

Wenner, E., and M. Thompson. 2000. Evaluation of harvesting impacts and population trends for *Limulus polyphemus* in South Carolina. South Carolina Department of Natural Resources, Marine Resources Research Institute. National Oceanic and Atmospheric Administration Final Report.

White, G.C. and K.P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird study, 46(sup1): S120-S139.

Widener, J. W., and R. B. Barlow. 1999. Decline of a horseshoe crab population on Cape Cod. The Biological Bulletin 197(2): 300–302.

Witherington, B. E., and D. Witherington. 2015. Our sea turtles: a practical guide for the Atlantic and Gulf, from Canada to Mexico. Pineapple Press, Sarasota, FL.

Zeileis, A., C. Kleiber, W. Krämer, and K. Hornik. 2003. Testing and dating of structural changes in practice. Computational Statistics and Data Analysis 44: 109.

10 TABLES

Table 1. Coastwide horseshoe crab (HSC) commercial bait landings in numbers, 1998-2016, as validated by ACCSP. The 2017 landings are from state compliance reports.

Year	Female HSC (#s)	Male HSC (#s)	Unclassified Sex (#s)	Total HSC (#s)
1998	382,199	413,698	1,120,553	1,916,450
1999	388,280	466,540	1,750,460	2,605,280
2000	189,653	392,123	1,095,137	1,676,913
2001	155,561	280,626	349,220	785,407
2002	299,296	558,704	408,794	1,266,795
2003	233,583	415,456	399,061	1,048,100
2004	146,399	201,252	308,790	656,441
2005	142,303	258,774	309,457	710,534
2006	201,063	212,478	383,870	797,411
2007	141,705	191,574	452,325	785,604
2008	89,817	229,265	333,781	652,863
2009	115,590	355,323	293,741	764,654
2010	97,546	269,886	245,067	612,499
2011	79,827	315,679	297,364	692,870
2012	135,266	287,991	373,610	796,867
2013	83,161	477,844	390,357	951,362
2014	38,314	423,265	325,819	787,397
2015	33,398	247,593	315,655	596,646
2016	42,636	353,061	345,065	740,762
2017	160,726	675,241	158,524	994,491

Table 2. State bait harvest quotas for 2019 as determined by the interstate FMP (ASMFC) and state-specific regulations (state).

Jurisdiction	ASMFC Quota 2019	State Quota 2019
MA	330,377	165,000
RI	26,053	8,398
CT	48,689	48,689
NY	366,272	150,000
NJ*	162,136	0
DE*	162,136	162,136
MD*	255,980	255,980
VA**	172,828	172,828
NC	24,036	24,036
SC	0	0
GA	29,312	29,312
FL	9,455	9,455
TOTAL	1,587,274	1,025,834

***Male-only harvest**
****Virginia harvest east of the COLREGS line is limited to 81,331 male-only crabs under the ARM harvest package #3. Value shown is the total state quota.**

Table 3. Numbers of tags released and recaptured by region.

		Recaptured by region								
Release region	# Released	Ches Bay	Coast DE-VA	Coast NY-NJ	Del Bay	Gulf	NC	North east	South east	Unk
Ches Bay	840	105	6	1	0	0	0	0	0	0
Coast DE-VA	96,095	18	5,983	123	2856	0	9	85	5	5
Coast NY-NJ	27,765	0	18	2872	44	1	1	142	1	0
Del Bay	78,841	5	506	291	14,006	1	4	27	3	17
Gulf	1,853	0	2	0	0	142	0	0	2	0
NC	280	1	1	0	1	0	4	1	0	0
Northeast	98,274	2	17	965	31	0	0	19,158	3	7
Southeast	13,305	0	5	6	9	3	0	6	1,713	0
Unknown	17	0	0	8	0	0	0	8	0	1

Table 4. Recapture (%) relative to total recaptures for each region of release.

		Recapture Region								
Release region	**Released**	**Ches Bay**	**Coast DE-VA**	**Coast NY-NJ**	**Del Bay**	**Gulf**	**NC**	**Northeast**	**Southeast**	**Unk**
Ches Bay	840	93.75	5.36	0.89	0.00	0.00	0.00	0.00	0.00	0.00
Coast DE-VA	96,095	0.20	65.86	1.35	31.44	0.00	0.10	0.94	0.06	0.06
Coast NY-NJ	27,765	0.00	0.58	93.28	1.43	0.03	0.03	4.61	0.03	0.00
Del Bay	78,841	0.03	3.41	1.96	94.25	0.01	0.03	0.18	0.02	0.11
Gulf	1,853	0.00	1.37	0.00	0.00	97.26	0.00	0.00	1.37	0.00
NC	280	12.50	12.50	0.00	12.50	0.00	50.00	12.50	0.00	0.00
Northeast	98,274	0.01	0.08	4.78	0.15	0.00	0.00	94.92	0.01	0.03
Southeast	13,305	0.00	0.29	0.34	0.52	0.17	0.00	0.34	98.34	0.00
Unknown	17	0.00	0.00	47.06	0.00	0.00	0.00	47.06	0.00	5.88

Table 5. Regional apparent annual survival rates, averaged among years 2009-2017.

Region	Phi-hat	SE	LCL	UCL
Coastal DE-VA	0.71	0.0118	0.6874	0.7335
Coastal NY-NJ	0.62	0.0162	0.5884	0.6516
Delaware Bay	0.76	0.0137	0.7275	0.7813
Northeast	0.67	0.0058	0.6587	0.6813
Southeast	0.63	0.0350	0.5545	0.6907

Table 6. Annual survival and movement rates for Delaware Bay and coastal embayments in Delaware and Virginia for the years 2003 to 2017 estimated from multi-state model using program MARK.

Parameter	Location	Estimate	Standard error	Lower confidence limit	Upper confidence limit
Annual survival rate	Coastal DE-VA	0.61	0.0148	0.5820	0.6400
	Delaware Bay	0.79	0.0103	0.7677	0.8080
	Other areas	0.59	0.0349	0.5182	0.6541
Annual movement rate	Coastal embayments to Delaware Bay	0.28	0.0478	0.1944	0.3804
	Coastal embayments to other areas	0.03	0.0014	0.0286	0.0339
	Delaware Bay to coastal embayments	0.23	0.0344	0.1741	0.3085
	Delaware Bay to other areas	0.02	0.0008	0.0233	0.0263
	Other areas to coastal embayments	0.70	0.1048	0.4643	0.8581
	Other areas to Delaware Bay	0.27	0.1038	0.1169	0.5097

Table 7. Instantaneous natural mortality rate (M) schedule.

Age	*S*	*M*	Reference
Age 0 to Age 1	0.00003	10.4143	Botton et al. 2003
Ages 1 to 8	0.9738	0.0265	Carmichael et al. 2003 (Table 13)
Age 9 to Age 10	0.7994	0.2239	Mean of 1-8 and 11-17 - assumption
Age 10 to Age 11	0.7994	0.2239	Mean of 1-8 and 11-17 - assumption
Ages 11 to 17	0.6250	0.4700	Carmichael et al. 2003 (Table 10 -mean of instars 20-23)
Ages 18 to 19	0.08	2.5257	Carmichael et al. 2003 (Table 10 –Instar 24)
Age 20	0		All dead - assumption

Table 8. Inputs for estimating natural morality for horseshoe crabs. NOAA average water temperatures for Lewes DE (https://www.nodc.noaa.gov/dsdt/cwtg/all_meanT.html).

Inputs	Combined-sex	Females	Males
Maximum Observed Age	27	27	27
Average Water Temp C*	12.99	12.99	12.99
K	0.15	0.14	0.17
L_inf cm	23.08	26.39	21.12
T0	0.10	0.12	0.09

Table 9. Models and estimates of age-invariant instantaneous natural mortality rates for horseshoe crabs.

Model	Formula	M (combined-sex)	M (females)	M (males)
Hoenig (1983)	Z = exp(1.44-0.982*ln(tmax)), 134 stocks	0.166	0.166	0.166
	Z = exp(1.46-1.01*ln(tmax)), 84 fish stocks	0.154	0.154	0.154
Longevity-Based ROTs	Z = ln(1.5%)/tmax or 4.22/tmax	0.156	0.156	0.156
	Z = ln(5%)/tmax or 3/tmax	0.111	0.111	0.111
Pauly (1980)	ln(M) = -0.0066-0.279*ln(Linf)+0.6543*ln(K)+0.4634*ln(T)	0.399	0.359	0.440
	ln(M) = -0.0152-0.279*ln(Linf)+0.6543*ln(K)+0.4634*ln(T)	0.396	0.356	0.436
Jensen (1996)	M = gK; g = 1.598	0.246	0.221	0.275

Table 10. Hypothetical instantaneous natural mortality rate schedules for horseshoe crab based on von Bertalanffy growth.

	Gislason, et al. 2010	Gislason, et al. 2010	Lorenzen 1996	Lorenzen 1996
Age	**Male M**	**Female M**	**Male M**	**Female M**
0	8.95	11.13	3.73	4.05
1	1.42	1.55	1.44	1.42
2	0.68	0.72	0.98	0.94
3	0.44	0.45	0.79	0.74
4	0.33	0.33	0.68	0.62
5	0.27	0.26	0.61	0.55
6	0.23	0.22	0.56	0.50
7	0.20	0.19	0.53	0.46
8	0.18	0.17	0.50	0.44
9	0.17	0.16	0.48	0.42
10	0.16	0.14	0.47	0.40
11	0.15	0.14	0.45	0.39
12	0.15	0.13	0.45	0.37
13	0.14	0.12	0.44	0.37
14	0.14	0.12	0.43	0.36
15	0.14	0.11	0.43	0.35
16	0.13	0.11	0.42	0.35
17	0.13	0.11	0.42	0.34
18	0.13	0.11	0.42	0.34
19	0.13	0.10	0.41	0.34
20	0.13	0.10	0.41	0.33
21	0.13	0.10	0.41	0.33
22	0.12	0.10	0.41	0.33
23	0.12	0.10	0.41	0.33
24	0.12	0.10	0.41	0.33
25	0.12	0.10	0.41	0.32
26	0.12	0.10	0.40	0.32
27	0.12	0.10	0.40	0.32

Table 11. Data and results for the Mann-Kendall test of temporal trends in sex ratios, defined as the ratio of males to females. Significant p-values are presented in bold. Trends test not applicable for biomedical data due to the low number of years with sex-specific harvest data. Survey type refers to fisheries independent (FI) and dependent (FD) data. Confidential biomedical data have been removed from this public document.

Source	Type	State	Location	Sex Ratio	tau	p value	Years included in analysis
Trawl	FI	NJ	DE_Bay Fall	2.16	0.18	0.19	1990-2017
Trawl	FI	NJ	**DE_Bay Spr**	**1.27**	**0.38**	**0.00**	1990-2017
Trawl	FI	NJ	NJ_Ocean_Fall	1.13	0.18	0.28	1999-2017
Trawl	FI	NJ	NJ_Ocean_Spr	1.03	0.13	0.46	1999-2017
Trawl	FI	NJ	NJ_SurfClam	0.51	-0.05	0.84	1998-2012
Spawning	FI	NH	Beaches	1.55	0.31	0.21	2002-2012
Landings	FD	MD	MD	1.49	-	-	1998-2016
Landings	FD	VA	**VA**	**1.30**	**0.45**	**0.02**	2001-2016
Landings	FD	NJ	NJ	2.52	-0.17	0.60	1998-2006
Landings	FD	DE	DE	1.87	-	-	1998-2016
Commercial	FD	VA	VA_SIW	0.64	0.28	0.14	2000:2003, 2006:2017
Commercial	FD	VA	**VA_SOW**	**1.28**	**0.69**	**0.00**	2000, 2002, 2005, 2006, 2008, 2010:2017
Biomed	FD						
Biomed	FD						
Biomed	FD						**CONFIDENTIAL**
Biomed	FD						
Biomed	FD						
Biomed	FD						

Table 12. Sex ratio and proportion female information, along with associated confidence limits, for each survey of available fisheries-independent and –dependent data sources.

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Trawl	NJ_SurfClam	1998	57.9%	45.7%	70.1%	0.73	0.36	1.09
Trawl	NJ_SurfClam	1999	63.4%	51.7%	75.1%	0.58	0.29	0.87
Trawl	NJ_SurfClam	2000	60.0%	52.6%	67.4%	0.67	0.46	0.87
Trawl	NJ_SurfClam	2001	65.0%	54.5%	75.5%	0.54	0.29	0.79
Trawl	NJ_SurfClam	2002	68.3%	58.4%	78.3%	0.46	0.25	0.68
Trawl	NJ_SurfClam	2003	73.2%	64.7%	81.6%	0.37	0.21	0.52
Trawl	NJ_SurfClam	2004	80.1%	74.7%	85.4%	0.25	0.17	0.33
Trawl	NJ_SurfClam	2005	86.5%	80.6%	92.5%	0.16	0.08	0.24
Trawl	NJ_SurfClam	2006	74.2%	68.5%	80.0%	0.35	0.24	0.45
Trawl	NJ_SurfClam	2007	64.2%	53.7%	74.6%	0.56	0.30	0.81
Trawl	NJ_SurfClam	2008	62.4%	55.0%	69.8%	0.60	0.41	0.79
Trawl	NJ_SurfClam	2009	72.2%	61.3%	83.1%	0.39	0.18	0.59
Trawl	NJ_SurfClam	2010	60.8%	54.4%	67.2%	0.64	0.47	0.82
Trawl	NJ_SurfClam	2011	69.8%	61.2%	78.4%	0.43	0.26	0.61
Trawl	NJ_SurfClam	2012	53.6%	36.9%	70.3%	0.87	0.28	1.45
Trawl	NJ_Ocean_Spr	1996	59.9%	51.6%	68.2%	0.67	0.44	0.90
Trawl	NJ_Ocean_Spr	1999	44.2%	36.3%	52.1%	1.26	0.86	1.67
Trawl	NJ_Ocean_Spr	2000	48.8%	43.4%	54.3%	1.05	0.82	1.28
Trawl	NJ_Ocean_Spr	2001	45.5%	38.2%	52.7%	1.20	0.85	1.55
Trawl	NJ_Ocean_Spr	2002	62.4%	50.5%	74.2%	0.60	0.30	0.91
Trawl	NJ_Ocean_Spr	2003	48.0%	40.8%	55.1%	1.08	0.77	1.40
Trawl	NJ_Ocean_Spr	2004	50.8%	45.2%	56.5%	0.97	0.75	1.19
Trawl	NJ_Ocean_Spr	2005	47.5%	41.1%	54.0%	1.10	0.82	1.39
Trawl	NJ_Ocean_Spr	2006	54.0%	38.0%	70.0%	0.85	0.30	1.40
Trawl	NJ_Ocean_Spr	2007	52.9%	40.5%	65.4%	0.89	0.45	1.33
Trawl	NJ_Ocean_Spr	2008	50.1%	45.4%	54.9%	1.00	0.81	1.18
Trawl	NJ_Ocean_Spr	2009	44.4%	37.4%	51.4%	1.25	0.90	1.61
Trawl	NJ_Ocean_Spr	2010	41.5%	37.7%	45.2%	1.41	1.19	1.63
Trawl	NJ_Ocean_Spr	2011	55.9%	46.7%	65.1%	0.79	0.49	1.08
Trawl	NJ_Ocean_Spr	2012	46.4%	40.5%	52.2%	1.16	0.89	1.43
Trawl	NJ_Ocean_Spr	2013	53.7%	44.0%	63.4%	0.86	0.53	1.20
Trawl	NJ_Ocean_Spr	2014	51.6%	40.4%	62.8%	0.94	0.52	1.36
Trawl	NJ_Ocean_Spr	2015	46.2%	32.4%	60.0%	1.16	0.52	1.81
Trawl	NJ_Ocean_Spr	2016	48.6%	42.8%	54.3%	1.06	0.82	1.30
Trawl	NJ_Ocean_Spr	2017	45.0%	29.1%	60.9%	1.22	0.44	2.00

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Trawl	NJ_Ocean_Fall	1999	51.9%	46.1%	57.7%	0.93	0.71	1.14
Trawl	NJ_Ocean_Fall	2000	50.6%	41.2%	60.0%	0.98	0.61	1.34
Trawl	NJ_Ocean_Fall	2001	51.6%	43.4%	59.9%	0.94	0.63	1.25
Trawl	NJ_Ocean_Fall	2002	49.9%	42.1%	57.7%	1.00	0.69	1.32
Trawl	NJ_Ocean_Fall	2003	45.6%	37.6%	53.6%	1.19	0.81	1.58
Trawl	NJ_Ocean_Fall	2004	51.1%	46.5%	55.8%	0.96	0.78	1.13
Trawl	NJ_Ocean_Fall	2005	38.0%	31.8%	44.2%	1.63	1.20	2.06
Trawl	NJ_Ocean_Fall	2006	43.9%	36.6%	51.1%	1.28	0.90	1.66
Trawl	NJ_Ocean_Fall	2007	43.9%	38.8%	49.1%	1.28	1.01	1.54
Trawl	NJ_Ocean_Fall	2008	58.8%	49.2%	68.4%	0.70	0.42	0.98
Trawl	NJ_Ocean_Fall	2009	49.7%	35.6%	63.8%	1.01	0.44	1.58
Trawl	NJ_Ocean_Fall	2010	46.2%	31.1%	61.3%	1.16	0.46	1.87
Trawl	NJ_Ocean_Fall	2011	42.8%	30.7%	54.9%	1.34	0.68	2.00
Trawl	NJ_Ocean_Fall	2012	45.1%	30.6%	59.7%	1.22	0.50	1.93
Trawl	NJ_Ocean_Fall	2013	65.0%	42.2%	87.9%	0.54	0.00	1.08
Trawl	NJ_Ocean_Fall	2014	43.3%	34.2%	52.4%	1.31	0.83	1.80
Trawl	NJ_Ocean_Fall	2015	47.2%	36.5%	57.9%	1.12	0.64	1.60
Trawl	NJ_Ocean_Fall	2016	39.7%	27.6%	51.8%	1.52	0.75	2.29
Trawl	NJ_Ocean_Fall	2017	47.1%	32.6%	61.7%	1.12	0.47	1.77
Trawl	DE_Spr	1990	56.7%	41.7%	71.7%	0.76	0.30	1.23
Trawl	DE_Spr	1991	48.8%	41.3%	56.3%	1.05	0.74	1.36
Trawl	DE_Spr	1992	55.2%	46.8%	63.6%	0.81	0.54	1.09
Trawl	DE_Spr	1993	44.0%	33.9%	54.1%	1.27	0.75	1.79
Trawl	DE_Spr	1994	38.4%	27.4%	49.4%	1.60	0.86	2.35
Trawl	DE_Spr	1995	49.6%	41.5%	57.8%	1.01	0.68	1.34
Trawl	DE_Spr	1996	65.2%	55.4%	74.9%	0.53	0.30	0.77
Trawl	DE_Spr	1997	44.4%	34.4%	54.4%	1.25	0.75	1.76
Trawl	DE_Spr	1998	52.5%	41.7%	63.4%	0.90	0.51	1.30
Trawl	DE_Spr	1999	42.9%	34.5%	51.4%	1.33	0.87	1.79
Trawl	DE_Spr	2000	46.7%	39.3%	54.1%	1.14	0.80	1.48
Trawl	DE_Spr	2001	48.6%	39.6%	57.6%	1.06	0.68	1.44
Trawl	DE_Spr	2002	65.0%	29.5%	100.5%	0.54	0.00	1.38
Trawl	DE_Spr	2003	52.5%	36.6%	68.5%	0.90	0.32	1.48
Trawl	DE_Spr	2004	75.0%	0.0%	100.0%	0.33	0.00	1.77
Trawl	DE_Spr	2005	71.4%	26.3%	100.0%	0.40	0.00	1.28
Trawl	DE_Spr	2006	48.8%	38.4%	59.2%	1.05	0.61	1.49
Trawl	DE_Spr	2007	37.0%	26.8%	47.1%	1.70	0.96	2.45
Trawl	DE_Spr	2008	41.7%	20.4%	62.9%	1.40	0.18	2.62
Trawl	DE_Spr	2009	38.8%	26.4%	51.2%	1.58	0.75	2.40

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Trawl	DE_Spr	2011	25.5%	13.6%	37.4%	2.93	1.09	4.76
Trawl	DE_Spr	2012	45.5%	31.0%	60.0%	1.20	0.50	1.90
Trawl	DE_Spr	2013	37.5%	7.7%	67.3%	1.67	0.00	3.78
Trawl	DE_Spr	2014	39.2%	30.2%	48.2%	1.55	0.97	2.14
Trawl	DE_Spr	2015	36.1%	26.0%	46.3%	1.77	0.99	2.55
Trawl	DE_Spr	2016	42.7%	34.4%	50.9%	1.34	0.89	1.80
Trawl	DE_Spr	2017	33.4%	25.8%	41.0%	2.00	1.31	2.68
Trawl	DE_Fall	1990	39.5%	30.9%	48.0%	1.53	0.99	2.08
Trawl	DE_Fall	1991	41.5%	31.2%	51.8%	1.41	0.81	2.01
Trawl	DE_Fall	1992	26.1%	16.6%	35.5%	2.83	1.45	4.22
Trawl	DE_Fall	1993	30.5%	24.3%	36.8%	2.28	1.61	2.95
Trawl	DE_Fall	1994	26.5%	4.6%	48.3%	2.78	0.00	5.90
Trawl	DE_Fall	1995	46.1%	36.2%	56.0%	1.17	0.71	1.64
Trawl	DE_Fall	1996	29.1%	23.2%	35.0%	2.43	1.74	3.13
Trawl	DE_Fall	1997	46.3%	37.4%	55.2%	1.16	0.75	1.57
Trawl	DE_Fall	1998	33.3%	20.3%	46.4%	2.00	0.83	3.17
Trawl	DE_Fall	1999	35.1%	23.1%	47.2%	1.85	0.87	2.82
Trawl	DE_Fall	2000	50.9%	40.3%	61.6%	0.96	0.55	1.37
Trawl	DE_Fall	2001	44.4%	0.0%	96.1%	1.25	0.00	3.87
Trawl	DE_Fall	2002	35.3%	0.0%	72.7%	1.83	0.00	4.83
Trawl	DE_Fall	2003	23.3%	9.9%	36.6%	3.30	0.82	5.78
Trawl	DE_Fall	2004	33.3%	0.0%	100.0%	2.00	0.00	27.41
Trawl	DE_Fall	2005	42.9%	0.0%	100.0%	1.33	0.00	4.50
Trawl	DE_Fall	2006	27.0%	18.7%	35.2%	2.71	1.57	3.85
Trawl	DE_Fall	2007	27.3%	11.9%	42.6%	2.67	0.60	4.73
Trawl	DE_Fall	2008	37.5%	0.0%	76.4%	1.67	0.00	4.43
Trawl	DE_Fall	2009	26.5%	7.5%	45.4%	2.78	0.07	5.48
Trawl	DE_Fall	2010	31.8%	0.4%	63.2%	2.14	0.00	5.25
Trawl	DE_Fall	2011	18.8%	0.0%	41.2%	4.33	0.00	10.71
Trawl	DE_Fall	2012	22.7%	0.0%	47.5%	3.40	0.00	8.20
Trawl	DE_Fall	2013	41.6%	27.6%	55.6%	1.41	0.60	2.22
Trawl	DE_Fall	2014	31.1%	18.7%	43.5%	2.21	0.93	3.50
Trawl	DE_Fall	2015	43.4%	33.1%	53.7%	1.31	0.76	1.85
Trawl	DE_Fall	2016	27.0%	22.2%	31.8%	2.71	2.04	3.37
Trawl	DE_Fall	2017	25.1%	17.7%	32.5%	2.99	1.81	4.16

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Survey	NH_Spawn	2002	40.4%	32.4%	48.4%	1.47	0.98	1.96
Survey	NH_Spawn	2003	48.8%	46.4%	51.2%	1.05	0.95	1.15
Survey	NH_Spawn	2004	48.8%	47.1%	50.4%	1.05	0.98	1.12
Survey	NH_Spawn	2005	46.5%	43.1%	49.9%	1.15	0.99	1.31
Survey	NH_Spawn	2006	46.2%	42.8%	49.5%	1.17	1.01	1.32
Survey	NH_Spawn	2007	49.7%	39.1%	60.3%	1.01	0.58	1.44
Survey	NH_Spawn	2008	32.1%	27.4%	36.8%	2.11	1.66	2.57
Survey	NH_Spawn	2009	28.0%	19.9%	36.0%	2.58	1.55	3.61
Survey	NH_Spawn	2010	23.7%	13.5%	33.9%	3.21	1.40	5.03
Survey	NH_Spawn	2011	47.8%	45.5%	50.2%	1.09	0.99	1.19
Survey	NH_Spawn	2012	45.7%	42.7%	48.7%	1.19	1.04	1.33
Landings	MD	1998	69.2%	-	-	0.45	-	-
Landings	MD	1999	82.6%	-	-	0.21	-	-
Landings	MD	2000	53.2%	-	-	0.88	-	-
Landings	MD	2001	50.3%	-	-	0.99	-	-
Landings	MD	2002	36.5%	-	-	1.74	-	-
Landings	MD	2003	43.3%	-	-	1.31	-	-
Landings	MD	2004	40.1%	-	-	1.49	-	-
Landings	MD	2005	36.0%	-	-	1.78	-	-
Landings	MD	2006	65.7%	-	-	0.52	-	-
Landings	MD	2007	59.0%	-	-	0.69	-	-
Landings	MD	2008	40.5%	-	-	1.47	-	-
Landings	MD	2009	30.8%	-	-	2.25	-	-
Landings	MD	2010	26.2%	-	-	2.82	-	-
Landings	MD	2011	21.3%	-	-	3.69	-	-
Landings	MD	2012	32.4%	-	-	2.09	-	-
Landings	MD	2013	0.0%	-	-	Inf	-	-
Landings	MD	2014	0.0%	-	-	Inf	-	-
Landings	MD	2015	0.0%	-	-	Inf	-	-
Landings	MD	2016	0.0%	-	-	Inf	-	-
Landings	VA	2001	30.2%	-	-	2.31	-	-
Landings	VA	2002	58.0%	-	-	0.72	-	-
Landings	VA	2003	87.1%	-	-	0.15	-	-
Landings	VA	2004	84.8%	-	-	0.18	-	-
Landings	VA	2005	67.7%	-	-	0.48	-	-

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Landings	VA	2007	50.5%	-	-	0.98	-	-
Landings	VA	2008	44.1%	-	-	1.27	-	-
Landings	VA	2009	34.6%	-	-	1.89	-	-
Landings	VA	2010	38.5%	-	-	1.60	-	-
Landings	VA	2011	36.6%	-	-	1.73	-	-
Landings	VA	2012	53.0%	-	-	0.89	-	-
Landings	VA	2013	53.1%	-	-	0.88	-	-
Landings	VA	2014	26.4%	-	-	2.79	-	-
Landings	VA	2015	32.7%	-	-	2.06	-	-
Landings	VA	2016	33.1%	-	-	2.02	-	-
Landings	NJ	1998	28.1%	-	-	2.56	-	-
Landings	NJ	1999	33.1%	-	-	2.02	-	-
Landings	NJ	2000	23.9%	-	-	3.19	-	-
Landings	NJ	2001	26.1%	-	-	2.83	-	-
Landings	NJ	2002	28.2%	-	-	2.54	-	-
Landings	NJ	2003	25.8%	-	-	2.87	-	-
Landings	NJ	2004	27.6%	-	-	2.63	-	-
Landings	NJ	2005	27.9%	-	-	2.59	-	-
Landings	NJ	2006	41.1%	-	-	1.43	-	-
Landings	DE	1998	53.9%	-	-	0.85	-	-
Landings	DE	1999	44.4%	-	-	1.25	-	-
Landings	DE	2000	45.6%	-	-	1.19	-	-
Landings	DE	2001	41.4%	-	-	1.41	-	-
Landings	DE	2002	39.4%	-	-	1.54	-	-
Landings	DE	2003	34.4%	-	-	1.91	-	-
Landings	DE	2004	35.0%	-	-	1.86	-	-
Landings	DE	2005	30.7%	-	-	2.25	-	-
Landings	DE	2006	17.9%	-	-	4.58	-	-
Landings	DE	2007	0.0%	-	-	Inf	-	-
Landings	DE	2008	0.0%	-	-	Inf	-	-
Landings	DE	2009	0.0%	-	-	Inf	-	-
Landings	DE	2010	0.0%	-	-	Inf	-	-
Landings	DE	2011	0.0%	-	-	Inf	-	-
Landings	DE	2012	0.0%	-	-	Inf	-	-
Landings	DE	2013	0.0%	-	-	Inf	-	-
Landings	DE	2014	0.0%	-	-	Inf	-	-
Landings	DE	2015	0.0%	-	-	Inf	-	-
Landings	DE	2016	0.0%	-	-	Inf	-	-
Commercial	SIW	2000	50.6%	-	-	0.98	-	-

Type	Source	Year	Proportion Female	LCL	UCL	Sex Ratio	LCL	UCL
Commercial	SIW	2002	58.2%	-	-	0.72	-	-
Commercial	SIW	2003	63.3%	-	-	0.58	-	-
Commercial	SIW	2004	-	-	-	-	-	-
Commercial	SIW	2005	-	-	-	-	-	-
Commercial	SIW	2006	83.2%	-	-	0.20	-	-
Commercial	SIW	2007	74.2%	-	-	0.35	-	-
Commercial	SIW	2008	75.4%	-	-	0.33	-	-
Commercial	SIW	2009	65.6%	-	-	0.53	-	-
Commercial	SIW	2010	67.1%	-	-	0.49	-	-
Commercial	SIW	2011	61.8%	-	-	0.62	-	-
Commercial	SIW	2012	66.1%	-	-	0.51	-	-
Commercial	SIW	2013	51.6%	-	-	0.94	-	-
Commercial	SIW	2014	48.8%	-	-	1.05	-	-
Commercial	SIW	2015	48.6%	-	-	1.06	-	-
Commercial	SIW	2016	61.8%	-	-	0.62	-	-
Commercial	SIW	2017	55.6%	-	-	0.80	-	-
Commercial	SOW	2000	79.5%	-	-	0.26	-	-
Commercial	SOW	2002	89.3%	-	-	0.12	-	-
Commercial	SOW	2005	56.5%	-	-	0.77	-	-
Commercial	SOW	2006	76.7%	-	-	0.30	-	-
Commercial	SOW	2007	-	-	-	-	-	-
Commercial	SOW	2008	59.3%	-	-	0.69	-	-
Commercial	SOW	2010	66.7%	-	-	0.50	-	-
Commercial	SOW	2011	44.9%	-	-	1.23	-	-
Commercial	SOW	2012	25.4%	-	-	2.93	-	-
Commercial	SOW	2013	52.0%	-	-	0.92	-	-
Commercial	SOW	2014	41.6%	-	-	1.41	-	-
Commercial	SOW	2015	46.5%	-	-	1.15	-	-
Commercial	SOW	2016	23.4%	-	-	3.27	-	-
Commercial	SOW	2017	24.6%	-	-	3.07	-	-

Biomedical **CONFIDENTIAL** Data Removed

Table 13. Commercial bait landings in numbers of horseshoe crabs by region, 1998-2016. The four regions are the Northeast (Maine, Massachusetts, Rhode Island), New York (Connecticut, New York), Delaware Bay (New Jersey, Delaware, Maryland, Virginia), and Southeast (North Carolina, South Carolina, Georgia, Florida).

	Region				
Year	Northeast	New York	Delaware Bay	Southeast	Coastwide
1998	413,700	387,045	1,088,393	27,312	1,916,450
1999	573,618	439,076	1,530,614	61,972	2,605,280
2000	288,310	644,363	718,805	25,435	1,676,913
2001	137,733	140,582	497,962	9,130	785,407
2002	142,770	209,351	900,241	14,432	1,266,795
2003	131,286	149,450	741,369	25,995	1,048,100
2004	75,466	166,002	402,696	12,277	656,441
2005	55,843	170,855	476,123	7,713	710,534
2006	149,851	199,270	437,490	10,800	797,411
2007	109,166	323,320	343,632	9,486	785,604
2008	111,392	181,284	333,946	26,241	652,863
2009	109,996	150,118	471,515	33,025	764,654
2010	75,243	155,404	370,921	10,931	612,499
2011	101,884	167,573	396,286	27,127	692,870
2012	145,218	203,679	423,296	24,674	796,867
2013	166,775	191,242	561,031	32,314	951,362
2014	144,212	155,004	461,579	26,603	787,397
2015	125,596	164,956	280,991	25,103	596,646
2016	131,101	188,767	395,697	25,197	740,762

Table 14. Horseshoe crab commercial bait harvest in numbers for the Delaware Bay states by sex, 1998-2017, validated by ACCSP. The number of female horseshoe crabs of Delaware Bay origin was developed to support the catch survey analysis for that region. See section 4.1.3 for how these numbers were developed.

Year	Female HSC (#s)	Male HSC (#s)	Unclassified Sex (#s)	Total HSC (#s)	DB Origin HSC (#s)	Female DB Origin HSC (#s)
1998	382,199	413,698	292,496	1,088,393	867,959	435,810
1999	388,280	466,540	675,794	1,530,614	1,041,126	530,743
2000	189,653	392,123	137,029	718,805	560,745	189,434
2001	155,561	280,626	61,775	497,962	375,546	120,932
2002	299,296	558,704	42,241	900,241	736,242	257,378
2003	233,583	415,456	92,330	741,369	592,206	220,354
2004	146,399	201,252	55,045	402,696	261,560	108,843
2005	142,303	258,774	75,046	476,123	335,971	116,577
2006	201,063	212,478	23,949	437,490	253,187	104,048
2007	141,705	191,574	10,353	343,632	200,858	67,674
2008	89,817	229,265	14,864	333,946	209,414	44,329
2009	115,590	355,323	602	471,515	268,547	48,663
2010	97,546	269,886	3,489	370,921	196,307	41,385
2011	79,827	315,679	780	396,286	235,358	33,728
2012	135,266	287,991	39	423,296	241,717	56,112
2013	83,161	477,844	26	561,031	341,199	29,111
2014	38,314	423,265		461,579	294,504	13,410
2015	33,398	247,593		280,991	201,066	11,689
2016	42,636	353,061		395,697	235,009	14,923
2017	48,447	524,359		572,806	369,161	16,956

Table 15. Numbers of horseshoe crabs collected, bled, and estimated mortality for the biomedical industry as reported in annual FMP Reviews.

	2004	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016**	*2017*
A. Number of crabs brought to biomedical facilities (bait and biomedical crabs)	335,501	282,723	282,787	478,911	491,543	521,330	551,052	600,772	622,098	525,667	534,702	563,631	426,286	575,760
B. Number of bait crabs bled	40,572	36,103	46,600	63,424	69,062	106,365	71,989	78,005	81,433	61,297	67,143	69,731	77,946	95,231
C. Number of biomedical-only crabs collected (not counted against state bait quotas)	284,215	248,475	237,822	416,824	422,958	414,959	480,914	545,164	541,956	464,657	467,897	494,123	344,495	483,245
D. Reported observed mortality of biomedical-only crabs from collection to release	10,145	3,030	2,450	4,663	6,476	6,318	6,829	24,139	7,370	5,447	5,658	5,362	1,004	6,057
E. Number of biomedical-only crabs bled	101,020	190,362	177,599	352,645	397,809	386,118	412,781	486,850	497,956	440,402	432,340	464,506	318,523	444,115
F. Estimated post-bleeding mortality of bled biomedical-only crabs (15% est. mortality)	15,153	28,554	26,640	52,897	59,671	57,918	61,917	73,028	74,693	66,060	64,851	69,676	47,778	66,617
G. Total estimated mortality on biomedical crabs not counted against state bait quotas (15% est. mortality)	25,298	31,584	29,090	57,560	66,147	64,236	68,746	97,166	82,063	71,507	70,509	75,038	48,782	72,674

***Some biomedical collections were reduced in 2016 due to temporary changes in production.**

Table 16. Summary of studies that estimate a mortality rate of crabs bled for biomedical purposes and the same size of crabs bled to obtain the rate. See Appendix A for complete citations for each published paper.

Author(s)	Year	Mortality Rate	Sample Size
Rudloe	1983	0.10	4822
		0.03	40
Thompson	1998	0.15	20
		0.00	594
SCDNR	1999	0.07	132
Wenner and Thompson	2000	0.08	75
Kurz and James-Pirrri	2002	0.20	10
Walls and Berkson	2003	0.00	10
		0.30	10
		0.00	30
		0.00	30
		0.20	30
		0.00	30
		0.07	30
		0.17	30
Hurton and Berkson	2005	0.00	40
		0.00	40
		0.00	40
		0.00	40
		0.03	39
		0.05	39
		0.10	39
		0.15	39

Author(s)	Year	Mortality Rate	Sample Size
Leschen and Correia	2010	0.15	15
		0.23	19
		0.40	13
		0.07	14
		0.31	14
		0.20	14
		0.20	17
		0.29	21
		0.49	14
		0.10	9
		0.40	15
		0.27	18
DeLancey and Floyd	2012	0.20	50
Anderson et al.	2013	0.00	7
		0.14	7
		0.14	7
		0.43	7
Linesh	2017	0.11	48
Owings	2017	0.00	8
		0.06	17
		0.14	8
		0.13	8
		0.44	9
		0.75	8

Table 17. All trawl captured horseshoe crabs that have been tagged and released since 1999. Shaded gray columns indicate biomedical companies that tag bled crabs (Lonza and Wako).

Release Year	Lonza	MDDNR	NCCRUISE	NYDEC	SHU	VATECH	Wako
1999	2,500	975	0	0	0	0	0
2000	2,500	0	0	0	0	0	0
2001	2,500	0	0	0	0	0	0
2002	2,499	0	0	0	0	0	0
2003	0	0	6	0	0	450	0
2004	2,500	0	3	0	0	330	0
2005	5,496	0	0	0	0	219	0
2006	5,000	0	9	0	0	196	0
2007	5,596	0	16	961	0	202	0
2008	5,496	0	8	257	0	233	75
2009	4,076	0	0	14	2	1,169	102
2010	4,950	0	0	26	3	0	68
2011	5,000	0	0	303	0	408	34
2012	4,150	0	0	65	11	0	153
2013	4,350	0	3	0	125	0	332
2014	2,400	0	0	0	123	0	437
2015	1,275	0	1	43	89	0	636
2016	2,449	0	0	0	51	0	275
2017	2,814	0	0	32	41	37	219
Totals	**65,551**	**975**	**46**	**1,701**	**445**	**3,244**	**2,331**

Table 18. List of recaptured trawl-tagged crabs since 1999. Shaded gray columns indicate biomedical companies that tag bled crabs (Lonza and Wako).

Recover Year	Lonza	MDDNR	NCCRUISE	NYDEC	SHU	VATECH	Wako
1999	16	1	0	0	0	0	0
2000	59	24	0	0	0	0	0
2001	65	18	0	0	0	0	0
2002	124	11	0	0	0	0	0
2003	117	5	0	0	0	2	0
2004	114	3	0	0	0	8	0
2005	140	3	0	0	0	9	0
2006	392	1	0	0	0	13	0
2007	261	0	0	20	0	22	0
2008	371	1	1	11	0	14	0
2009	505	3	0	18	0	11	5
2010	432	1	0	9	1	50	0
2011	470	0	1	9	0	40	4
2012	283	0	1	4	5	24	9
2013	371	1	0	3	0	46	10
2014	282	0	0	2	2	20	15
2015	237	0	0	2	4	13	22
2016	212	0	0	2	1	6	31
2017	250	0	0	0	3	13	18
Totals	**4,701**	**72**	**3**	**80**	**16**	**291**	**114**

Table 19. Total recaptures by years at large (YAL) for all trawl captured, bled male and female horseshoe crabs since 1999.

	Females			Males		
YAL	Alive	Dead	Unknown	Alive	Dead	Unknown
0	348	377	263	657	298	211
1	176	48	131	391	59	122
2	52	31	71	243	58	91
3	51	24	50	150	41	62
4	38	18	39	107	39	43
5	18	12	27	83	23	29
6	8	8	18	76	21	32
7	1	5	19	50	15	10
8	3	3	11	32	15	11
9	1	0	9	13	7	9
10	1	1	8	7	5	6
11	3	3	7	7	6	5

Table 20. Total recaptures by years at large (YAL) for trawl captured, unbled male and female horseshoe crabs since 1999.

	Females			Males		
YAL	Alive	Dead	Unknown	Alive	Dead	Unknown
0	37	23	6	67	20	6
1	14	8	4	52	7	4
2	10	7	4	25	6	2
3	10	4	1	31	15	2
4	8	9	0	17	4	3
5	4	1	1	10	4	2

Table 21. Model statistics for the top 6 out of 70 models fit to the capture recapture data for horseshoe crabs tagged in the coastal Delaware and Virginia geographic area between 1999 and 2017. Model names include group and time effects for apparent survival (Phi) and capture probability (p); npar=number of parameters; AICc=corrected Akaike Information Criteria; Delta AICc=0 indicates the best fitting model.

Model	npar	AICc	Delta AICc
Phi(~sex * bled * timebin3) p(~sex * bled * time)	144	52255.95	0
Phi(~sex * time) p(~sex * bled * time)	162	52264.21	8.263303
Phi(~bled * timebin3) p(~sex * bled * time)	120	52286.22	30.26859
Phi(~sex * bled * timebin4) p(~sex * bled * time)	138	52288.65	32.70104
Phi(~sex * bled * timebin3) p(~bled * time)	72	52289.79	33.83709
Phi(~sex * time) p(~bled * time)	90	52310.64	54.68489

Table 22. Apparent survival (Phi_hat) estimated from the best fitting model (Table 21). Estimates are annual survival within 3-year periods with standard error (SE) and 95% confidence intervals (LCL, UCL).

		Not bled				Bled			
Sex	Years	Phi_hat	SE	LCL	UCL	Phi_hat	SE	LCL	UCL
F	1999-2001	0.5576	0.1386	0.2953	0.7914	0.7747	0.0667	0.6191	0.8791
F	2002-2004	0.6263	0.1078	0.4046	0.8051	0.8212	0.0527	0.6945	0.9027
F	2005-2007	1.000*	0.0001	0.0000	1.0000	0.5068	0.0227	0.4623	0.5512
F	2008-2010	0.6483	0.0488	0.5480	0.7371	0.7472	0.0313	0.6811	0.8036
F	2011-2013	0.7036	0.0770	0.5352	0.8303	0.8434	0.0547	0.7050	0.9238
F	2014-2017	0.7022	0.3896	0.0577	0.9891	0.8126	0.1769	0.3079	0.9769
M	1999-2001	0.7068	0.0729	0.5474	0.8276	0.9161	0.0408	0.7940	0.9687
M	2002-2004	0.7243	0.0870	0.5278	0.8606	0.7215	0.0280	0.6636	0.7729
M	2005-2007	0.9010	0.0752	0.6357	0.9793	0.7472	0.0210	0.7039	0.7860
M	2008-2010	0.6365	0.0268	0.5825	0.6873	0.6731	0.0208	0.6311	0.7125
M	2011-2013	0.6804	0.0438	0.5892	0.7596	0.8624	0.0358	0.7762	0.9189
M	2014-2017	0.7813	0.1789	0.3145	0.9653	0.6660	0.0790	0.4986	0.7999

* Survival for unbled females during 2005-2007 was not estimable.

Table 23. Annual biomedical data availability by state. State-year combinations filled green indicate that number of crabs collected, number or percent bled, number or percent observed dead, and sex ratio (for at least a subsample) were all reported. State-year combinations filled yellow indicate that number of crabs collected was reported and at least one of the following, indicated within the cell, was not reported: number or percent bled (NB), number or percent observed dead (ND), or sex ratio (NS). State-year combinations filled red indicate that number of crabs collected was not reported.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 24. Proportions of horseshoe crabs collected for biomedical use that were observed dead and bled by state.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 25. Reported sex ratios of horseshoe crabs used for biomedical purposes by state and year, shown as percent female. No sex ratios were reported prior to 2004.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 26. Regional (NE: Northeast, DB: Delaware Bay, SE: Southeast; CONFIDENTIAL data removed) and coastwide estimates of biomedical mortality (numbers of crabs) using bleeding mortalities of 4%, 15%, and 30%. Delaware Bay estimates include all crabs caught from New Jersey through Virginia, not only those of Delaware Bay origin.

Year	Biomedical Mortality with 4% Bleeding Mortality				Biomedical Mortality with 15% Bleeding Mortality				Biomedical Mortality with 30% Bleeding Mortality			
	NE	DB	SE	Coastwide	NE	DB	SE	Coastwide	NE	DB	SE	Coastwide
1999				7,511				22,528				43,007
2000				10,236				31,563				60,644
2001				12,500				36,316				68,791
2002				20,783				46,150				80,742
2003				19,579				43,479				76,069
2004				32,431				66,450				112,838
2005				22,557				54,772				98,702
2006				23,351				56,189				100,965
2007				26,922				74,936				140,409
2008				22,388				66,148				125,818
2009				21,762				64,236				122,153
2010				23,340				68,747				130,664
2011				43,613				97,166				170,195
2012				27,288				82,064				156,757
2013				23,063				71,507				137,568
2014				24,020				71,577				136,429
2015				26,511				77,608				147,283
2016				13,745				48,782				96,561
2017				23,822				72,674				139,291

Table 27. Directed (bait and biomedical) use mortality by numbers of crabs using biomedical bleeding mortalities of 4%, 15%, and 30%. Biomedical mortalities are also shown as annual percentages of total directed use mortality.

Year	Bait Harvest	Biomedical Use					
		Total Mortality with 4% Bled Mortality	% Directed Use Mortality	Total Mortality with 15% Bled Mortality	% Directed Use Mortality	Total Mortality with 30% Bled Mortality	% Directed Use Mortality
1999	2,605,280	7,511	0.29%	22,528	0.86%	43,007	1.62%
2000	1,676,913	10,236	0.61%	31,563	1.85%	60,644	3.49%
2001	785,407	12,500	1.57%	36,316	4.42%	68,791	8.05%
2002	1,266,795	20,783	1.61%	46,150	3.51%	80,742	5.99%
2003	1,048,100	19,579	1.83%	43,479	3.98%	76,069	6.77%
2004	656,441	32,431	4.71%	66,450	9.19%	112,838	14.67%
2005	710,534	22,557	3.08%	54,772	7.16%	98,702	12.20%
2006	797,411	23,351	2.85%	56,189	6.58%	100,965	11.24%
2007	785,604	26,922	3.31%	74,936	8.71%	140,409	15.16%
2008	652,863	22,388	3.32%	66,148	9.20%	125,818	16.16%
2009	764,654	21,762	2.77%	64,236	7.75%	122,153	13.77%
2010	612,499	23,340	3.67%	68,747	10.09%	130,664	17.58%
2011	692,870	43,613	5.92%	97,166	12.30%	170,195	19.72%
2012	796,867	27,288	3.31%	82,064	9.34%	156,757	16.44%
2013	951,362	23,063	2.37%	71,507	6.99%	137,568	12.63%
2014	787,397	24,020	2.96%	71,577	8.33%	136,429	14.77%
2015	596,646	26,511	4.25%	77,608	11.51%	147,283	19.80%
2016	740,762	13,745	1.82%	48,782	6.18%	96,561	11.53%
2017	994,491	23,822	2.34%	72,674	6.81%	139,291	12.29%

Table 28. Commercial bait harvest and biomedical harvest by region in numbers of horseshoe crabs, 1999-2016. The numbers for biomedical harvest represent the total number of horseshoe crabs bled and released with the 15% mortality applied. % Biomed represents the percent amount of directed harvest (bait + biomedical) attributed to biomedical regionally and coastwide.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 29. Estimated biomedical mortality (numbers of crabs) for crabs of Delaware Bay origin, with bleeding mortalities of 4%, 15%, and 30%, used as inputs in the Catch Multiple Survey Analysis model. This includes all biomedical mortality from New Jersey, 51% of biomedical mortality from Maryland, and 35% of biomedical mortality from Virginia.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 30. Estimated horseshoe crab dredge discards in weight (lbs) and numbers. Data collected in 2010 was used to convert weight to discards in numbers for all years. To convert pounds (lbs) to numbers, a conversion of 1.8 pounds/crab was used.

Year	Ratio	Ratio CV	Discards (lbs)	Discards LCI	Discards UCI	n Fish Counted	Total Subsample Weight (lbs)	n Subsamples	Mean Weight (lbs)	Discards (numbers)
2004	0.00081	0.22006	583,410	326,642	840,178	NA	NA	NA	NA	317,935
2005	0.00065	0.19863	342,233	206,277	478,189	NA	NA	NA	NA	186,503
2006	0.00232	0.47539	1,223,591	60,219	2,386,964	NA	NA	NA	NA	666,807
2007	0.00031	0.34298	172,505	54,173	290,836	NA	NA	NA	NA	94,008
2008	0.00079	0.28886	432,739	182,734	682,743	NA	NA	NA	NA	235,825
2009	0.00118	0.23483	603,889	320,266	887,512	NA	NA	NA	NA	329,095
2010	0.00164	0.59808	811,481	0	1,782,147	21	75	1	3.57	442,224
2011	0.00079	0.31310	389,230	145,492	632,969	NA	NA	NA	NA	212,115
2012	0.00049	0.55345	217,559	0	458,378	NA	NA	NA	NA	118,561
2013	0.00017	0.31907	62,813	22,729	102,896	NA	NA	NA	NA	34,230
2014	0.00594	0.87940	2,237,922	0	6,173,968	NA	NA	NA	NA	1,219,576
2015	0.00380	0.34944	1,406,693	423,577	2,389,809	NA	NA	NA	NA	766,590
2016	0.01193	0.37253	4,523,910	1,153,293	7,894,527	NA	NA	NA	NA	2,465,346
2017	0.00568	0.55577	2,003,434	0	4,230,343	NA	NA	NA	NA	1,091,790

Table 31. Estimated horseshoe crab gill net discards in weight (lbs) and numbers. Data collected in 2005 was used to convert weight to discards in numbers for all years. To convert pounds (lbs) to numbers, a conversion of 1.8 pounds/crab was used.

Year	Ratio	Ratio CV	Discards (lbs)	Discards LCI	Discards UCI	n Fish Counted	Total Subsample Weight (lbs)	n Subsamples	Mean Weight (lbs)	Discards (numbers)
2004	0.01899	0.42285	239,909	37,018	442,801	NA	NA	NA	NA	130,741
2005	0.00373	0.29202	35,358	14,707	56,008	1	4	1	4.00	19,268
2006	0.00225	0.38654	13,853	3,144	24,562	NA	NA	NA	NA	7,549
2007	0.01465	0.38903	175,329	38,913	311,745	NA	NA	NA	NA	95,547
2008	0.00926	0.39576	90,751	18,920	162,581	NA	NA	NA	NA	49,455
2009	0.01389	0.49618	147,298	1,126	293,471	NA	NA	NA	NA	80,272
2010	0.03066	0.21314	246,878	141,641	352,115	NA	NA	NA	NA	134,538
2011	0.04753	0.29030	392,901	164,784	621,017	NA	NA	NA	NA	214,115
2012	0.01197	0.30259	76,634	30,257	123,010	NA	NA	NA	NA	41,762
2013	0.05793	0.38904	416,868	92,513	741,222	NA	NA	NA	NA	227,176
2014	0.00990	0.44947	128,300	12,967	243,634	NA	NA	NA	NA	69,918
2015	0.00933	0.24701	86,424	43,728	129,120	NA	NA	NA	NA	47,098
2016	0.00301	0.16393	16,613	11,167	22,060	NA	NA	NA	NA	9,054
2017	0.00324	0.23918	34,092	17,784	50,399	NA	NA	NA	NA	18,579

Table 32. Estimated horseshoe crab trawl discards in weight (lbs) and numbers. Year-specific data was used to convert weight to numbers for 2012-2016. For the remaining years, data was pooled among all years of available data for the conversions.

Year	Ratio	Ratio CV	Discards (lbs)	Discards LCI	Discards UCI	n Fish Counted	Total Subsample Weight (lbs)	n Subsamples	Mean Weight (lbs)	Discards (numbers)
2004	0.00173	0.35004	1,495	448	2,541	NA	NA	NA	NA	1,700
2005	0.00659	0.65466	5,235	0	12,089	NA	NA	NA	NA	5,954
2006	0.00214	0.48793	2,729	66	5,392	NA	NA	NA	NA	3,104
2007	0.02139	0.43254	15,591	2,104	29,079	NA	NA	NA	NA	17,734
2008	0.02147	0.36827	47,298	12,461	82,135	NA	NA	NA	NA	53,798
2009	0.02243	0.32233	62,144	22,082	102,207	735	237	4	0.32	77,605
2010	0.02183	0.46159	46,695	3,587	89,802	NA	NA	NA	NA	53,112
2011	0.03961	0.32002	170,758	61,465	280,050	NA	NA	NA	NA	194,225
2012	0.02051	0.31988	67,766	24,412	111,120	1751	1906	14	1.09	62,255
2013	0.04386	0.29299	112,787	46,695	178,879	2791	1555	13	0.56	202,436
2014	0.01057	0.31140	20,617	7,777	33,458	488	456	6	0.93	22,064
2015	0.04630	0.27952	89,541	39,484	139,598	3386	3,244	33	0.96	93,467
2016	0.03534	0.23252	51,907	27,768	76,045	1739	1,823	27	1.05	49,520
2017	0.010384	0.22696	32,090	17,524	46,656	1,711	1,192	22	0.70	30,614

Table 33. Surveys considered for developing abundance indices for horseshoe crab. Table indicates which surveys were accepted for index development and which were rejected.

Data Source	Survey	Accepted	Rejected	Reason(s) Rejected			
				Time series too short or broken	Rare occurance of HSC	Inconsistent methods, gear changes	Better survey available with similar coverage
ME DMR	ME-NH Trawl		X		X		
NH F&G	Habitat Monitoring Survey		X	X			
NH F&G	Spawning Survey	X					
MA DMF	Resource Assessment Trawl	X					
MA DMF	Spawning Beach Survey		X	X		X	
RI DEM	Coastal Trawl Survey (seasonal segment)		X				X
RI DEM	Coastal Trawl Survey (monthly segment)	X					
Sacred Heart Univ	Project limulus		X			X	
CT DEEP	Long Island Trawl Survey	X					
NYS DEC	Peconic Bay Small Mesh Trawl Survey	X					
NYS DEC	Western Long Island Beach Seine Survey	X					
NYS DEC	Horseshoe Crab Spawning and Tagging Survey		X			X	
NJ DFW	Ocean Trawl	X					
NJ DFW	Delaware Bay Trawl Survey		X				X
NJ DFW	Surf Clam Survey	X					
DE DFW	Adult Trawl Survey (30')	X					
DE DFW	Juvenile Trawl Survey (16')		X				X
MD DNR	Coastal Bays	X					
Virginia Tech	Virginia Tech Mid-Atl HSC Benthic Trawl	X					
NC DMF	North Carolina fisheries independent gillnet survey	X					
SC DNR	Crustacean Research and Monitoring large trawl survey	X					
SC DNR	SEAMAP- South Atlantic Coastal Trawl Survey	X					
SC DNR	Trammel Net Survey	X					
GA DNR	Ecological Monitoring Trawl Survey	X					
FL FWC	Fisheries- Independent Monitoring Program (FIM)		X	X	X		
NMFS	NEFSC Trawl		X		X		X
NEAMAP	NEAMAP	X					

Table 34. List of fishery-independent surveys that were developed in relative abundance indices for this stock assessment, the gear used in the survey, the minimum and maximum prosomal width, and median prosomal width of horseshoe crabs caught.

Survey	Gear	Range of widths (cm)	Median width (cm)
MA DMF	3/4 size North Atlantic type two seam otter trawl; codend has a 6.4 mm knotless liner	4-53	16
RI Trawl	Otter trawl with a ¼ mesh inch line; survey net is 210 x 4.5”, 2 seam (40’ / 55’), mesh size 4.5”	4-31	23
CT LISTS	Otter trawl with 102 mm mesh in wings and belly, 76 mm mesh in tailpiece, 51 mm mesh codend	5-34	22
NY Peconic	Trawl - 4.8 meter semi-balloon shrimp trawl net	4-53	23
NY WLIS	Seine - ¼ inch square mesh in the wings, 3/16 inch square mesh in the bunt	2-53	17
NEAMAP	Trawl - four-seam, three-bridle, 400x12 cm bottom trawl	4-53	17
NJ OT	Two-seam trawl with forward netting of 12 cm stretch mesh, rear netting of 8 cm, lined with 6.4 mm bar mesh liner	3-53	20
NJ Surfclam	Commercial hydraulic clam dredge	2-53	15
DE Adult	30 ft 2-seam otter trawl, 3" (7.6cm) stretch mesh in wings and body, 2" (5.1cm) stretch mesh in cod end	4-53	19
Virginia Tech	Two-seam trawl with net body of 15.2 cm stretched mesh, bag 14.3 cm stretched mesh	2-53	16
MD Coastal	Otter trawl, usually 5.5 or 6 inch mesh	6-38	19
NC Esturine	Floating gill nets with 30-yard segments of 3, 3 ½, 4, 4 ½, 5, 5 ½, 6, and 6 ½ inch stretched mesh	1-50	20
SC CRMS	20-foot trawl net, with 1” stretch mesh	2-53	23
SC Trammel	183 x 2.1 m trammel net	2-48	23
SEAMAP	Paired 75-ft (22.9-m) mongoose-type Falcon trawl nets with 1.875-in (47.6-mm) stretch mesh	2-53	23
GA Trawl	40' flat beam trawl	4-53	22

Table 35. Indices of bay-wide male and female horseshoe crab spawning activity (ISA), number of beaches surveyed, standard deviation (SD), coefficient of variations (CV), 90% confidence intervals (CI) and sex ratio for the Delaware Bay from 1999 to 2017 (Source: DE DFW).

Year	Beaches Surveyed	Male				Female				Annual Sex Ratio (M:F)
		ISA	90% CI	SD	CV (%)	ISA	90% CI	SD	CV (%)	
1999	17	2.5	1.86, 3.37	0.45	18	0.77	0.62, 0.97	0.1	13	3.2
2000	22	2.96	2.31, 3.80	0.45	15	0.91	0.74, 1.13	0.12	13	3.2
2001	22	2.37	1.91, 2.95	0.31	13	0.75	0.63, 0.90	0.08	10	3.1
2002	23	2.86	2.45, 3.34	0.27	9	0.91	0.79, 1.04	0.07	8	3.1
2003	23	2.89	2.50, 3.33	0.25	9	0.8	0.71, 0.91	0.06	8	3.6
2004	24	2.93	2.55, 3.36	0.24	8	0.77	0.68, 0.87	0.06	7	3.8
2005	23	3.23	2.79, 3.74	0.29	9	0.82	0.72, 0.93	0.07	9	3.9
2006	24	3.99	3.49, 4.56	0.33	8	0.99	0.89, 1.10	0.07	7	4
2007	24	4.22	3.63, 4.90	0.38	9	0.89	0.78, 1.01	0.07	8	4.7
2008	25	2.3	1.83, 2,90	0.32	14	0.68	0.59, 0.78	0.06	9	3.4
2009	26	4.67	4.11, 5.29	0.36	8	1	0.89, 1.11	0.06	6	4.7
2010	25	3.39	2.93, 3.94	0.31	9	0.8	0.70, 0.92	0.07	8	4.2
2011	25	3.31	2.83, 3.87	0.31	10	0.64	0.57, 0.72	0.05	7	5.2
2012	25	2.44	1.97, 3.01	0.31	13	0.56	0.47, 0.67	0.06	10	4.4
2013	25	3.2	2.98, 3.44	0.14	4	0.85	0.80, 0.91	0.03	4	3.8
2014	25	2.28	2.09, 2.48	0.12	5	0.54	0.50, 0.59	0.03	5	4.2
2015	23	2.75	2.59, 2.92	0.1	4	0.66	0.62, 0.70	0.02	4	4.2
2016	25	4.1	3.86, 4.36	0.2	4	0.9	0.85, 0.95	0.03	3	4.6
2017	25	3.68	3.37, 4.02	0.2	5	0.71	0.65, 0.78	0.04	6	5.2

Table 36. Results of the power analysis by survey for linear and exponential trends in horseshoe crab abundance indices over a twenty-year period. Power were calculated as the probability of detecting a 50% change following the methods of Gerrodette (1987). Sex includes all mature horseshoe crab or multiparous (M) or primiparous (P) if indicated.

State	Survey	Season	Sex	Time Period	Median CV	Linear Trend		Exponential Trend	
						+50%	-50%	+50%	-50%
NH	Beach Spawner	Spring	Female	2002-2012	0.488	0.33	0.46	0.35	0.51
NH	Beach Spawner	Spring	Male	2002-2012	0.488	0.33	0.46	0.35	0.51
MA	Trawl North Cape	Fall	All	1978-2017	0.817	0.18	0.24	0.20	0.30
MA	Trawl South Cape	Fall	All	1978-2017	0.574	0.27	0.37	0.29	0.42
RI	Monthly Trawl	Fall	All	1998-2016	0.365	0.48	0.66	0.50	0.70
CT	CT LISTS	Fall	All	1997-2016	0.254	0.74	0.91	0.75	0.92
NY	Peconic Bay	Fall	All	1987-2016	0.132	1.00	1.00	1.00	1.00
NY	Seine - Jamaica	Spring	All	1987-2017	0.418	0.40	0.56	0.42	0.60
NY	Seine - LN & Man	Spring	All	1987-2017	0.302	0.61	0.80	0.63	0.82
DE	Adult Trawl	Fall	All	1990-2017	0.341	0.53	0.71	0.54	0.74
DE	Adult Trawl	Spring	All	1990-2017	0.272	0.69	0.87	0.70	0.88
DE	Adult Trawl	Fall	Female	1990-2017	0.337	0.54	0.72	0.55	0.75
DE	Adult Trawl	Spring	Female	1990-2017	0.275	0.68	0.86	0.70	0.88
DE	Adult Trawl	Fall	Male	1990-2017	0.380	0.46	0.63	0.47	0.67
DE	Adult Trawl	Spring	Male	1990-2017	0.281	0.67	0.85	0.68	0.87
NY	NEAMAP	Fall	All	2007-2017	0.303	0.61	0.80	0.62	0.82
DB	NEAMAP	Fall	All	2008-2016	0.213	0.86	0.97	0.87	0.97
NJ	Ocean Trawl	Fall	All	1989-2017	0.329	0.55	0.74	0.57	0.77
NJ	Ocean Trawl	Spring	All	1989-2017	0.284	0.66	0.84	0.67	0.86
NJ	Ocean Trawl	Fall	Female	1999-2017	0.298	0.62	0.81	0.64	0.83
NJ	Ocean Trawl	Spring	Female	1999-2017	0.250	0.75	0.91	0.76	0.92
NJ	Ocean Trawl	Fall	Male	1999-2017	0.373	0.47	0.65	0.49	0.68
NJ	Ocean Trawl	Spring	Male	1999-2017	0.298	0.62	0.81	0.64	0.83
NJ	Surf Clam	Summer	All	1998-2012	0.135	1.00	1.00	1.00	1.00
NJ	Surf Clam	Summer	Female	1998-2012	0.141	0.99	1.00	0.99	1.00
NJ	Surf Clam	Summer	Male	1998-2012	0.199	0.90	0.98	0.90	0.99
MD	Coastal Bays	Spring	All	1990-2017	0.500	0.32	0.45	0.34	0.50
NJ-VA	Virginia Tech Trawl	Fall	Female - M	2002-2017	0.262	0.72	0.89	0.73	0.90
NJ-VA	Virginia Tech Trawl	Fall	Female - P	2002-2017	0.300	0.62	0.81	0.63	0.83
NJ-VA	Virginia Tech Trawl	Fall	Male - M	2002-2017	0.281	0.67	0.85	0.68	0.87
NJ-VA	Virginia Tech Trawl	Fall	Male - P	2002-2017	0.336	0.54	0.73	0.55	0.75
NC	Gillnet	Spring	All	2001-2016	0.152	0.99	1.00	0.99	1.00
SC	SEAMAP	Fall	All	2001-2017	0.435	0.54	0.38	0.58	0.40
GA-FL	SEAMAP	Fall	All	2001-2017	0.390	0.61	0.44	0.65	0.46
SC	CRMS	Spring	All	1995-2017	0.291	0.64	0.83	0.65	0.85
SC	Trammel	Spring	All	1995-2017	0.344	0.52	0.71	0.54	0.74
GA	Trawl	Spring	All	1999-2017	0.176	0.95	1.00	0.95	1.00

Table 37. List of surveys used in the regional Conn indices and their associated sigma values, or the standard deviation of the process error. All surveys are for combined sexes and adult horseshoe crabs unless specified in the parentheticals.

Survey	σ^p
MA Trawl North Cape (Fall)	4.097
MA Trawl South Cape (Fall)	2.651
RI Monthly (Fall)	0.308
CT LISTS (Fall)	0.224
NY Peconic (Fall)	0.641
NY Seine Jamaica Bay (Spring)	0.466
NY Seine Little N & Manh (Spring)	0.298
NY NEAMAP (Fall)	0.705
DB NEAMAP (Fall)	0.680
NJ Ocean Trawl (Spring)	0.602
NJ Ocean Trawl (Fall)	0.467
NJ Ocean Trawl (Spring, F only)	0.535
NJ Ocean Trawl (Spring, M only)	0.626
NJ Ocean Trawl (Fall, F only)	0.541
NJ Ocean Trawl (Fall, M only)	0.709
NJ Surf Clam	0.579
NJ Surf Clam (F only)	0.429
NJ Surf Clam (M only)	0.362

Survey	σ^p
DE Adult Trawl (Fall)	0.918
DE Adult Trawl (Spring, F only)	0.820
DE Adult Trawl (Spring, M only)	0.806
DE Adult Trawl (Fall, F only)	0.714
DE Adult Trawl (Fall, M only)	0.817
VT Tech Trawl	0.171
VT Tech Trawl (F only)	0.233
VT Tech Trawl (M only)	0.155
MD Coastal Bays (Spring)	0.561
NC Gillnet (Pamlico Sound, Spring)	0.423
SC Trammel (Spring)	0.280
SC CRMS (Spring)	0.819
SEAMAP (SC only, Fall)	4.281
GA Trawl (Spring)	0.651
SEAMAP (GA & FL, Fall)	3.551

Table 38. Results of autoregressive integrated moving average (ARIMA) model fits for horseshoe crab surveys. W is the Shapiro-Wilk test statistic for normality of residuals (p value in parentheses); n is the number of years in the time series; r1, r2, and r3 are the first three autocorrelations; θ is the moving average parameter; SE is the standard error of θ; and σ^2c is the variance of the index.

Survey	Years	n	W	p	r_1	r_2	r_3	θ	SE	σ^2_c
Northeast Region										
MA DMF Trawl – North of Cape Cod	1978-2017	40	0.82	0.01	-0.43	-0.11	0.06	1.00	0.13	3.82
MA DMF Trawl – South of Cape Cod	1978-2017	40	0.96	0.17	-.39	-0.01	-0.10	0.63	0.21	1.79
NH Spawner - Female	2002-2012	11	0.96	0.74	-0.31	-0.22	0.06	0.59	0.27	0.71
NH Spawner - Male	2002-2012	11	0.90	0.20	-0.36	-0.19	0.05	0.62	0.23	0.31
RI Monthly Trawl - Fall	1998-2016	19	0.96	0.58	-0.29	-0.29	0.24	0.64	0.24	0.40
New York Region										
CT Long Island Sound Trawl - Fall	1997-2016	20	0.93	0.15	-0.24	-0.20	-0.12	0.49	0.23	0.17
NEAMAP - Fall	2007-2017	11	0.92	0.34	-0.31	-0.13	-0.08	0.78	0.70	0.71
NY Jamaica Bay Seine	1988-2016	29	0.99	0.96	-0.52	-0.10	0.38	0.75	0.15	0.57
NY Little Neck and Manhasset Bay Seine	1988-2016	29	0.96	0.36	-0.40	-0.17	0.07	0.64	0.15	0.29
NY Peconic Trawl	1987-2016	30	0.97	0.53	-0.52	0.32	-0.16	0.21	0.19	0.20
Mid-Atlantic Region										
DE 30 ft Trawl - Fall	1990-2017	28	0.97	0.49	-0.24	-0.11	0.17	0.62	0.16	1.22
DE 30 ft Trawl - Fall Female	1990-2017	28	0.95	0.20	-0.32	-0.04	0.07	0.63	0.15	1.11
DE 30 ft Trawl - Fall Male	1990-2017	28	0.96	0.35	-0.28	-0.11	0.17	0.64	0.15	1.32
DE 30 ft Trawl - Spring	1990-2017	28	0.96	0.34	0.09	-0.07	0.19	0.57	0.18	1.15
DE 30 ft Trawl - Spring Female	1990-2017	28	0.96	0.40	-0.10	-0.22	0.17	0.61	0.17	1.02
DE 30 ft Trawl - Spring Male	1990-2017	28	0.94	0.09	-0.29	-0.13	0.20	0.63	0.17	1.32
MD Coastal Bays Trawl - Spring	1990-2017	28	0.96	0.31	-0.44	-0.10	0.14	1.00	0.11	0.40
NEAMAP - Fall	2007-2017	11	0.92	0.30	-0.45	-0.12	0.12	1.00	0.29	0.48
NJ Ocean Trawl - Fall	1989-2017	29	0.97	0.49	-0.55	0.28	-0.28	0.75	0.15	0.45
NJ Ocean Trawl - Fall Female	1999-2017	19	0.94	0.32	-0.19	-0.19	-0.13	1.00	0.15	0.21
NJ Ocean Trawl - Fall Male	1999-2017	19	0.97	0.87	-0.34	0.12	-0.30	1.00	0.16	0.27

Table 38 ***Continued***

Survey	Years	n	W	p	r_1	r_2	r_3	θ	SE	σ^2_c
Mid-Atlantic Region										
NJ Ocean Trawl - Spring	1989-2017	29	0.97	0.50	-0.42	-0.04	0.00	0.48	0.18	0.32
NJ Ocean Trawl - Spring Female	1999-2017	19	0.93	0.16	-0.37	0.01	-0.05	0.45	0.22	0.34
NJ Ocean Trawl - Spring Male	1999-2017	19	0.93	0.15	-0.22	-0.09	-0.10	0.27	0.30	0.29
NJ Surf Clam Dredge	1998-2012	15	0.97	0.90	-0.36	-0.09	0.17	0.41	0.19	0.15
NJ Surf Clam Dredge - Female	1998-2012	15	0.96	0.74	-0.47	0.20	-0.23	0.68	0.23	0.15
NJ Surf Clam Dredge - Male	1998-2012	15	0.97	0.92	-0.38	0.06	0.00	0.54	0.28	0.28
VA Tech Trawl	2002-2017	12	0.92	0.32	-0.49	-0.05	0.19	0.64	0.29	0.21
VA Tech Trawl - Immature Female	2002-2017	12	0.97	0.91	-0.52	-0.05	0.21	1.00	0.30	0.39
VA Tech Trawl - Immature Male	2002-2017	12	0.96	0.78	-0.51	-0.10	0.24	1.00	0.32	0.47
VA Tech Trawl - Mature Female	2002-2017	12	0.92	0.26	0.04	-0.33	-0.46	0.00	0.47	0.17
VA Tech Trawl - Mature Male	2002-2017	12	0.89	0.13	-0.14	-0.06	-0.65	0.45	0.59	0.25
VA Tech Trawl - Newly Mature Female	2002-2017	12	0.92	0.28	-0.14	0.10	-0.71	0.03	0.37	0.47
VA Tech Trawl - Newly Mature Male	2002-2017	12	0.93	0.41	-0.27	-0.19	-0.04	0.60	0.31	1.10
Southeast Region										
GA Trawl - Spring	1999-2017	19	0.87	0.02	-0.50	0.16	-0.22	0.77	0.15	0.44
NC Gillnet - Spring	2001-2016	16	0.90	0.08	0.10	-0.27	-0.30	0.10	0.30	0.12
SC CRMS	1995-2017	23	0.96	0.53	-0.25	-0.20	0.09	0.32	0.27	0.43
SC Trammel Net	1995-2017	23	0.96	0.54	-0.33	-0.33	0.18	0.73	0.14	0.31
SEAMAP - SC Fall	2001-2017	17	0.93	0.19	-0.14	-0.09	-0.32	0.52	0.17	3.48
SEAMAP GA-FL - Fall	2001-2017	17	0.97	0.75	-0.13	-0.35	-0.23	0.42	0.24	2.55

Table 39. Reference points from the ARIMA model for each survey and the probability that the terminal year's fitted index (i_f) is below the reference point. The 1998 reference is i_{1998} and the lower quartile reference is Q_{25}. Reference points are based on ln transformed index values. Surveys that began after 1998 do not have a 1998 reference value.

Survey	i_f	i_{1998}	$P(i_f<i_{1998})$	Q_{25}	$P(i_f<Q_{25})$
Northeast Region					
MA DMF Trawl – North of Cape Cod	-0.70	-0.66	0.41	-0.59	0.21
MA DMF Trawl – South of Cape Cod	-0.11	-1.13	0.08	-1.60	0.04
NH Spawner - Female	0.73			0.69	0.34
NH Spawner - Male	1.14			1.18	0.44
RI Monthly Trawl - Fall	-1.16	-0.88	0.62	-0.92	0.56
New York Region					
CT Long Island Sound Trawl - Fall	0.06	0.86	1.00	0.32	0.83
NEAMAP - Fall	1.19			0.98	0.23
NY Jamaica Bay Seine	-0.69	0.10	0.96	-0.34	0.64
NY Little Neck and Manhasset Bay Seine	0.33	1.47	1	0.48	0.60
NY Peconic Trawl	-1.65	0.38	1.00	-0.81	0.97
Mid-Atlantic Region					
DE 30 ft Trawl - Fall	1.90	0.59	0.02	0.19	0.00
DE 30 ft Trawl - Fall Female	0.70	-0.45	0.03	-0.82	0.00
DE 30 ft Trawl - Fall Male	1.40	0.02	0.02	-0.26	0.01
DE 30 ft Trawl - Spring	1.28	1.07	0.33	0.10	0.04
DE 30 ft Trawl - Spring Female	0.33	0.25	0.50	-0.66	0.06
DE 30 ft Trawl - Spring Male	0.61	0.21	0.21	-0.52	0.04
MD Coastal Bays Trawl - Spring	-1.14	-1.00	0.36	-1.30	0.01
NEAMAP - Fall	2.82			2.69	0.05
NJ Ocean Trawl - Fall	1.48	1.89	0.82	1.42	0.32
NJ Ocean Trawl - Fall Female	0.72			0.67	0.11
NJ Ocean Trawl - Fall Male	0.79			0.71	0.07
NJ Ocean Trawl - Spring	2.42	2.36	0.51	1.62	0.00
NJ Ocean Trawl - Spring Female	1.53			0.66	0.00
NJ Ocean Trawl - Spring Male	1.76			0.57	0.00
NJ Surf Clam Dredge	0.85	0.11	0.00	-0.06	0.00
NJ Surf Clam Dredge - Female	-0.52	-0.60	0.12	-0.75	0.04
NJ Surf Clam Dredge - Male	-1.13	-1.02	0.54	-1.70	0.01
VA Tech Trawl	4.65			4.46	0.04
VA Tech Trawl - Immature Female	3.02			2.87	0.02
VA Tech Trawl - Immature Male	2.66			2.44	0.01
VA Tech Trawl - Mature Female	2.83			2.08	0.00
VA Tech Trawl - Mature Male	3.80			3.16	0.00
VA Tech Trawl - Newly Mature Female	1.26			0.46	0.04

Table 39 ***Continued***

Survey	i_f	i_{1998}	$P(i_f<i_{1998})$	Q_{25}	$P(i_f<Q_{25})$
Mid-Atlantic Region					
VA Tech Trawl - Newly Mature Male	1.24			0.76	0.03
Southeast Region					
GA Trawl - Spring	0.89			0.54	0.03
NC Gillnett - Spring	-0.47			-1.30	0.00
SC CRMS	0.22	-1.00	0.00	-0.25	0.13
SC Trammel Net	-0.67	-1.39	0.00	-1.12	0.00
SEAMAP - SC Fall	0.60			-0.36	0.02
SEAMAP GA-FL - Fall	-0.11			-1.08	0.02

Table 40. Number of surveys with terminal year having a greater than 0.50 probability of being less than the reference point (i.e. likely less than the reference point). Time series were only included in this summary if the terminal year was 2016 or 2017, residuals from ARIMA model fits were normally distributed, and combined-sex surveys. Those surveys that did not begin until after 1998 were not included in the $P(if<i_{1998})>0.50$ summary.

Region	$P(i_f<i_{1998})>0.50$	$P(i_f<Q_{25})>0.50$
Northeast	1 out of 2	1 out of 2
New York	4 out of 4	4 out of 5
Mid-Atlantic	2 out of 5	0 out of 7
Southeast	0 out of 2	0 out of 5
Coastwide	7 out of 13	5 out of 19

Table 41. Horseshoe crab life history parameters used in the operating model.

Age	Natural mortality (*M*)	Probability of Maturing[3] (m)	Fishery Recruitment (*R*)	Fecundity (*f*)
0	10.4143	0.00	0.00	0
1 – 9	0.0265	0.00	0.00	0
10	0.0265[1]; 0.4700[2]	0.20	0.00[1];1.0[2]	80,300
11	0.0265[1]; 0.4700[2]	0.6577	0.00[1];1.0[2]	80,300
12	0.4627	1.00	0.99	80,300
13 – 17	0.4700	1.00	1.00	80,300
18 – 20	2.5257	1.00	1.00	80,300

[1]immature individuals; [2]mature individuals

[3]The probability of maturing represents the probability of becoming a mature individual at age *i* if that individual was immature at age *i*-1.

Table 42. Scenarios of *F* simulated by the operating model to generate data sets used in a surplus production model and a catch survey model. Fishing mortality varied annually according to a uniform distribution with bounds described below.

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
Years	Min *F*	Max *F*	Min *F*	Max *F*	Min *F*	Max *F*	Min *F*	Max *F*
2001 - 2020	0.18	0.22	0.18	0.22	0.18	0.22	0.18	0.22
2021 - 2040	0.18	0.22	0.08	0.12	0.01	0.02	0.06	0.10
2040 - 2060	0.18	0.22	0.02	0.06	0.02	0.06	0.01	0.02

Table 43. Catch multiple survey analysis base model inputs. *Values shown in millions. CONFIDENTIAL biomedical data has been removed.

	Lambdas			Starting Values							
M	VT	DE	NJ	R	N	q_de	q_nj	s	Biomed.		
0.274	0.59	0.16	0.25	2.0E+06	3.6E+06	2.3E-07	5.0E-07	1	15%		
	Harvest			Survey Indices				Coefficient of Variation			
Year	Commercial	Discard	Biomedical	VT*, r	VT*, n	DE	NJ	VT, r	VT, n	DE	NJ
2003	220,354	35,941		1.537	4.959	1.203	2.246	0.24	0.26	0.492	0.188
2004	108,843	39,416		0.794	3.379	0.056	2.502	0.45	0.22	0.566	0.229
2005	116,577	10,530		0.358	2.735	0.093	2.77	0.32	0.2	0.43	0.241
2006	104,048	18,560		0.479	3.138	1.411	1.856	0.34	0.22	0.305	0.258
2007	67,674	29,444		2.051	6.611	1.284	1.474	0.33	0.31	0.274	0.249
2008	44,329	30,441		2.373	7.746	0.185	2.37	0.33	0.25	0.379	0.32
2009	48,663	45,789		2.571	6.311	0.34	1.368	0.36	0.4	0.356	0.289
2010	41,385	55,649		0.885	2.975	0.206	0.579	0.26	0.33	0.492	0.302
2011	33,728	103,092		1.338	5.178	0.25	2.215	0.74	0.26	0.385	0.256
2012	56,112	27,810		0.845	5.29	0.275	1.804	0.34	0.2	0.296	0.249
2013	29,111	103,928		-	-	0.111	7.996	-	-	0.448	0.347
2014	13,410	51,346		-	-	1.218	3.358	-	-	0.266	0.239
2015	11,689	52,134		-	-	0.439	3.145	-	-	0.289	0.249
2016	14,923	73,226		-	-	1.079	3.989	-	-	0.215	0.244
2017	16,956	38,009		1.608	6.024	1.6	5.613	0.22	0.17	0.216	0.25
2018	-	-	-	1.48	7.185	3.127	3.104	0.27	0.27	0.237	0.226

Table 44. The number of parameters estimated in the catch multiple survey analysis: median primiparous abundance (1); primiparous abundance for each year (16); catchability coefficients (2) for the Delaware and New Jersey surveys; and multiparous abundance for the start of the time series (1).

Parameter	No. Estimates	Description
R_{median}	1	Median primiparous abundance (log-scale)
Φ	16	Deviations from median primiparous abundance (log-scale)
N_0	1	Initial multiparous abundance (log-scale)
q_de	1	Catchability coefficient for the Delaware trawl survey (log-scale)
q_nj	1	Catchability coefficient for the New Jersey survey (log-scale)

Table 45. Selected catch multiple survey analysis based model outputs: q=catchability coefficients; R=primiparous abundance; N=multiparous abundance; u=exploitation rate; Z= instantaneous total mortality rate; A=annual mortality rate; and F=instantaneous fishing mortality rate.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 46. Mohn's p statistic for total, multiparous, and primiparous abundance.

[Table Removed Due to **CONFIDENTIAL** Data]

Table 47. Sensitivity runs for the catch multiple survey analysis model. All runs that included CONFIDENTIAL biomedical data have been removed.

		M	λ			Biomed	Starting Values				Terminal Output Values			
	Name		VT	DE	NJ		*R*	*N*	*q_de*	*q_nj*	*NegLL*	*R*	*N*	*F*
	Base													
	alt_base													
M [0.10-0.80]	**M_0.10**													
	M_0.15													
	M_0.19													
	M_0.195													
	M_0.198													
	M_0.199													
	M_0.20													
	M_0.201													
	M_0.202													
	M_0.203													
	M_0.204													
	M_0.205													
	M_0.206													
	M_0.21													
	M_0.25													
	M_0.30													
	M_0.35													
	M_0.40													
	M_0.45													
	M_0.47													
	M_0.50													
	M_0.80													
Harvest	**Biomed_0%**	0.274	0.59	0.16	0.25	0%	14.5	15.1	-15.3	-14.5	25.16	1,587,760	7,145,540	0.007
	Biomed_4%													

	Biomed_30%				
	Discard=0				
λ	**λ=Conn unadj.**				
	λ=1				
cv	**cv_average**				
	cv_fixed				
	cv_off				
q_VT	**q_vt**				
	q_vt_s				
s [0.5-1.5]	**s_0.5**				
	s_0.6				
	s_0.7				
	s_0.8				
	s_0.9				
	s_1.0				
	s_1.1				
	s_1.2				
	s_1.3				
	s_1.4				
	s_1.5				
	s_free				
Starting Values	**R_14.0**				
	R_14.3				
	R_14.7				
	N_14.4				
	N_15.8				
	N_17.0				
	q_DE_-14.6				
	q_DE_-16.0				
	q_DE_-17.5				

	q_NJ_-13.8					
	q_NJ_-15.5					
	q_NJ_-17.0					

Table 48. Horseshoe crab life history parameters used in the projection model to estimate biological reference points.

Age	Natural mortality (*M*)[1]	Probability of Maturing (m)[2]	Fishery Recruitment (*R*)	Fecundity (*f*)
0	10.4143	0.00	0.00	0
1 – 9	0.0817, 0.0744, 0.0685	0.00	0.00	0
$10_{immature}$	0.0817, 0.0744, 0.0685	0.00	0.00	80,300
10_{mature}	0.274	0.20	1.00	80,300
$11_{immature}$	0.0817, 0.0744, 0.0685	0.00	0.00	80,300
11_{mature}	0.274	0.66	1.00	80,300
12	0.274	1.00	1.00	80,300
13 – 20+	0.274	1.00	1.00	80,300

[1]Three levels of natural mortality corresponding to K = 10, 14, 18 million female horseshoe crabs, respectively.

[2]The probability of maturing represents the probability of becoming a mature individual at age *i* if that individual was immature at age *i*-1.

Table 49. Horseshoe crab life history parameters used in the egg- and yield-per-recruit modeling.

Age	Natural Mortality (M)[1]	Proportion Mature (m)	Fishery Recruitment (R)	Fecundity (f)	Weight
1	0.0817, 0.0744, 0.0685	0	0	0	1
2	0.0817, 0.0744, 0.0685	0	0	0	1
3	0.0817, 0.0744, 0.0685	0	0	0	1
4	0.0817, 0.0744, 0.0685	0	0	0	1
5	0.0817, 0.0744, 0.0685	0	0	0	1
6	0.0817, 0.0744, 0.0685	0	0	0	1
7	0.0817, 0.0744, 0.0685	0	0	0	1
8	0.0817, 0.0744, 0.0685	0	0	0	1
9	0.0817, 0.0744, 0.0685	0	0	0	1
10	0.1173,0.1112, 0.1064	0.2000	0.2000	80,300	1
11	0.2156, 0.2131, 0.2111	0.7163,0.7159, 0.7156	0.7050	80,300	1
12	0.274	1	1	80,300	1
13	0.274	1	1	80,300	1
14	0.274	1	1	80,300	1
15	0.274	1	1	80,300	1
16	0.274	1	1	80,300	1
17	0.274	1	1	80,300	1
18	0.274	1	1	80,300	1
19	0.274	1	1	80,300	1
20	0.274	1	1	80,300	1

[1]Three levels of natural mortality corresponding to K = 10, 14, 18 million female horseshoe crabs, respectively.

Table 50. Reference points for female horseshoe crab harvest in the Delaware Bay generated from a population projection model. Reference points were generated for a range of possible carrying capacities (*K*) and associated juvenile mortalities (M_{juv}) needed to stabilize an unfished population at those carrying capacities.

K	M_{juv}	N_{msy}	F_{msy}	MSY	u_{msy}	N_{40}	F_{40}	N_{20}	F_{20}
10,000,000	0.0817	3,664,522	0.0695	215,498	0.0588	4,000,000	0.0632	2,000,000	0.1140
14,000,000	0.0744	5,132,293	0.0749	324,508	0.0632	5,600,000	0.0682	2,800,000	0.1232
18,000,000	0.0685	6,600,291	0.0796	442,334	0.0670	7,200,000	0.0724	3,600,000	0.1310

Table 51. Reference points generated from horseshoe crab egg-per-recruit models for the Delaware Bay population under varying levels of juvenile natural mortality (M_{juv}).

M_{juv}	F_{20}	F_{40}
0.0817	2.2675	0.6465
0.0744	2.2582	0.6453
0.0685	2.2508	0.6443

Table 52. Sex specific fishing mortality (*F*) and biomass reference points for the Delaware Bay region generated from a population projection model (Table 50) along with terminal year values from the base run of the catch survey model. [3]

	Delaware Bay Horseshoe Crabs	
	Reference Point	Benchmark Values
Females	F_{MSY} = 0.0695 - 0.0796	F_{2017} = **CONFIDENTIAL***
	N_{MSY} = 3,664,522 - 6,600,291	N_{2018} = **CONFIDENTIAL***
Males	Sex Ratio (M:F) = 2:1	2017 Sex Ratio (M:F) = 5.2:1

***Benchmark values are CONFIDENTIAL because they are based on harvest that includes numbers of horseshoe crabs attributed the biomedical industry. Values without biomedical data are F_{2017}=0.007 and B_{2018}=8,718,040. The benchmark values of F_{2017} and B_{2018} with the biomedical data are slightly higher and lower, respectively, and although minimally different, represent the best data but are CONFIDENTIAL. The stock status of not overfished and overfishing not occurring is unchanged with or without the biomedical data.**

Table 53. Stock status determination for the coastwide and regional stocks based on the 1998 index-based reference points from ARIMA models. Status was based on the percentage of surveys within a region (or coastwide) having a >50% probability of their terminal year fitted value being less than the 1998 index-based reference point. "Poor" status was >66% of surveys meeting this criterion, "Good" status was <33% of surveys, and "Neutral" status was 34 – 65% of surveys. The same criteria were applied to ARIMA results from the 2009 benchmark assessment and 2013 update assessment for comparison purposes. NOTE: The suite of surveys used in each assessment as well as the index values differed between assessments (see Section 7.3 for explanation).

Region	2009 Benchmark	2013 Update	2019 Benchmark	2019 Stock Status
Northeast	2 out of 3	5 out of 6	1 out of 2	Neutral
New York	1 out of 5	3 out of 5	4 out of 4	Poor
Delaware Bay	5 out of 11	4 out of 11	2 out of 5	Neutral
Southeast	0 out of 5	0 out of 2	0 out of 2	Good
Coastwide	7 out of 24	12 out of 24	7 out of 13	Neutral

[3] The Peer Review Panel did not endorse the use of the reference points developed for this stock assessment.

Table 54. Details of surveys used in determining regional stock status. Arrows indicate increasing (↗), decreasing (↘), or stable (↔) trends over the most recent 5 and 10 year periods. $P(i_f<i_{1998})$ represents the probability of the terminal year's fitted index value (i_f) being less than the 1998 index-based reference point from ARIMA modeling. The average of this probabilities within a region is also given.

Region	SurveyName	5 year trend	10 year trend	$P(i_f<i_{1998})$	Avg. Prob
New England	MA DMF Trawl - South of Cape Cod	↗	↗	0.08	
	RI Monthly Trawl - Fall	↘	↘	0.62	0.35
New York	CT Long Island Sound Trawl - Fall	↘	↘	1.00	
	NY Jamaica Bay Seine	↘	↘	0.96	
	NY Little Neck and Manhasset Bay Seine	↘	↘	1.00	
	NY Peconic Trawl	↔	↘	1.00	0.99
Delaware Bay	DE 30 ft Trawl - Fall	↗	↗	0.02	
	DE 30 ft Trawl - Spring	↗	↗	0.33	
	MD Coastal Bays Trawl - Spring	↗	↔	0.36	
	NJ Ocean Trawl - Fall	↔	↔	0.82	
	NJ Ocean Trawl - Spring	↗	↗	0.51	0.41
Southeast	SC CRMS	↗	↔	0.00	
	SC Trammel Net	↔	↗	0.00	0.00

Table 55. Comparison of the current stock assessment and the adaptive resource management (ARM) model for horseshoe crabs in the Delaware Bay region.

	Coastwide Stock Assessment	**Adaptive Resource Management (ARM)**
Management objective	Maximum sustainable yield	Maximum yield while maintaining ecological function (shorebird constraints)
Model types	Single species models	Multi-species models
Management triggers	Reference points based on HSC biology and life history (F_{msy}, B_{msy}, etc.)	Threshold values based on Red Knot abundance (81,900) **OR** female HSC abundance (80% of K, 11.2 million)
Status conclusions	Not overfished; overfishing not occurring	Thresholds for each species not met – female harvest not valued
Management recommendations	Female harvest could increase	Continued male only harvest (as of 2018)

11 FIGURES

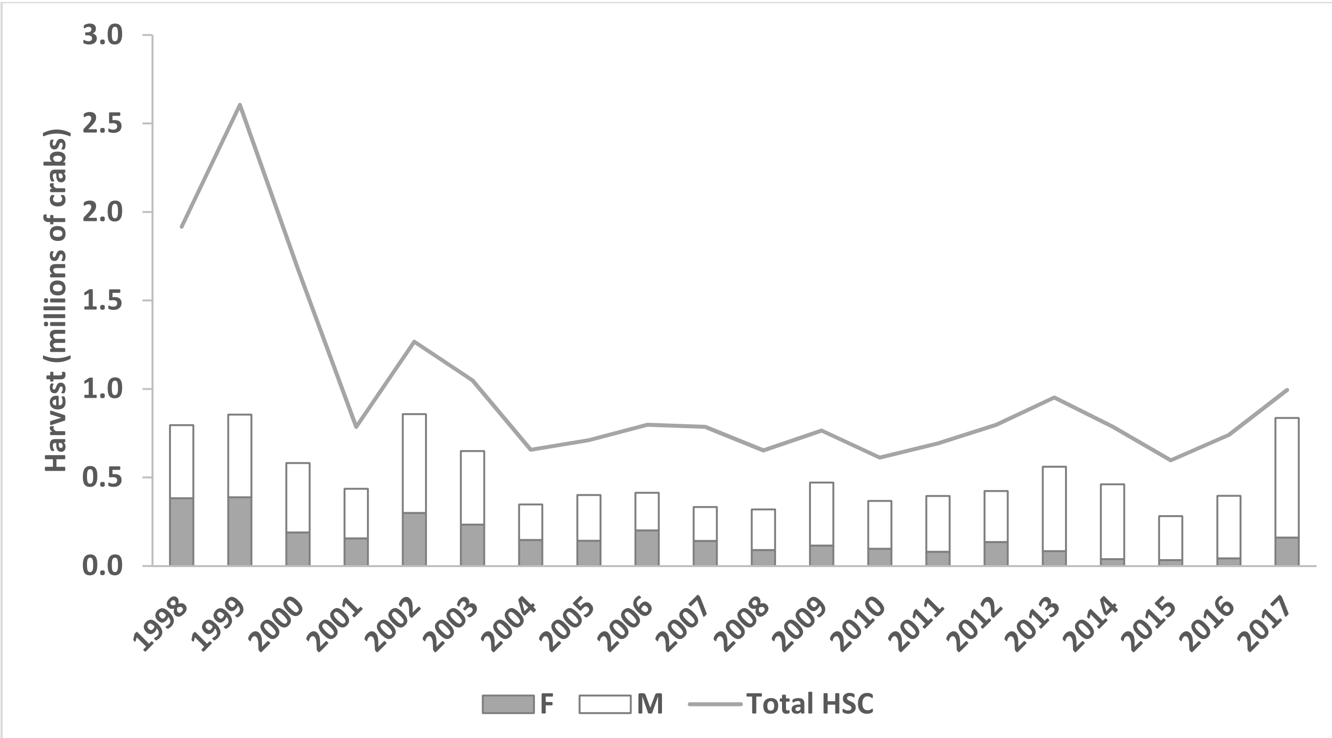


Figure 1. Coastwide horseshoe crab bait landings, 1998-2017, in numbers and by sex. Not every state along the Atlantic coast provides comprehensive sex data and therefore some are unclassified. Landings from 1998-2016 were validated by ACCSP; 2017 landings came from the 2018 FMP Review and state compliance reports.

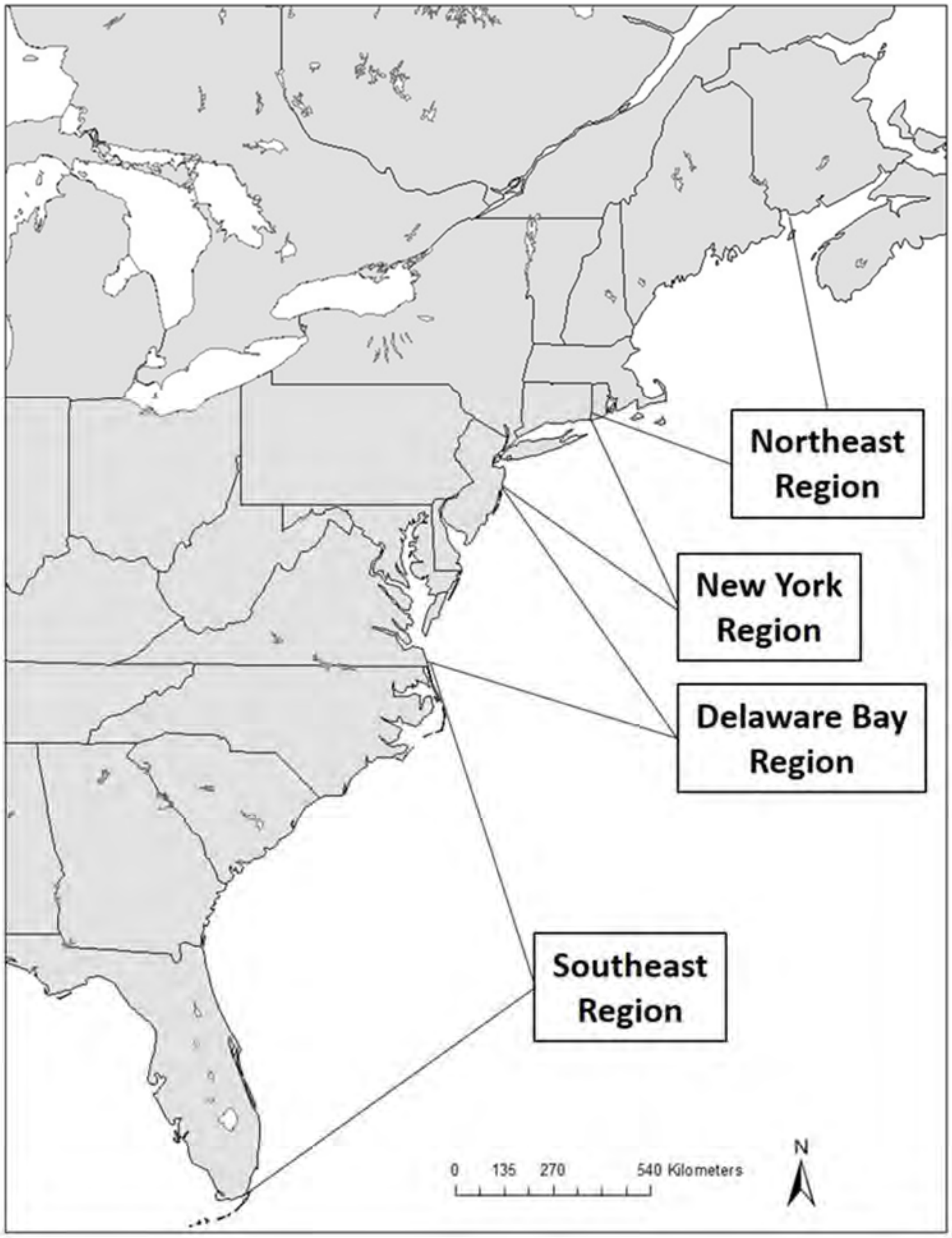


Figure 2. Map of the Atlantic coast showing the regions for horseshoe crab assessment.

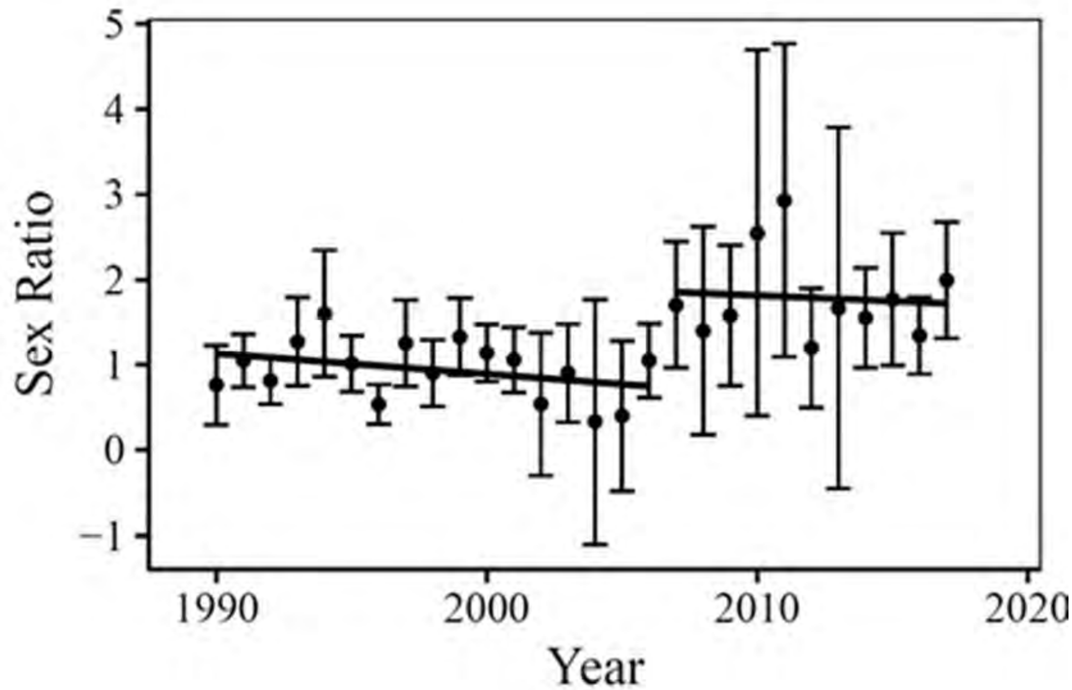


Figure 3. **Annual sex ratio (M:F) and associated confidence intervals for horseshoe crabs collected in the Delaware Bay 30' adult trawl survey from 1990 to 2017. Despite significant increases in sex ratio for these data, breakpoint analysis detected a significant shift in the relationship between these variables in 2006.**

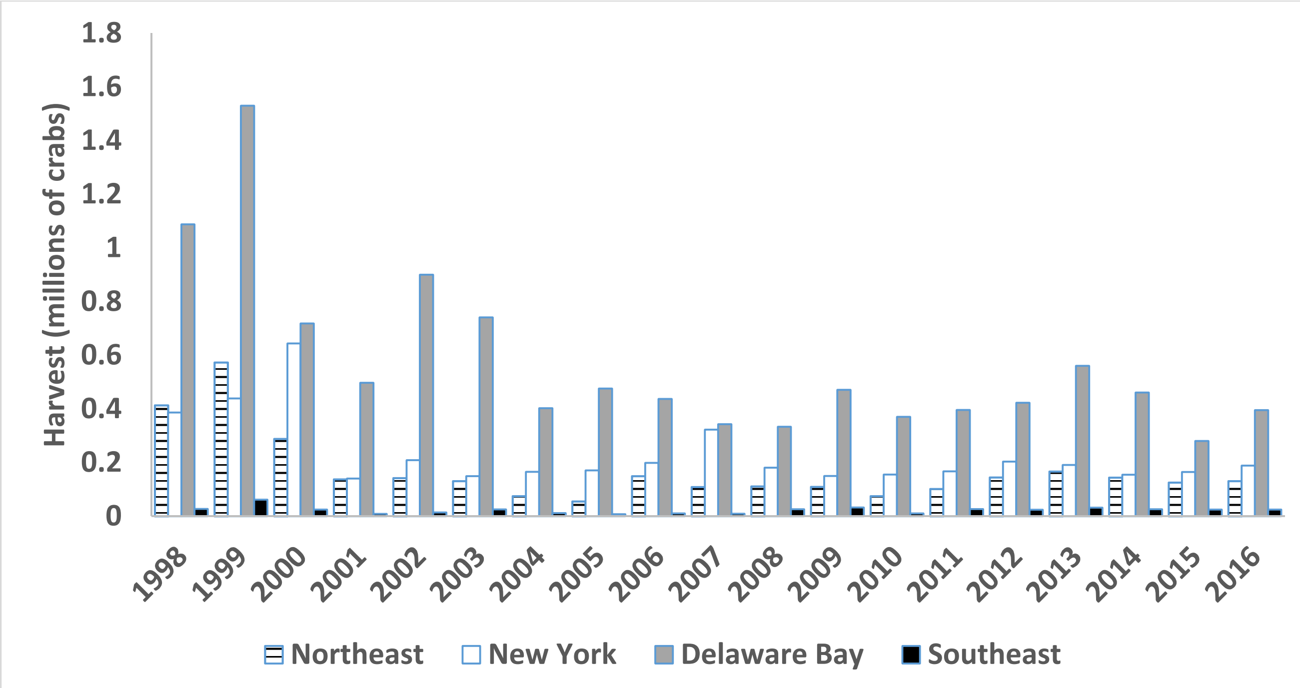


Figure 4. Horseshoe crab bait harvest by region, 1998-2016. The four regions are the Northeast (Maine, Massachusetts, Rhode Island), New York (Connecticut, New York), Delaware Bay (New Jersey, Delaware, Maryland, Virginia), and Southeast (North Carolina, South Carolina, Georgia, Florida).

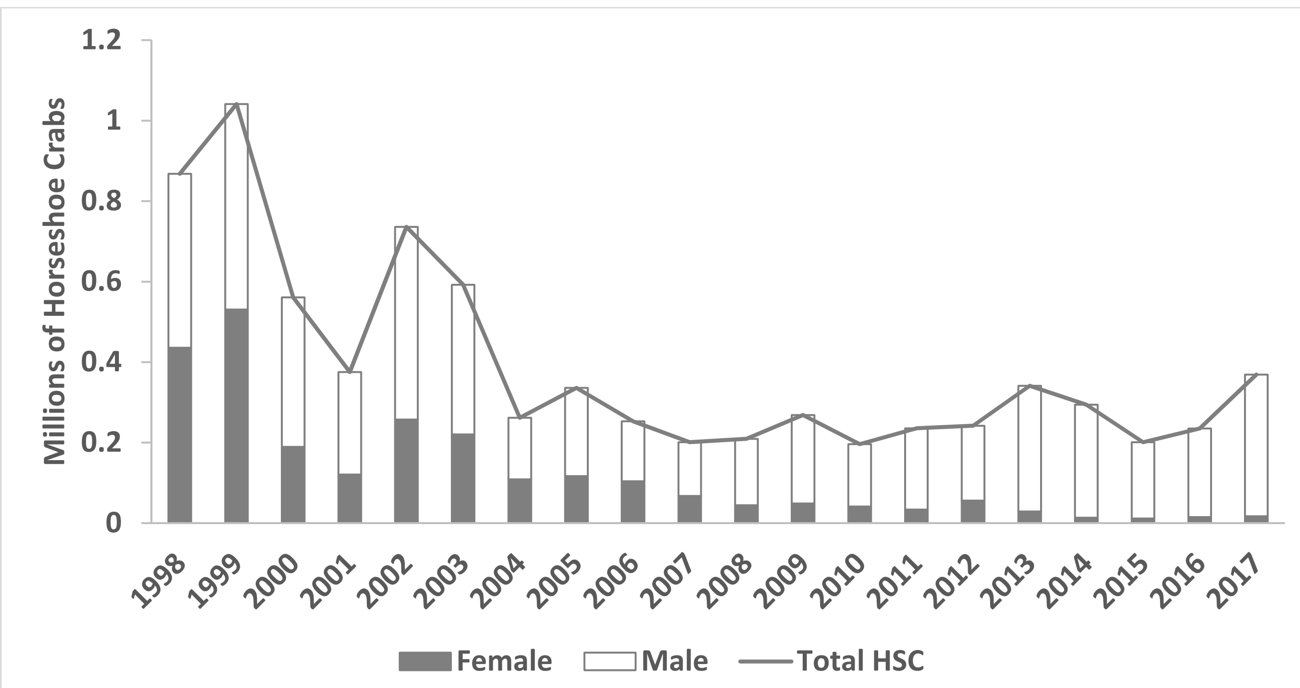


Figure 5. Horseshoe crab bait landings of Delaware Bay origin, 1998-2017, by sex to support the catch multiple survey model. All landings were validated through ACCSP.

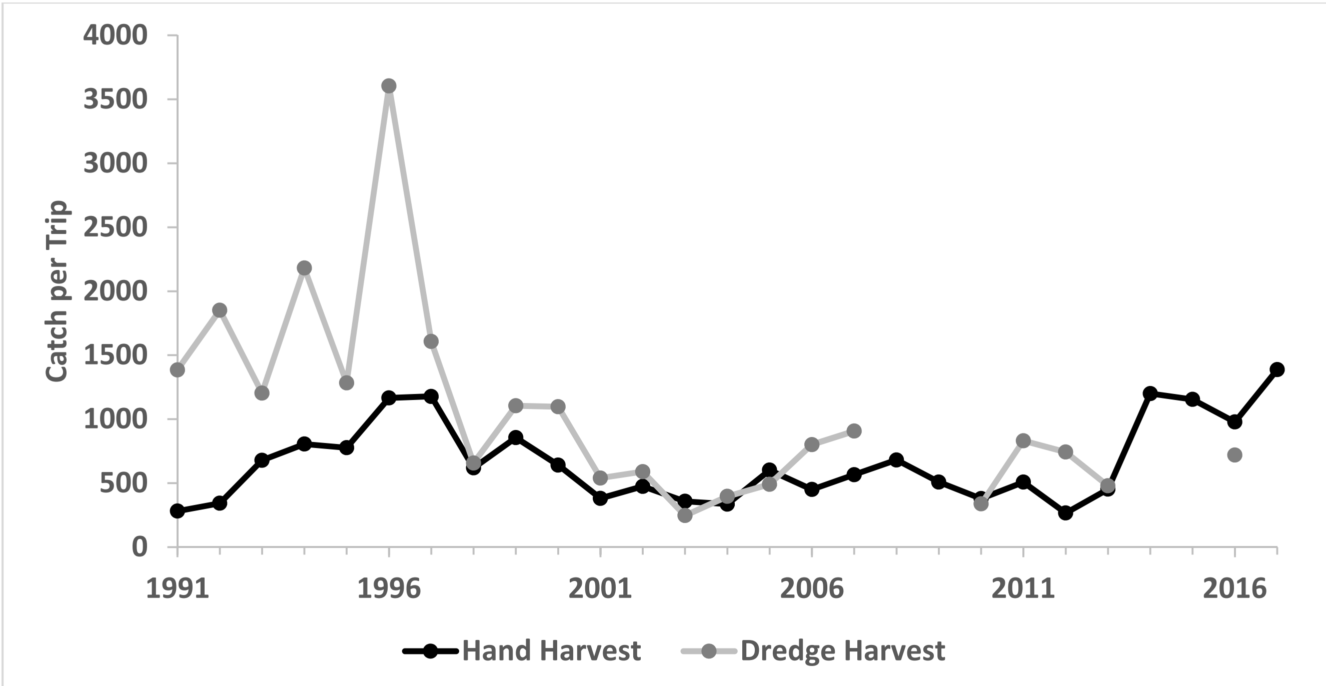


Figure 6. Delaware's commercial horseshoe crab catch rates (mean number of crabs per trip). Missing values for dredge harvest in 2008, 2009, 2014, 2015, and 2017 are due to no dredge fishery in those years. Source: Delaware's Department of Fish and Wildlife's 2017 Compliance Report.

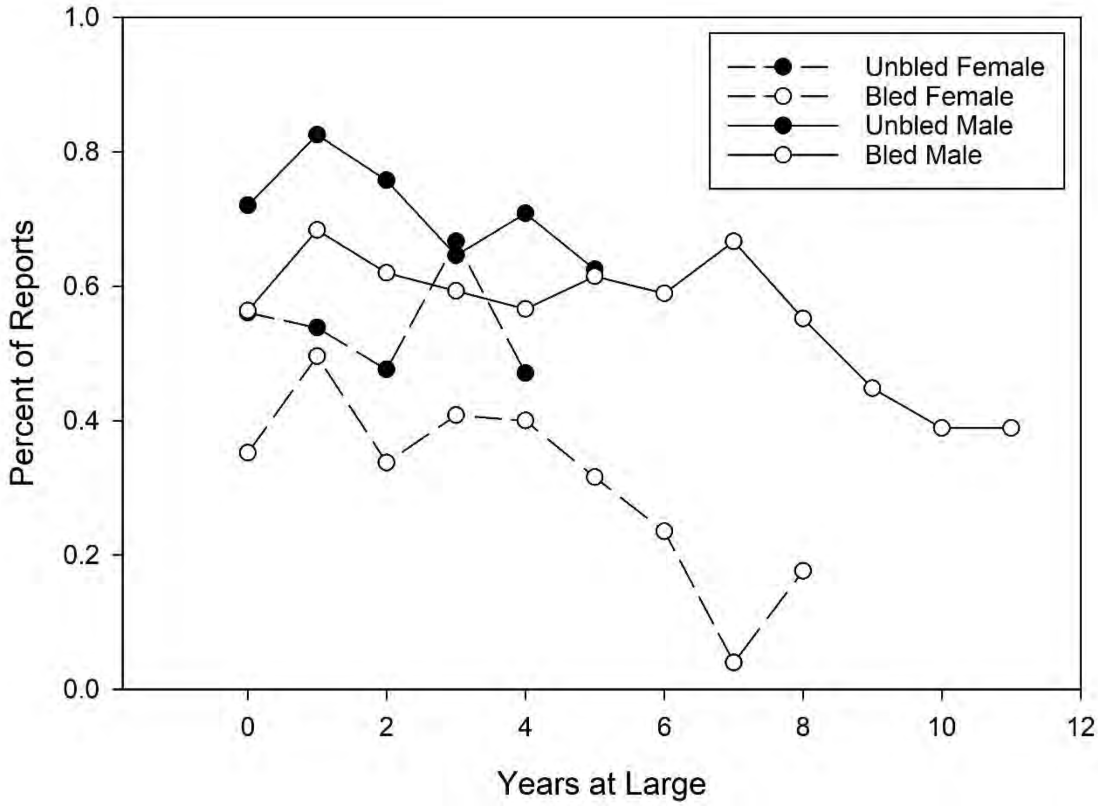


Figure 7. Comparison of bled (open circles) and unbled (filled circles) male (solid line) and female (dashed line) horseshoe crabs recaptured as alive over time.

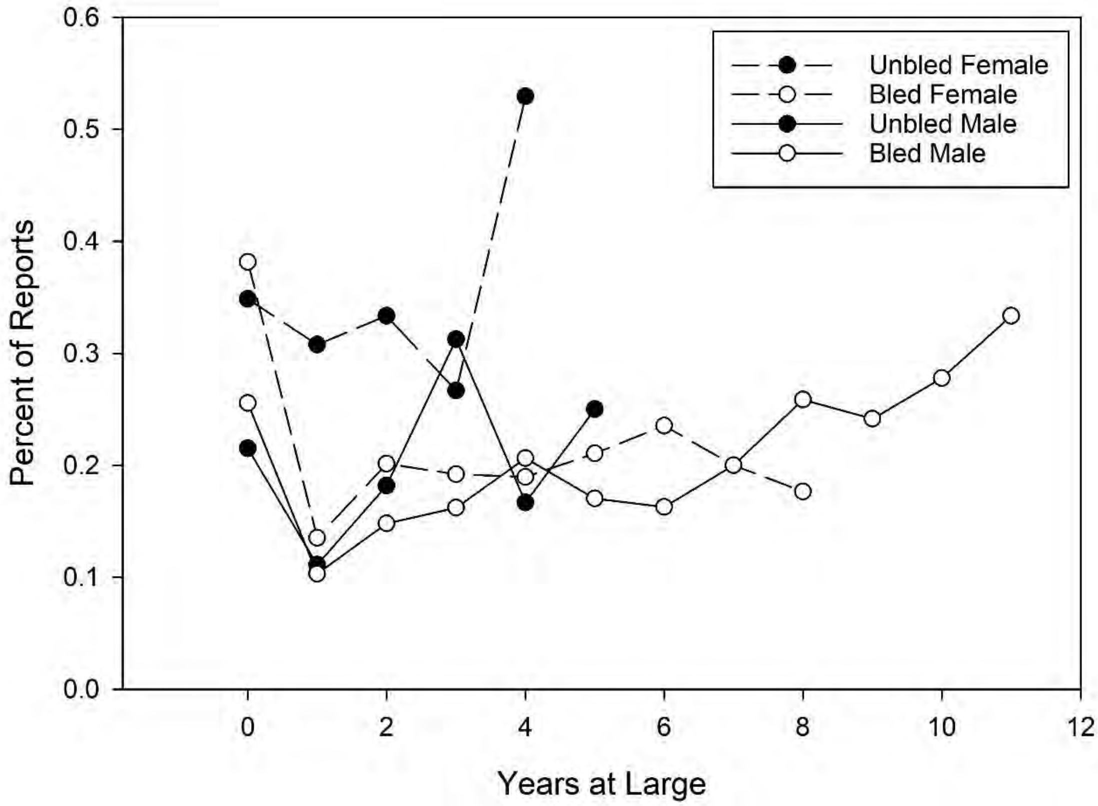


Figure 8. Comparison of bled (open circles) and unbled (filled circles) male (solid line) and female (dashed line) horseshoe crabs recaptured as dead over time.

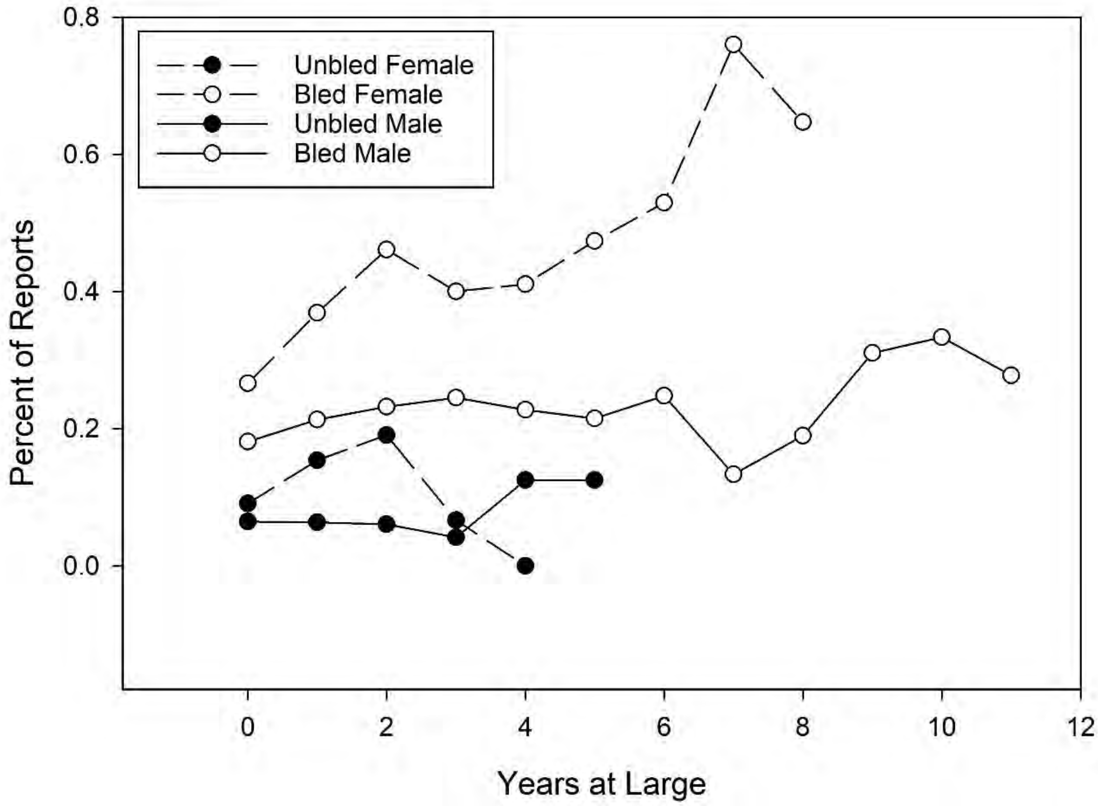


Figure 9. Comparison of bled (open circles) and unbled (filled circles) male (solid line) and female (dashed line) horseshoe crab tags reported as unknown disposition (e.g., tag was found unattached from crab).

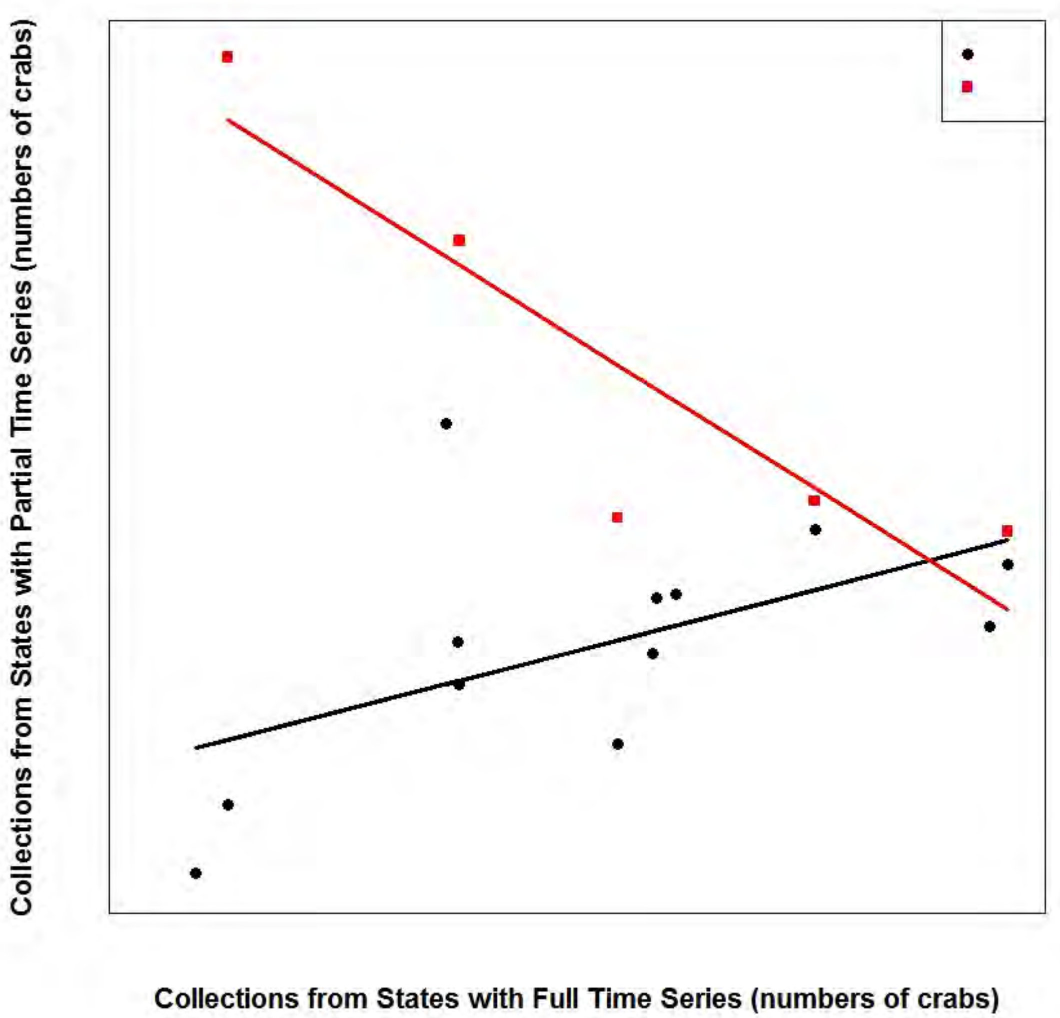


Figure 10. Linear regressions of biomedical collections of horseshoe crabs from states with partial and full time series from 1999-2017. Axis values and state names have been removed due to CONFIDENTIAL data.

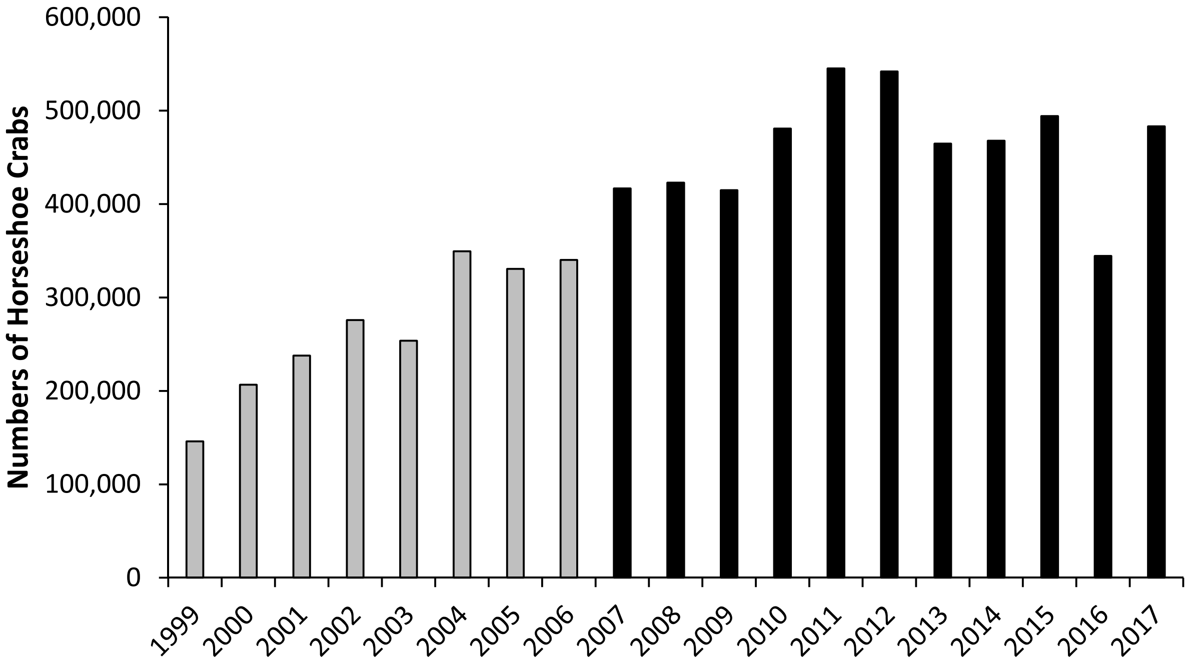


Figure 11. Annual numbers of horseshoe crabs collected solely for biomedical use coastwide. These numbers do not include crabs that entered the bait market after bleeding. Black bars indicate years in which all states reported collection numbers, and grey bars indicate years that include imputed values for at least one state due to missing data when collections were known to have occurred.

[Figure Removed Due to **CONFIDENTIAL** Data]

Figure 12. Estimated mortality attributable to biomedical use of horseshoe crabs along the US Atlantic coast. Sex-specific mortality of crabs of Delaware (DE) Bay origin is highlighted. Delaware Bay origin crabs include 100% of New Jersey, 51% of Maryland, and 35% of Virginia mortality, based on genetic information.

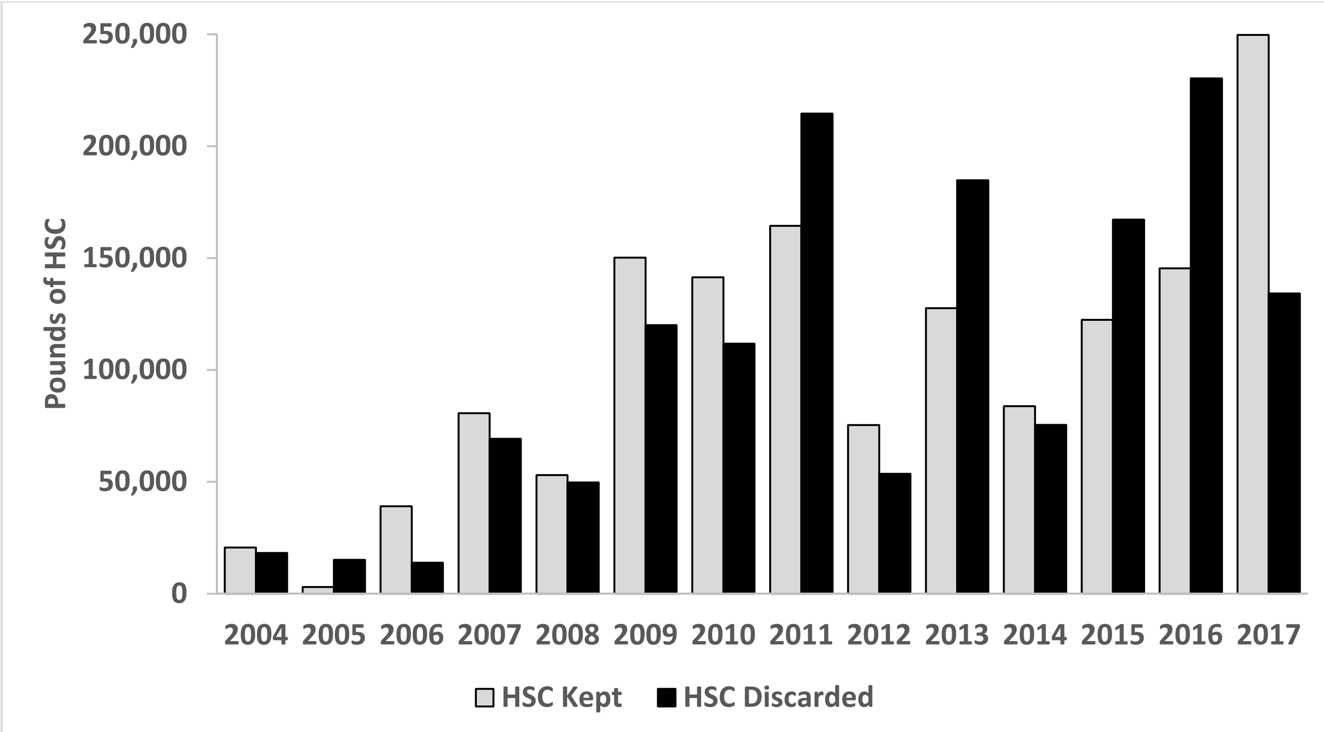


Figure 13. Total pounds of horseshoe crabs (HSC) discarded and horseshoe crabs kept in observed fishing trips in the NEFOP data set for the Delaware Bay states, 2004-2017.

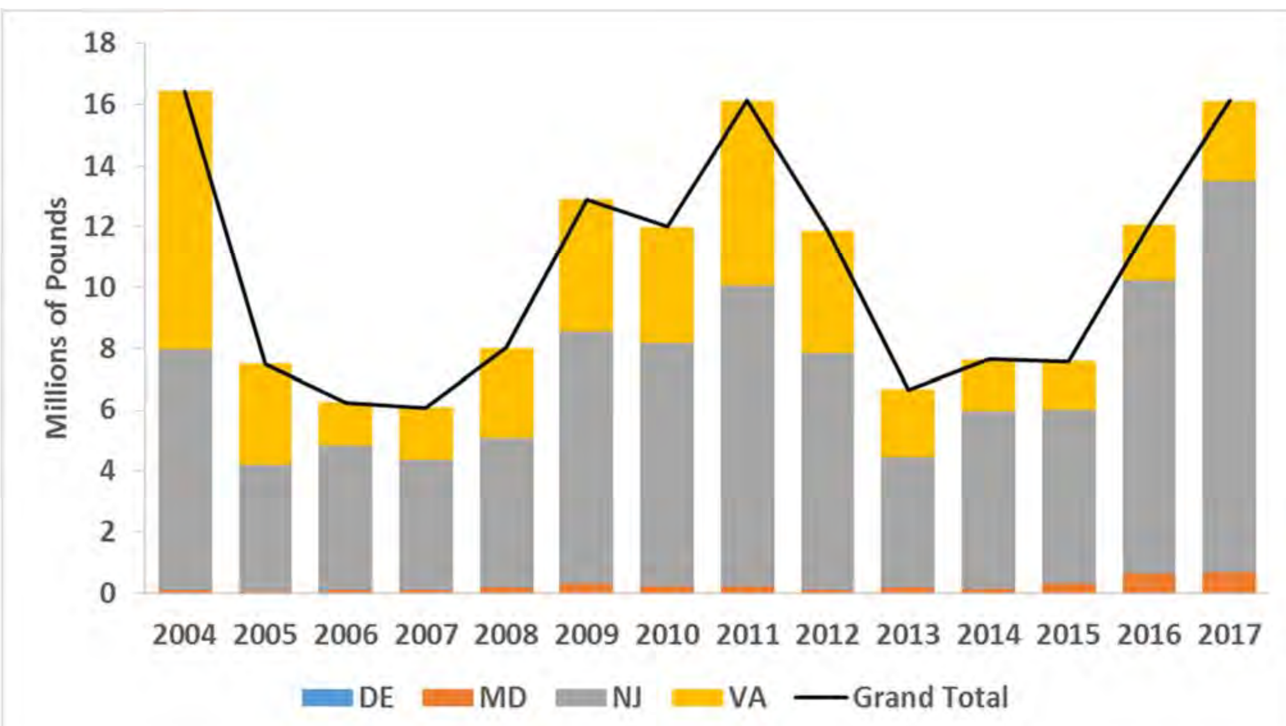


Figure 14. Total pounds of observed landings, all species, from the NEFOP data set for the Delaware Bay states, 2004-2017.

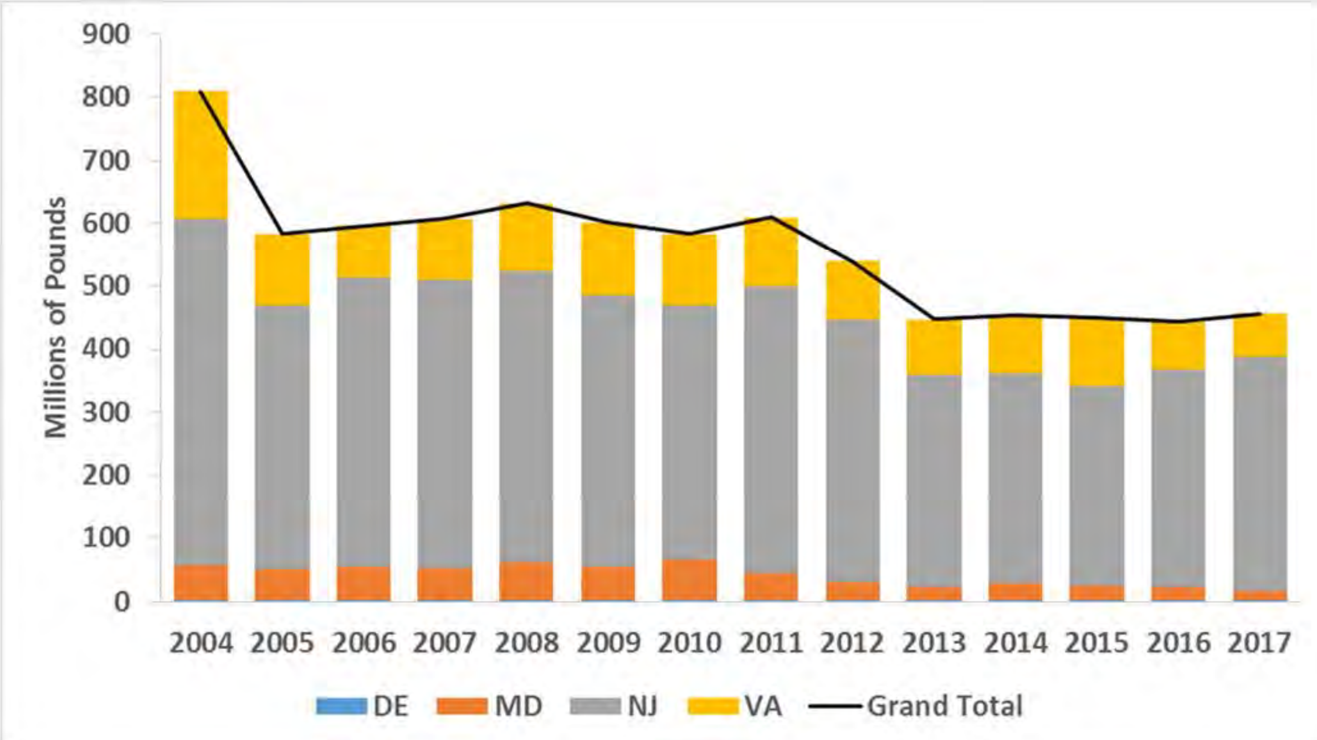


Figure 15. All species landings by state for gillnets, trawls, dredge, and "not coded" for the Delaware Bay region for 2004-2017 (source: ACCSP).

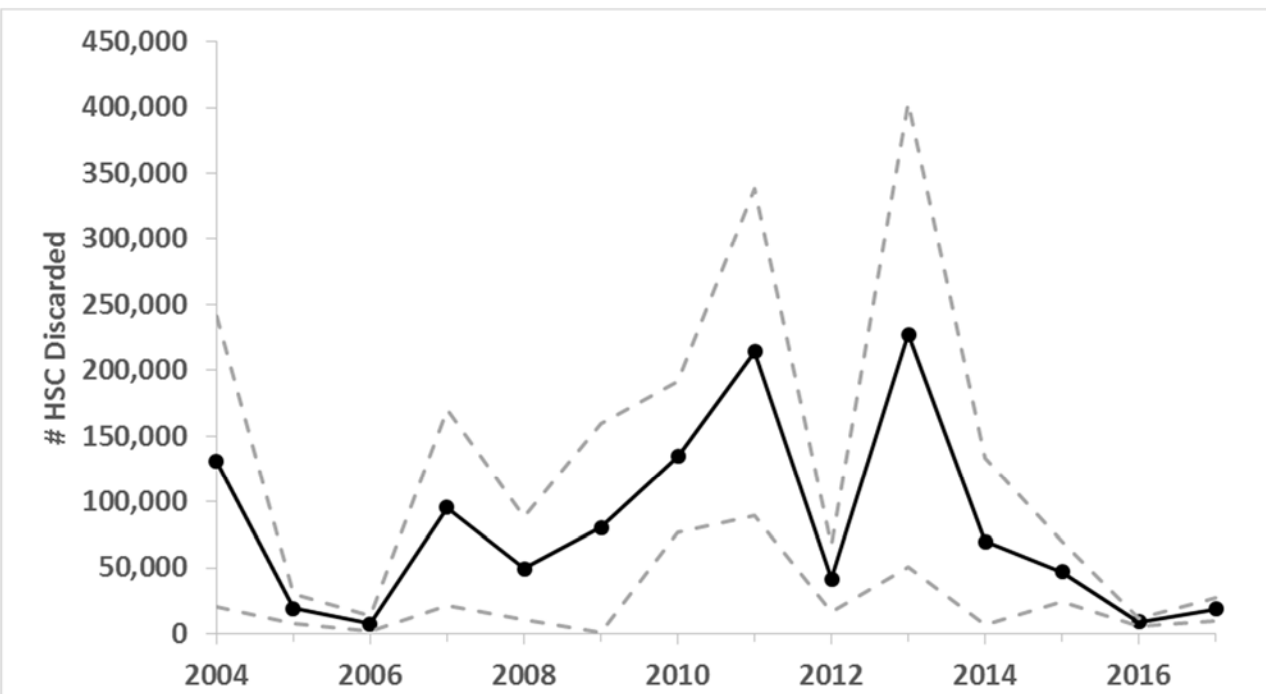


Figure 16. Estimated number of horseshoe crabs discarded from gill nets in the Delaware Bay region, 2004-2017, with 95% confidence intervals.

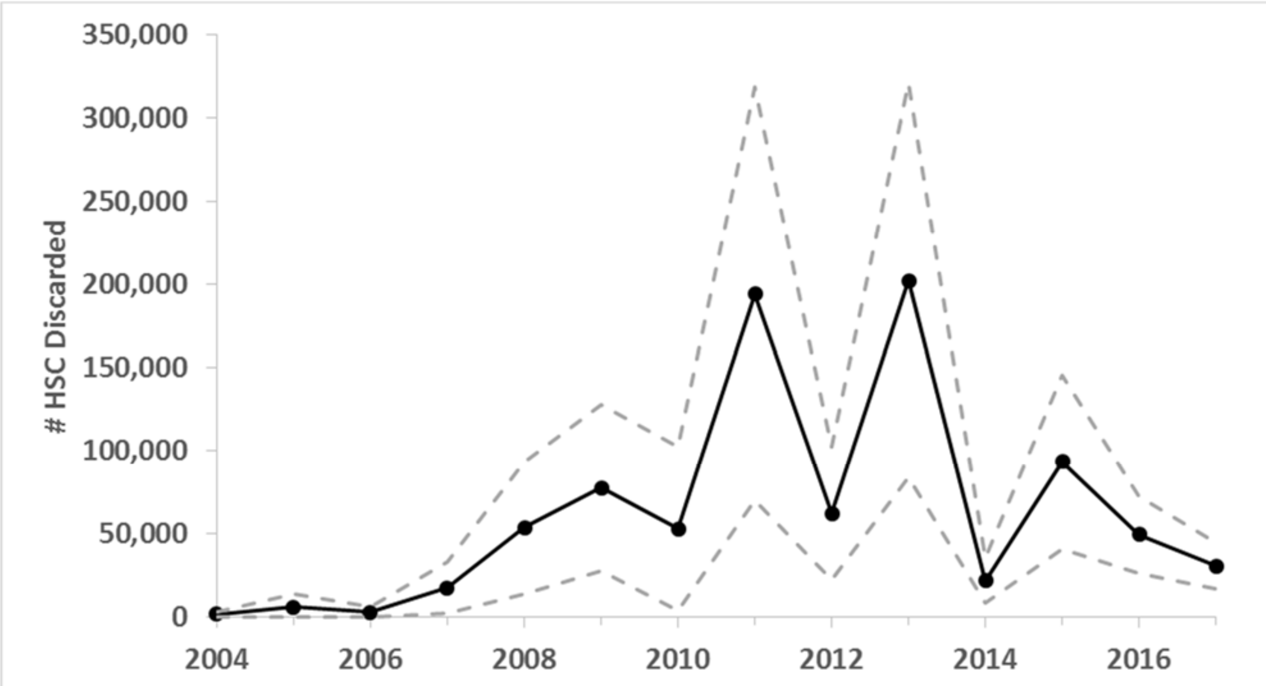


Figure 17. Estimated number of horseshoe crabs discarded from trawls in the Delaware Bay region, 2004-2017, with 95% confidence intervals.

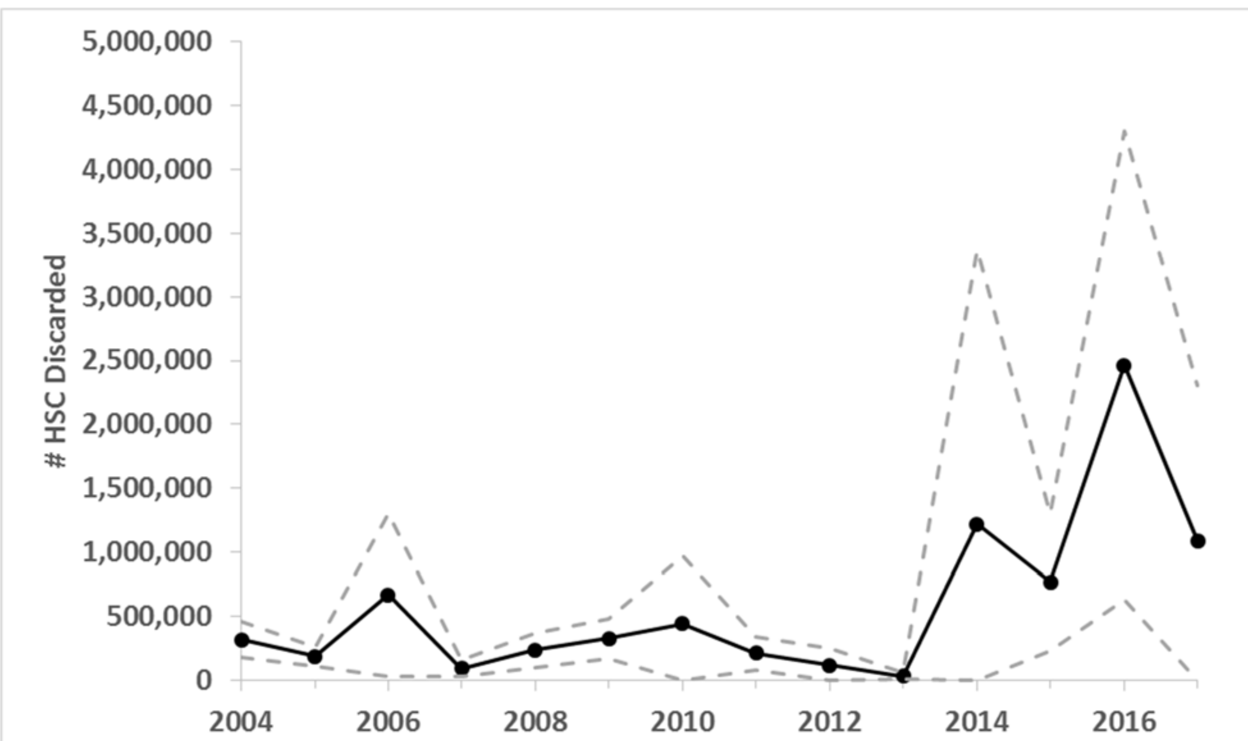


Figure 18. Estimated number of horseshoe crabs discarded from dredges in the Delaware Bay region, 2004-2017, with 95% confidence intervals.

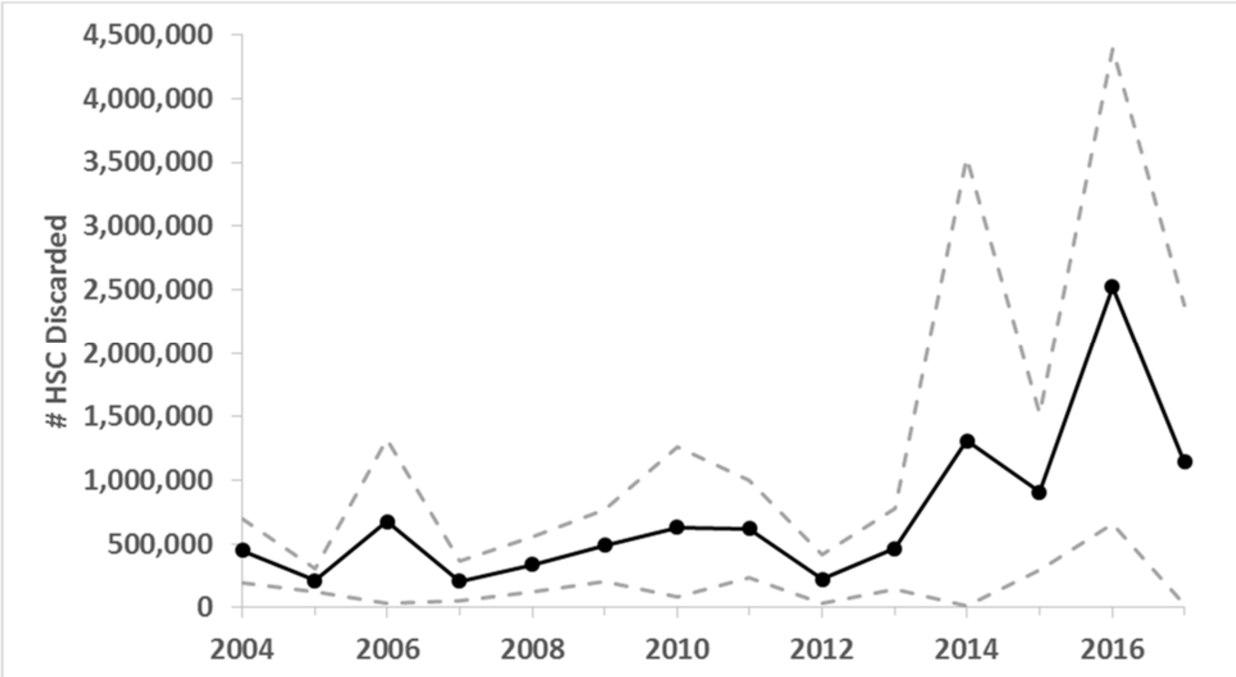


Figure 19. Estimated number of horseshoe crabs discarded from gill nets, trawls, and dredges in the Delaware Bay region, 2004-2017, with 95% confidence intervals.

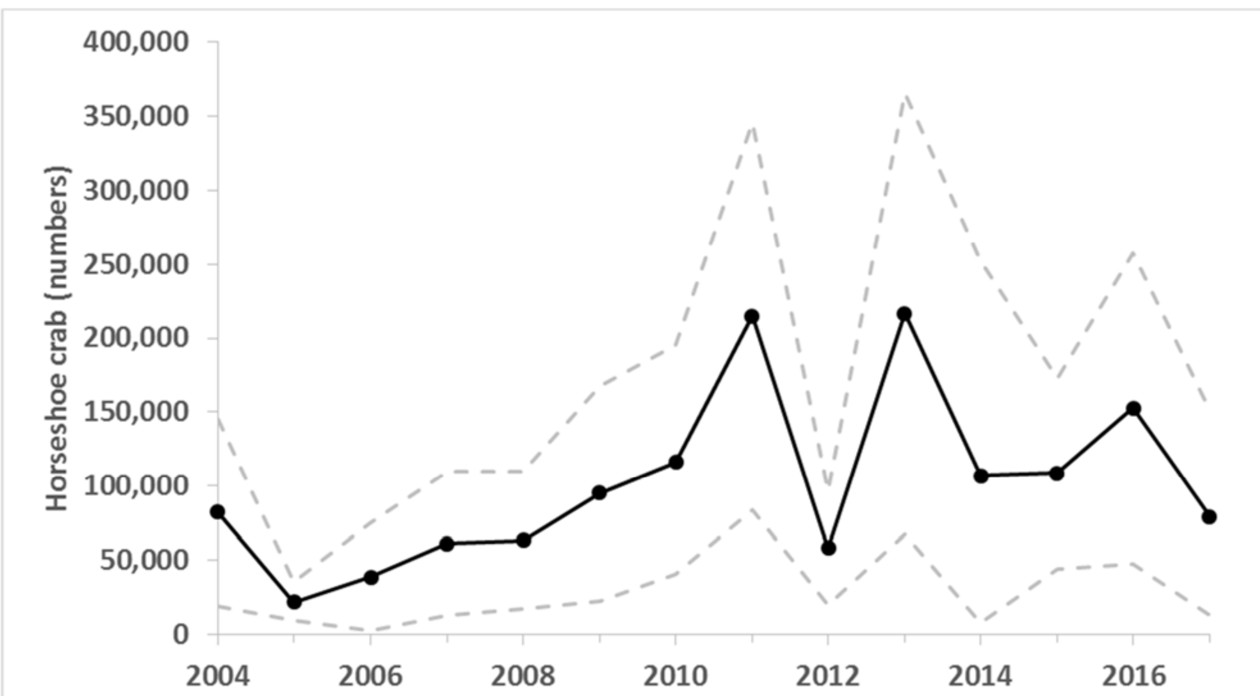


Figure 20. Number of dead discarded horseshoe crabs in the Delaware Bay region, 2004-2017, from gillnets, trawls, and dredges with 95% confidence intervals.

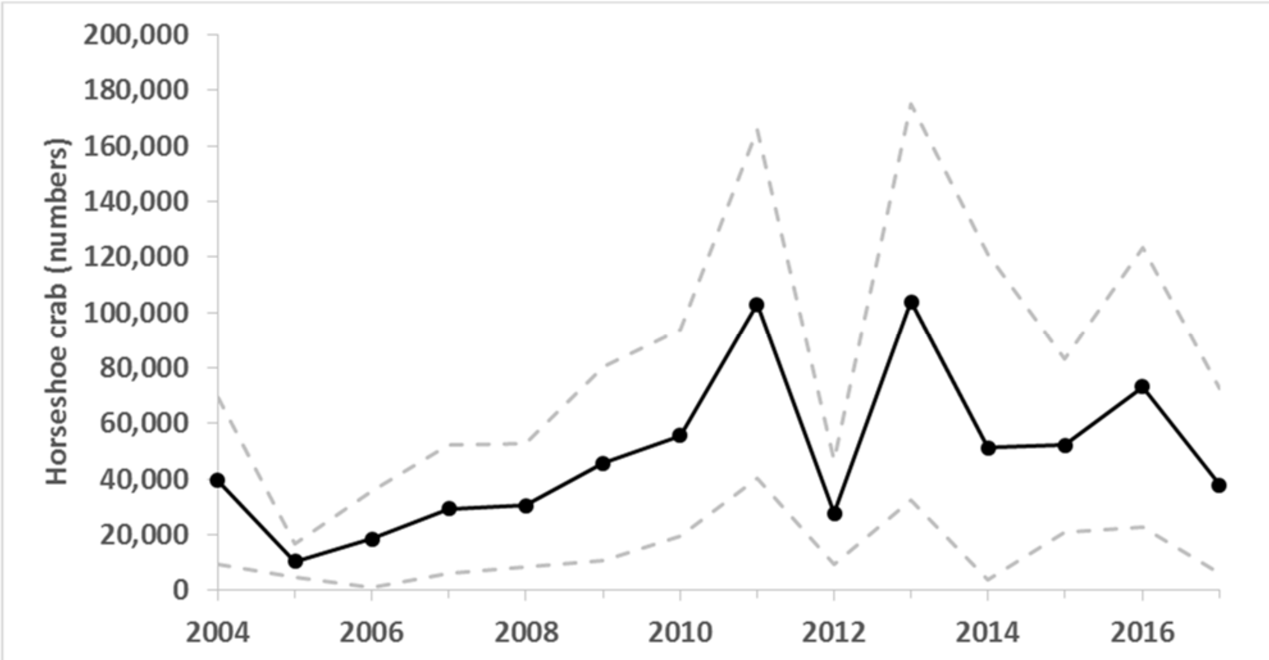


Figure 21. Number of dead discarded female horseshoe crabs in the Delaware Bay region, 2004-2017, from gillnets, trawls, and dredges with 95% confidence intervals.

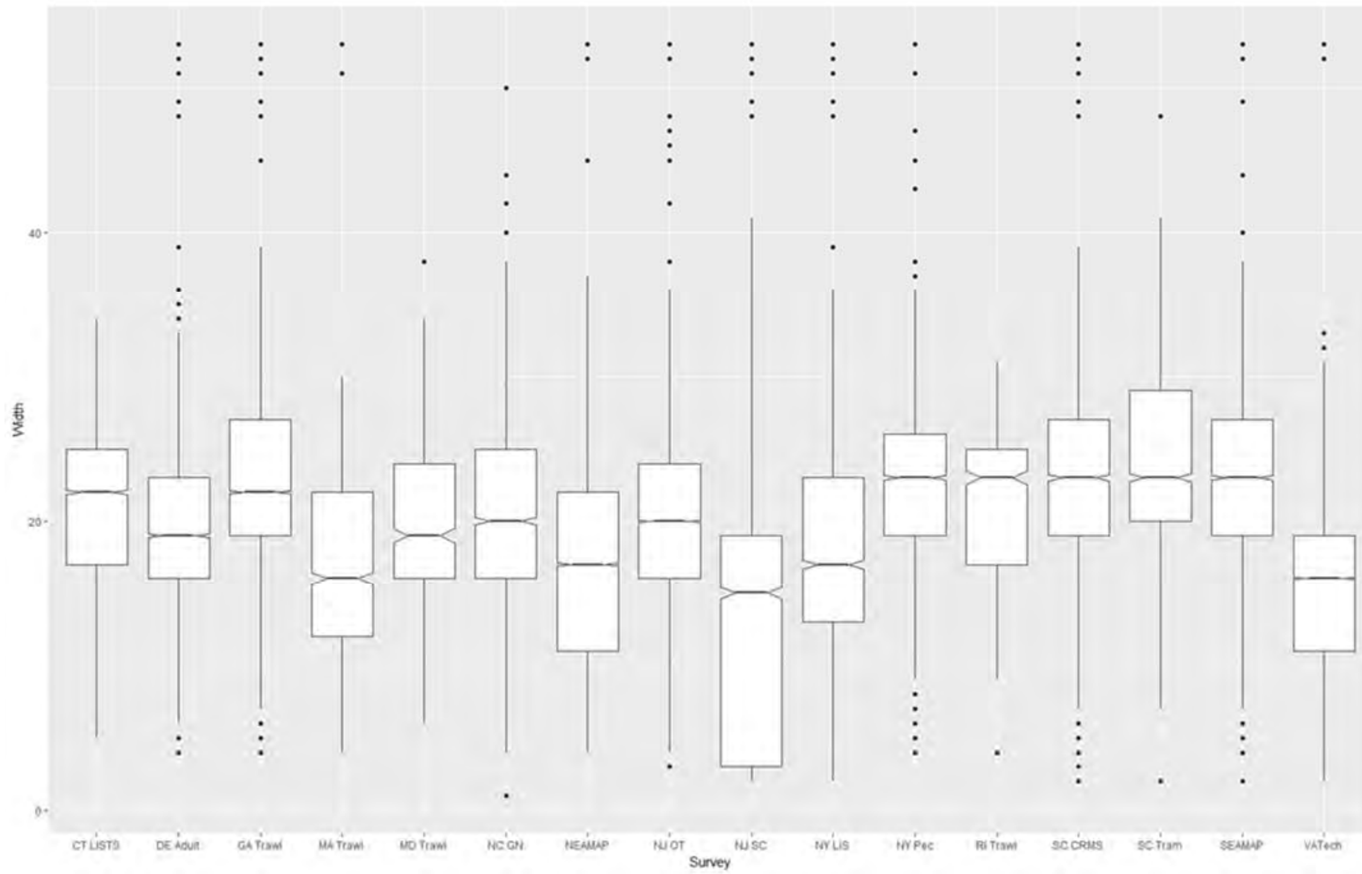


Figure 22. Boxplot of horseshoe crab prosomal widths (cm) caught in each fishery independent survey used in this assessment.

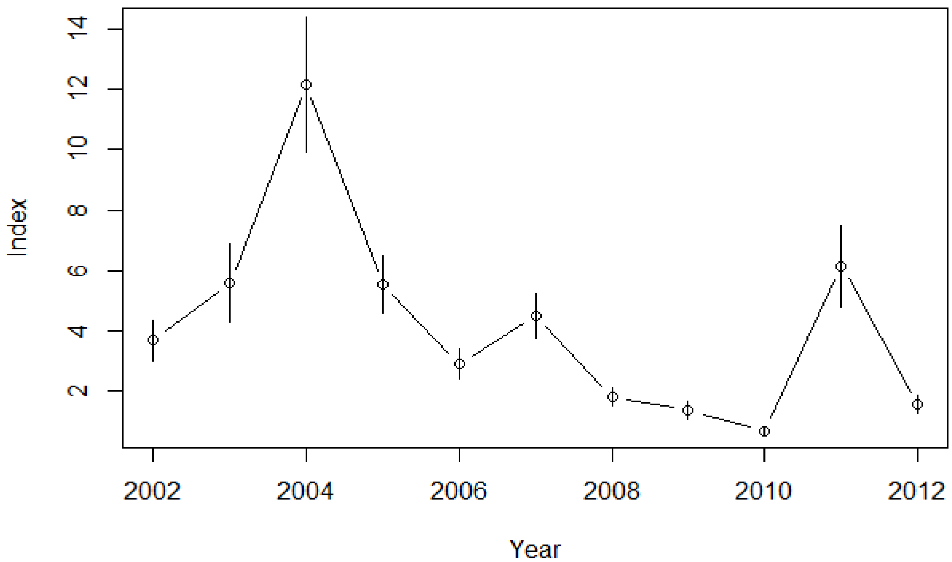


Figure 23. Index of relative abundance of female horseshoe crabs (delta mean crabs per sampling event) developed from the spring portion of New Hampshire's Spawning Beach Survey with 95% confidence intervals.

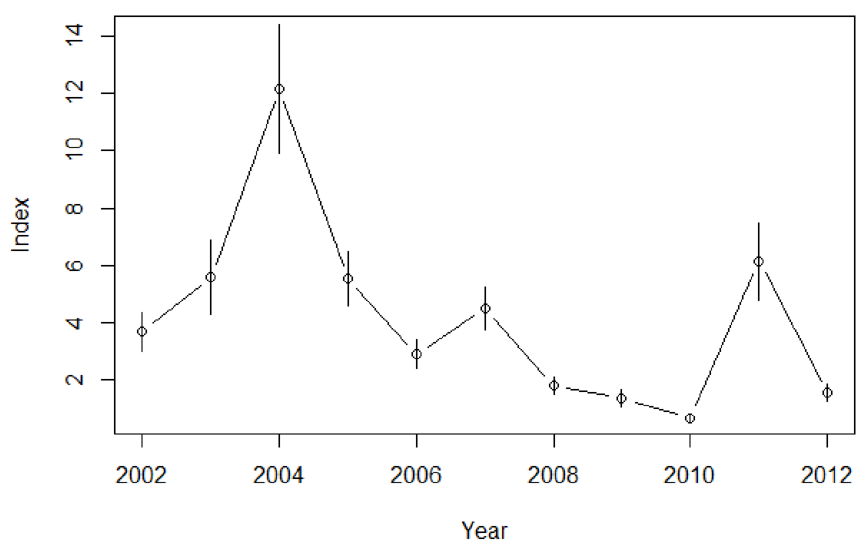


Figure 24. Index of relative abundance of male horseshoe crabs (delta mean crabs per sampling event) developed from the spring portion of New Hampshire's Spawning Beach Survey with 95% confidence intervals.

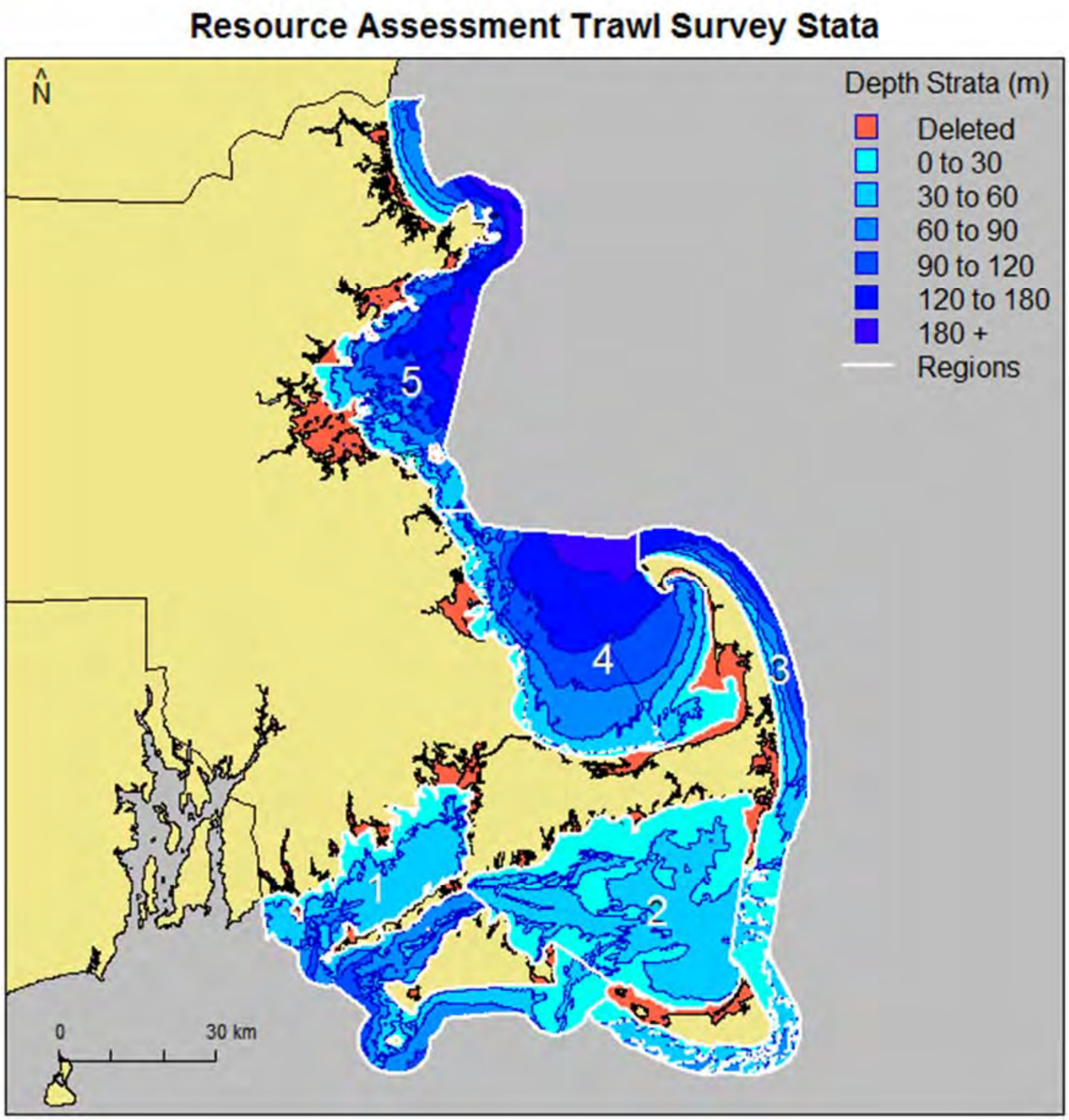


Figure 25. Map of Massachusetts Assessment Trawl Survey Strata.

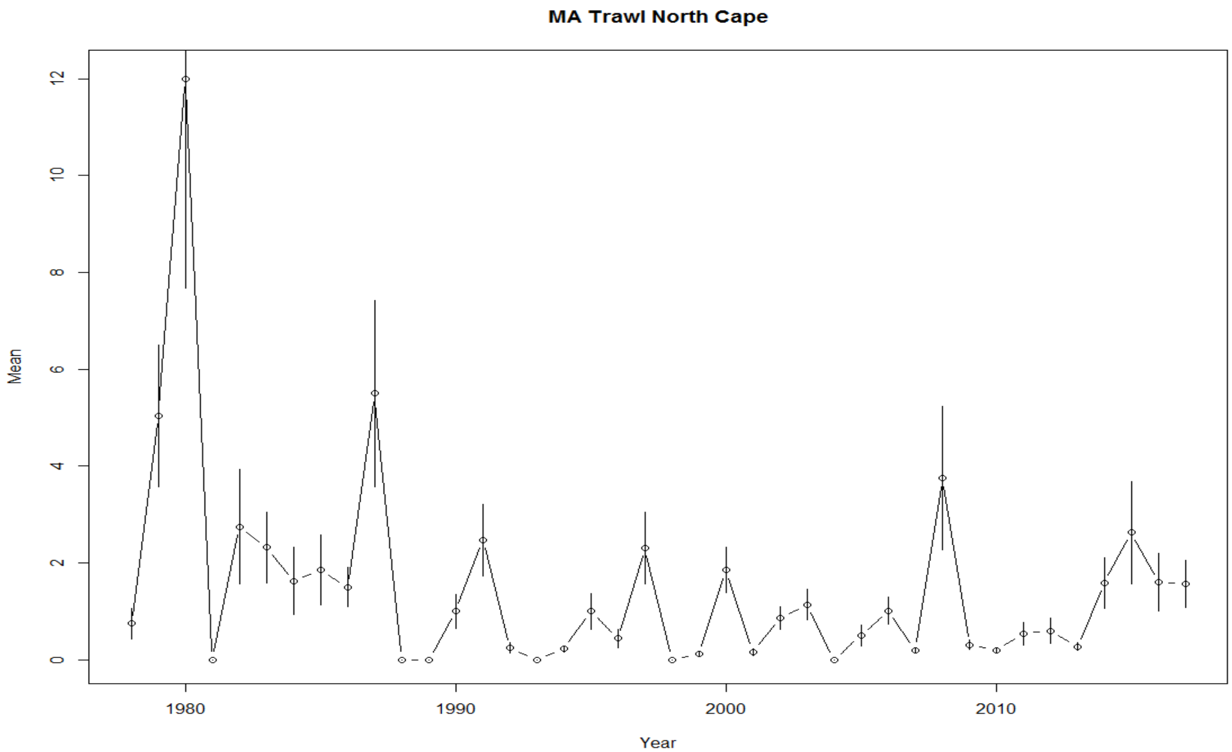


Figure 26. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of Massachusetts' Resource Assessment Trawl Survey in strata north of Cape Cod with 95% confidence intervals.

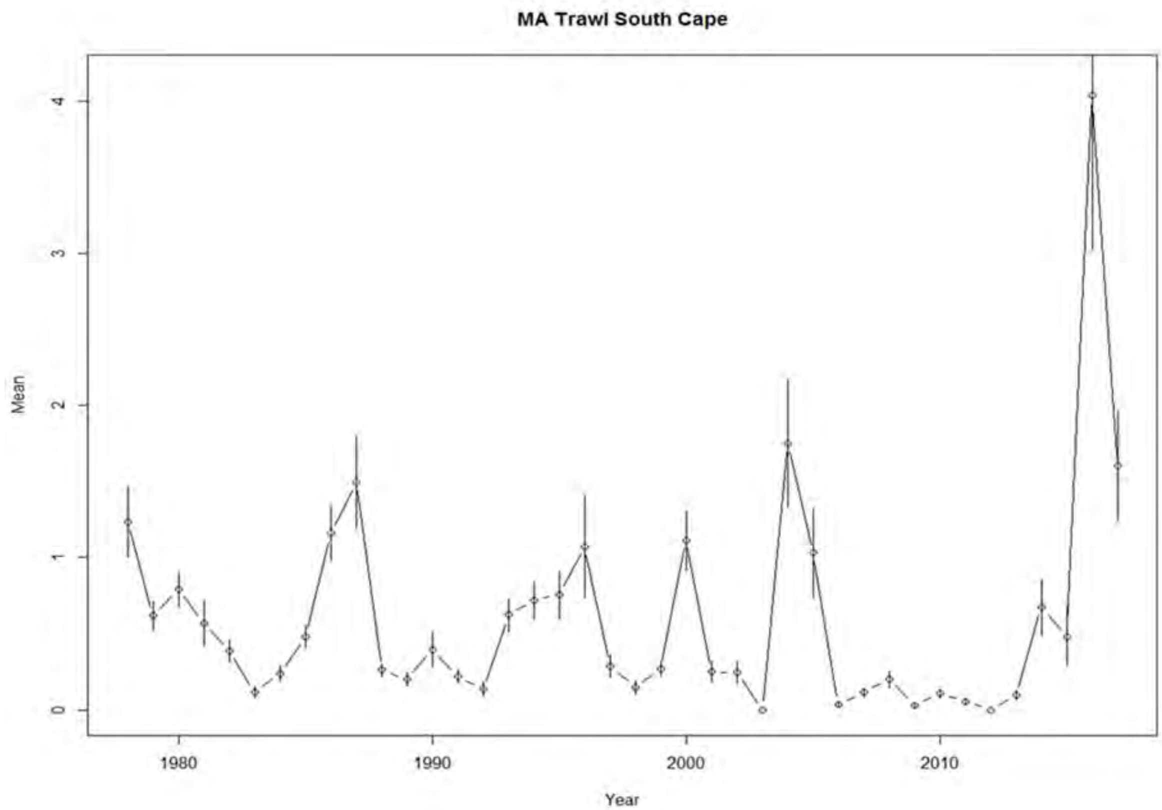


Figure 27. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of Massachusetts' Resource Assessment Trawl Survey in strata south of Cape Cod with 95% confidence intervals.

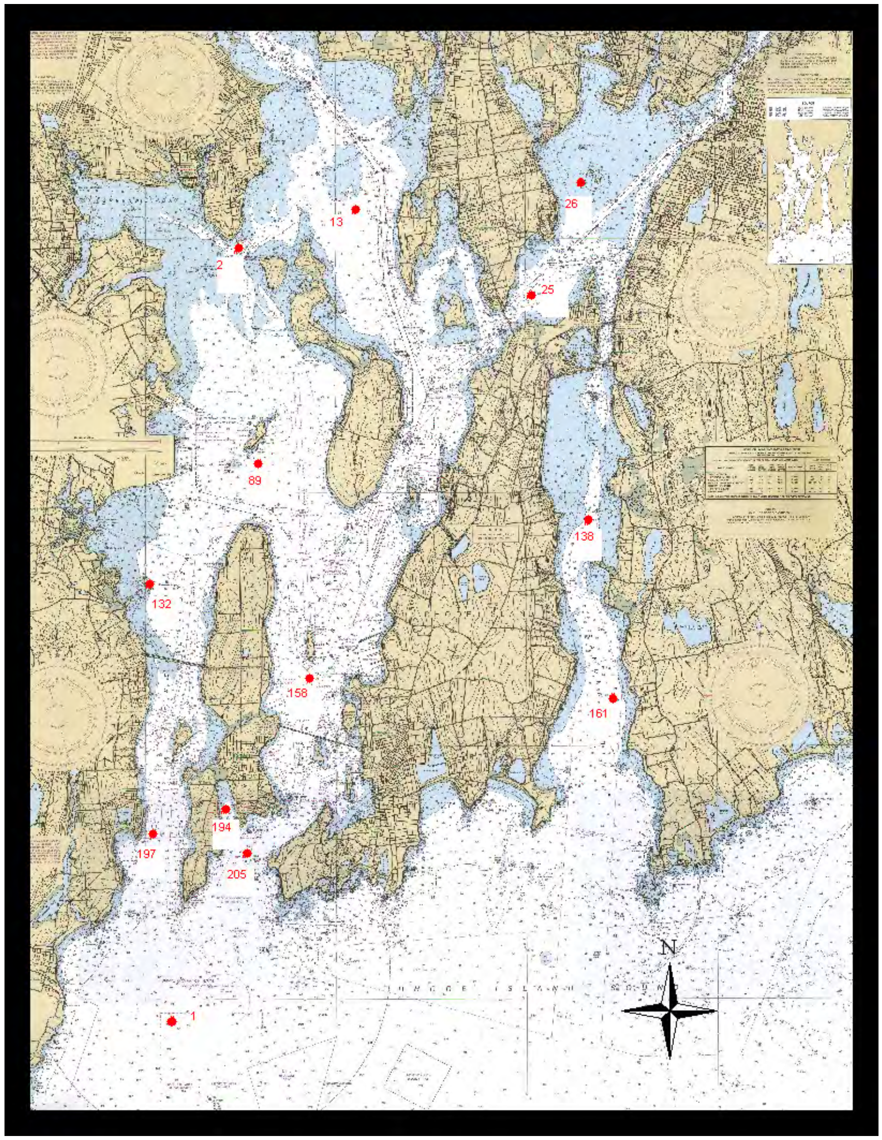


Figure 28. Map of Rhode Island Coastal Trawl Survey Monthly Segment fixed tow stations.

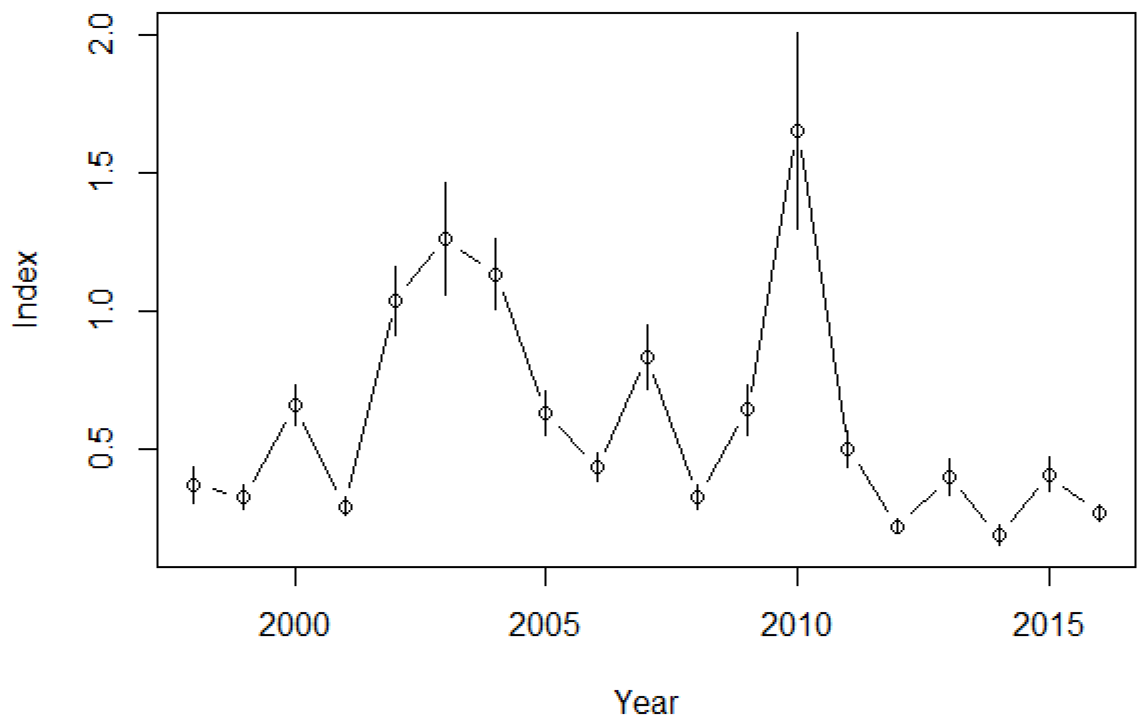


Figure 29. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of Rhode Island's Coastal Trawl Survey Monthly Segment with 95% confidence intervals.

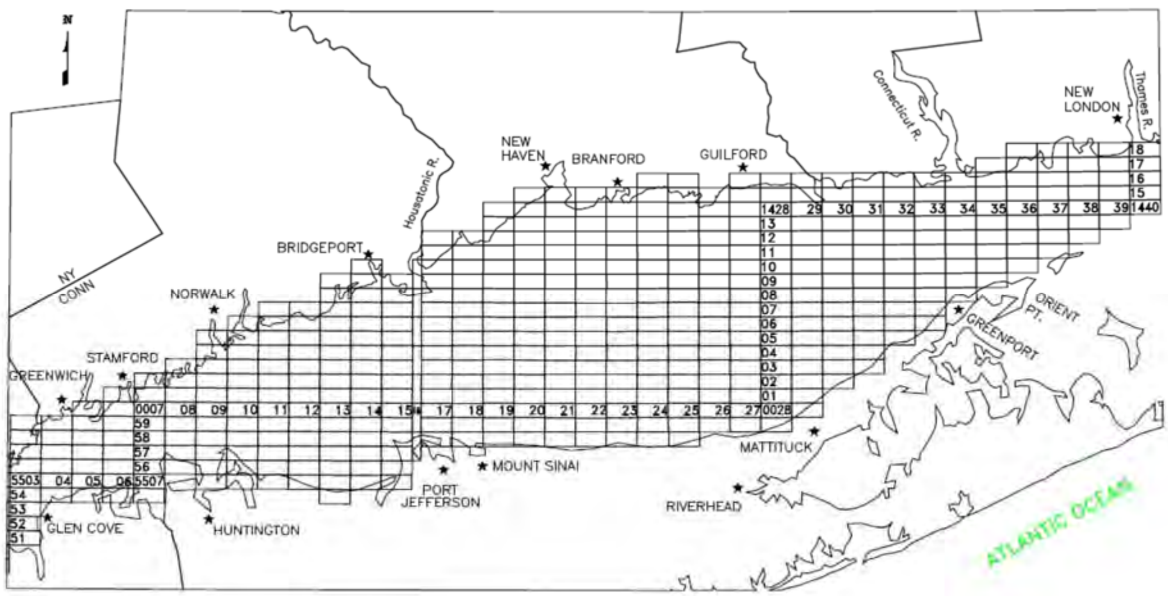


Figure 30. Map pf Connecticut DEEP Long Island Sound Trawl Survey site grid.

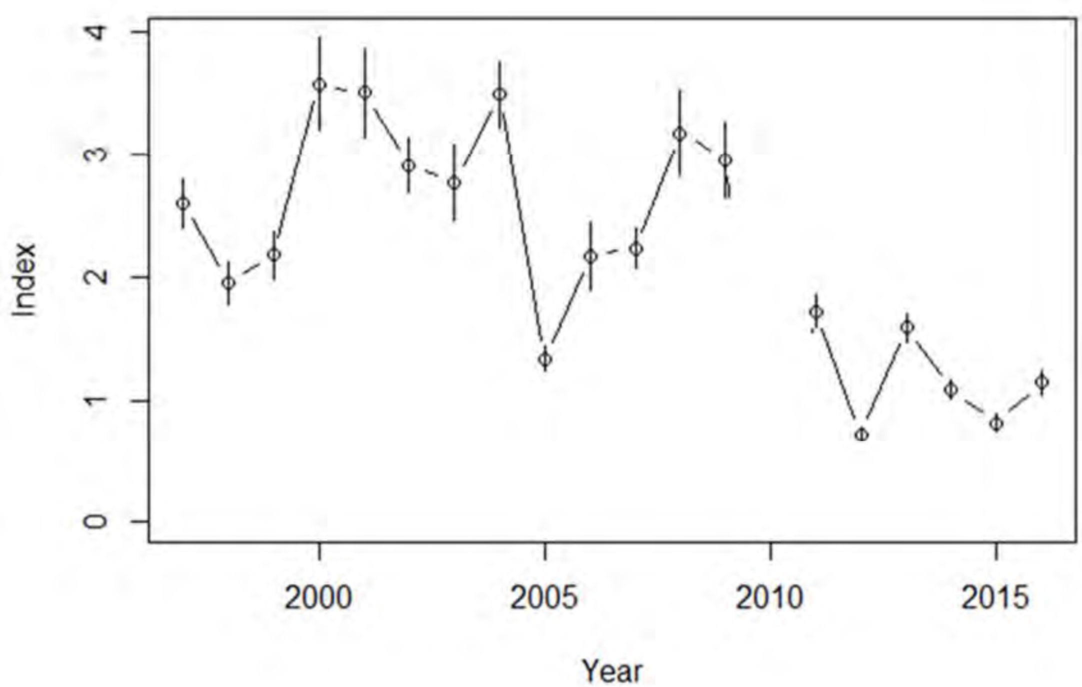


Figure 31. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of Connecticut DEEP Long Island Sound Trawl Survey with 95% confidence intervals.

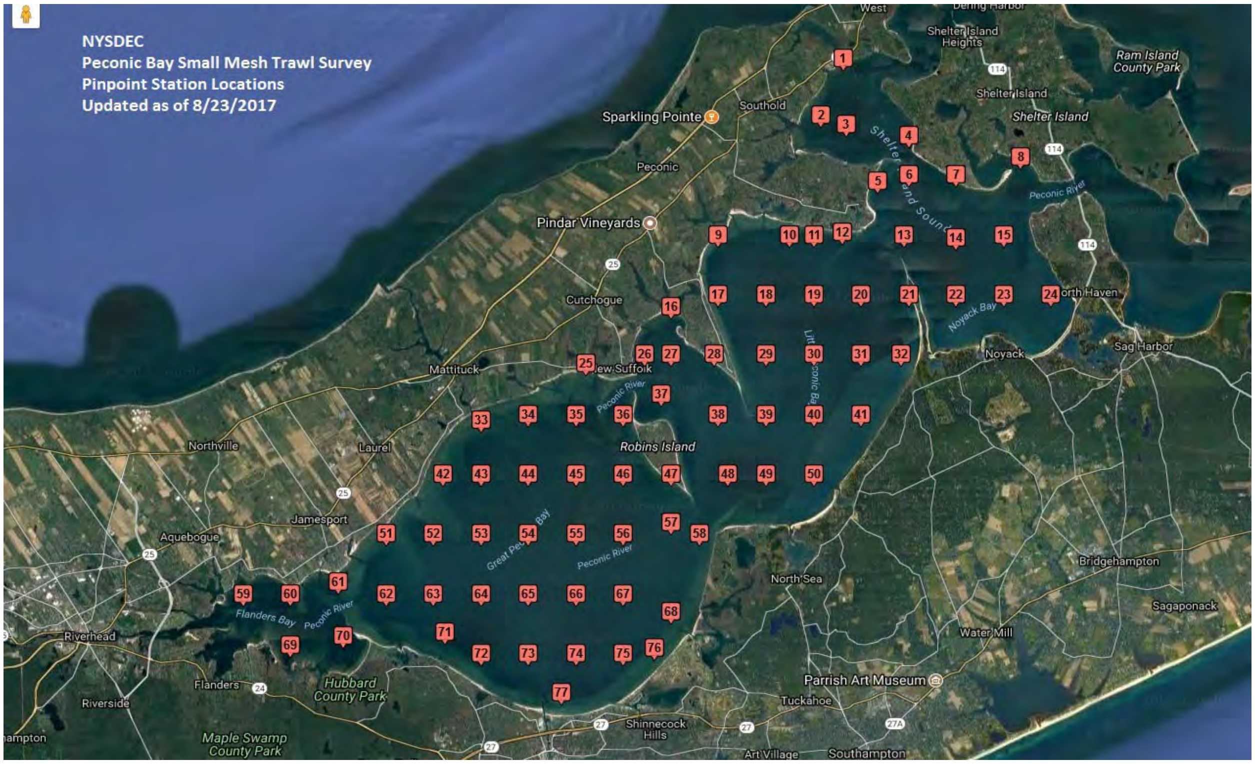


Figure 32. Map of New York Peconic Bay Small Mesh Trawl Survey Sampling Grid.

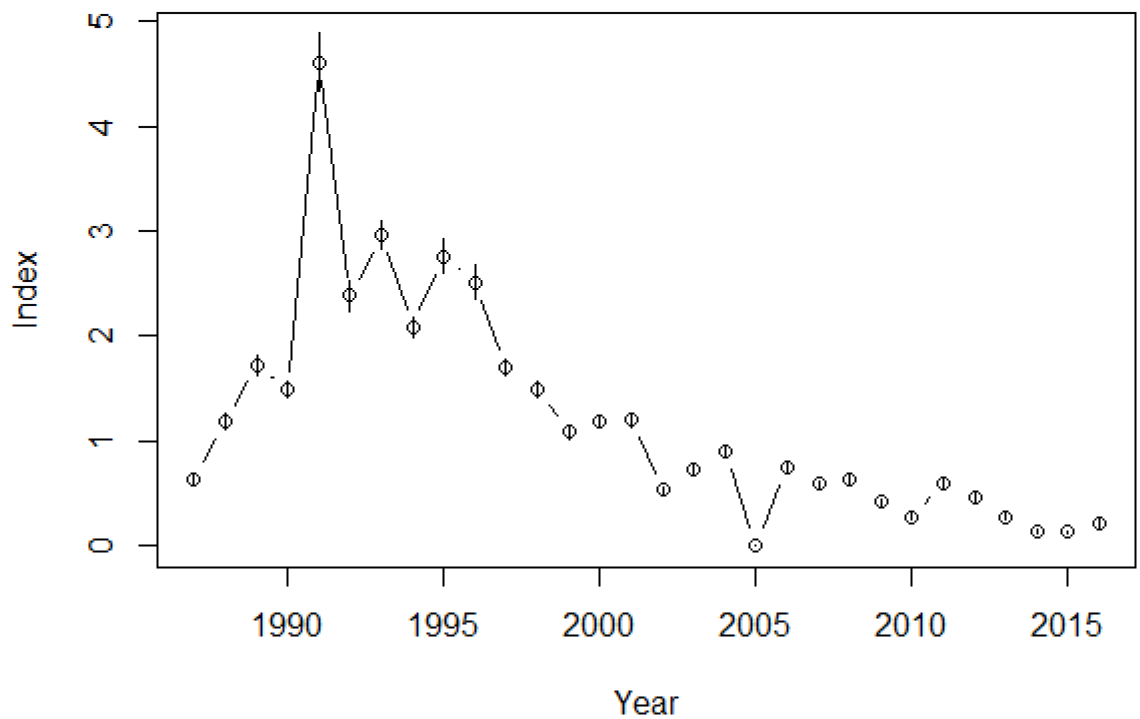


Figure 33. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of the New York DEC Peconic Bay Small Mesh Trawl Survey with 95% confidence intervals.

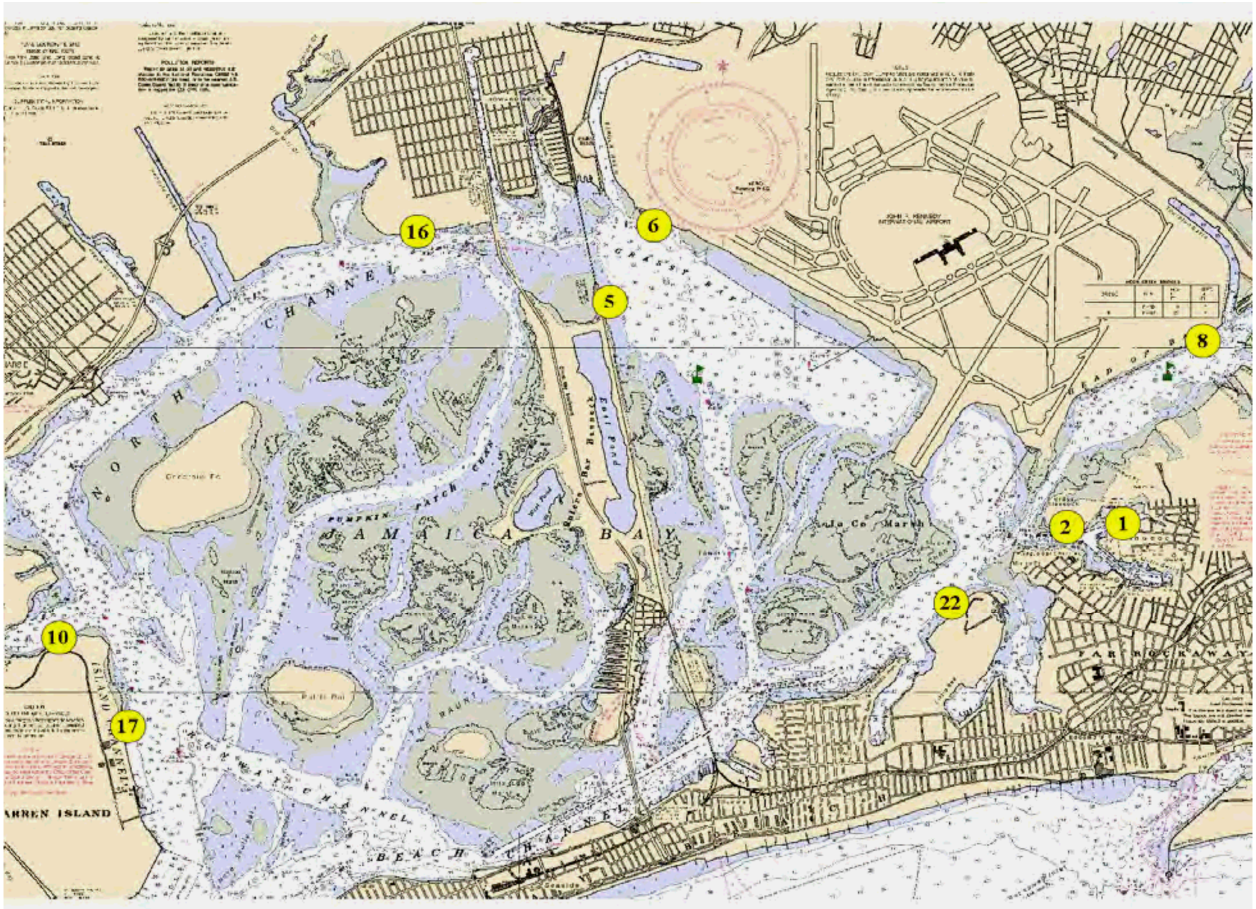


Figure 34. Map of New York DEC Western Long Island Beach Seine Survey Jamaica Bay Stations.

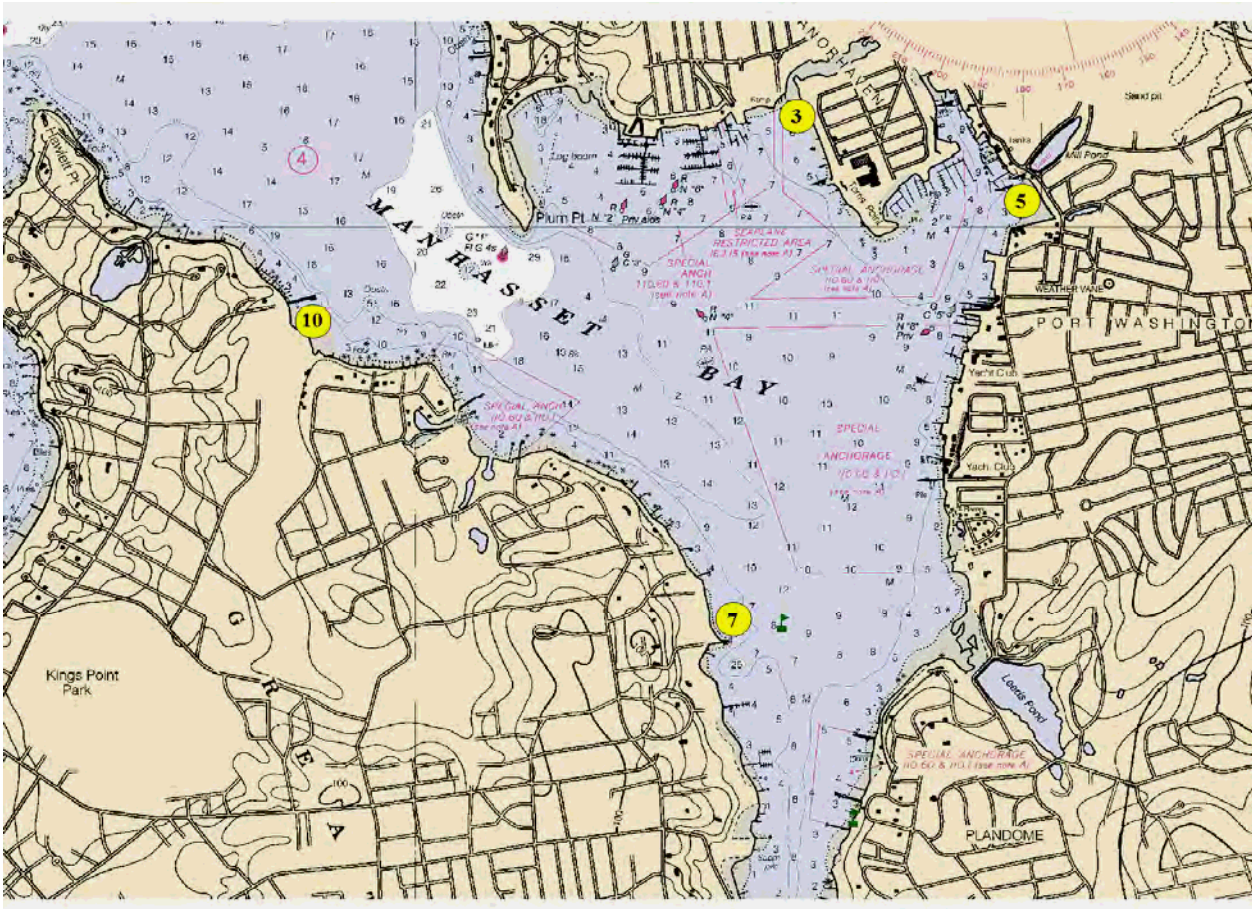


Figure 35. Map of New York DEC Western Long Island Beach Seine Survey Manhasset Bay Stations.

DRAFT DOCUMENT FOR BOARD REVIEW. PLEASE DO NOT CITE OR DISTRIBUTE.

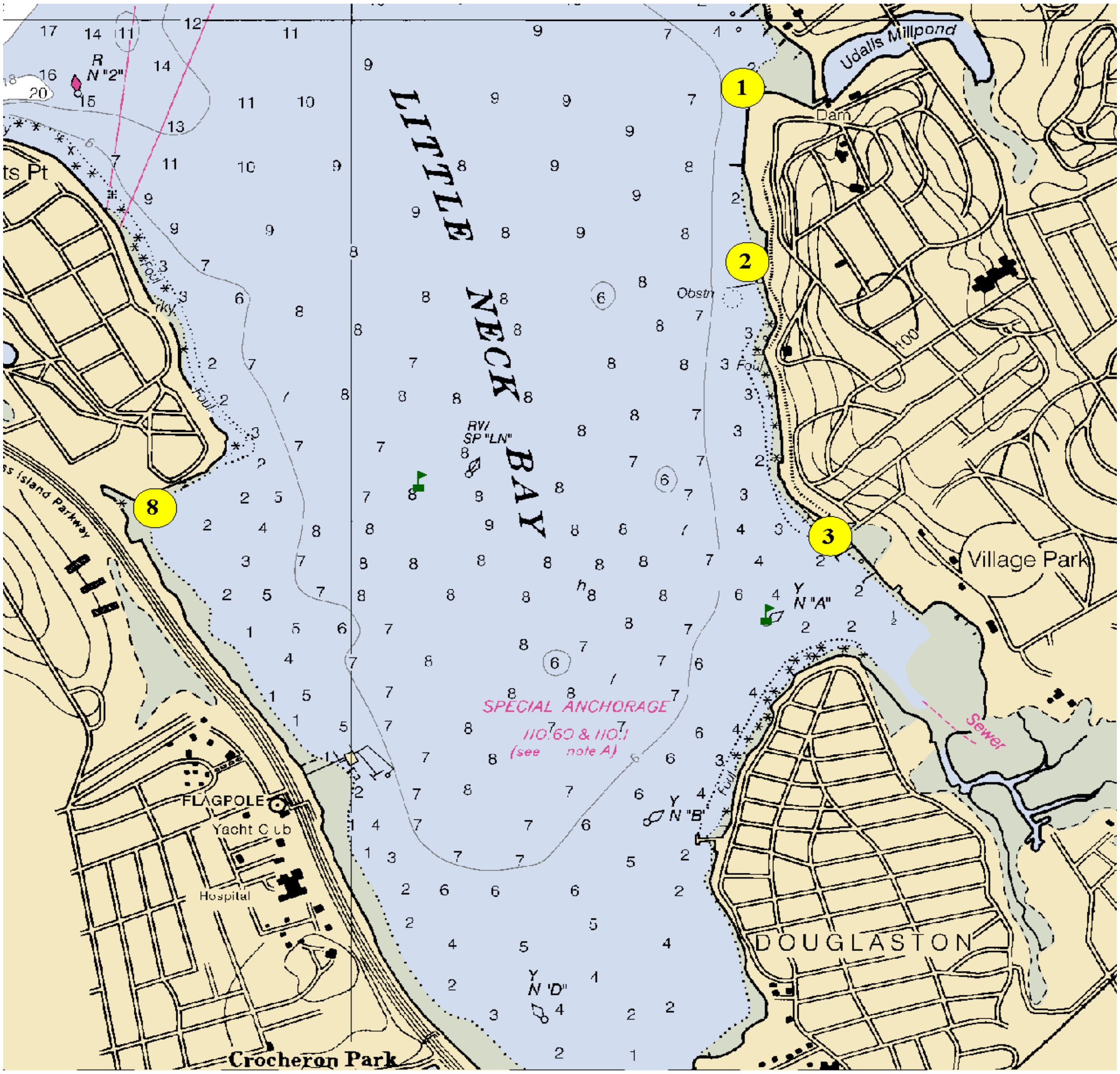


Figure 36. Map of New York DEC Western Long Island Beach Seine Survey Little Neck Bay Stations.

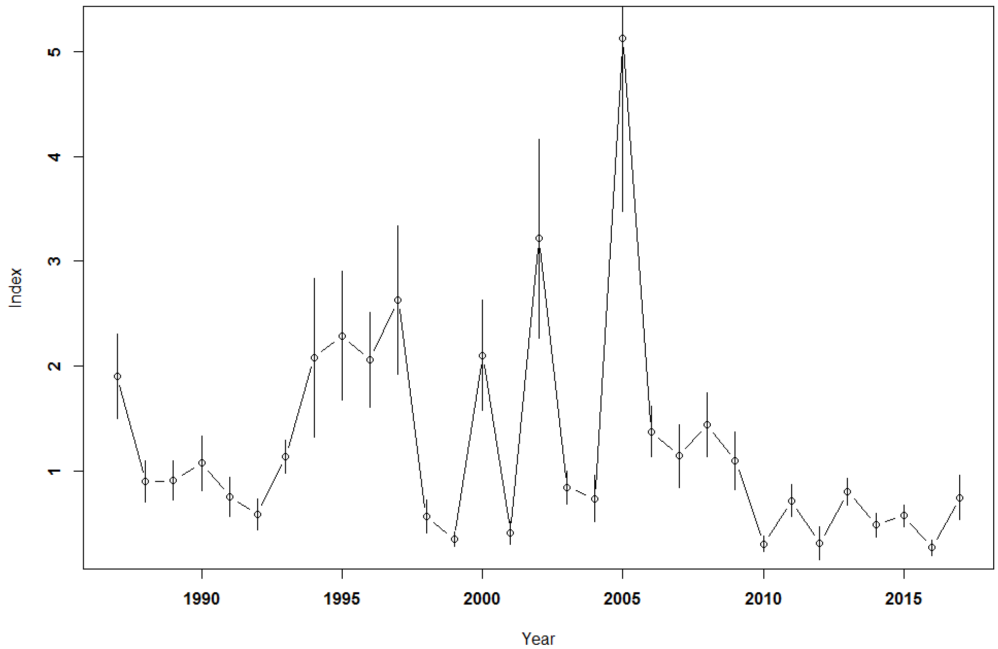


Figure 37. Index of relative abundance of horseshoe crab (delta mean catch per tow) in Jamaica Bay developed from the spring portion of the New York Seine Survey with 95% confidence intervals.

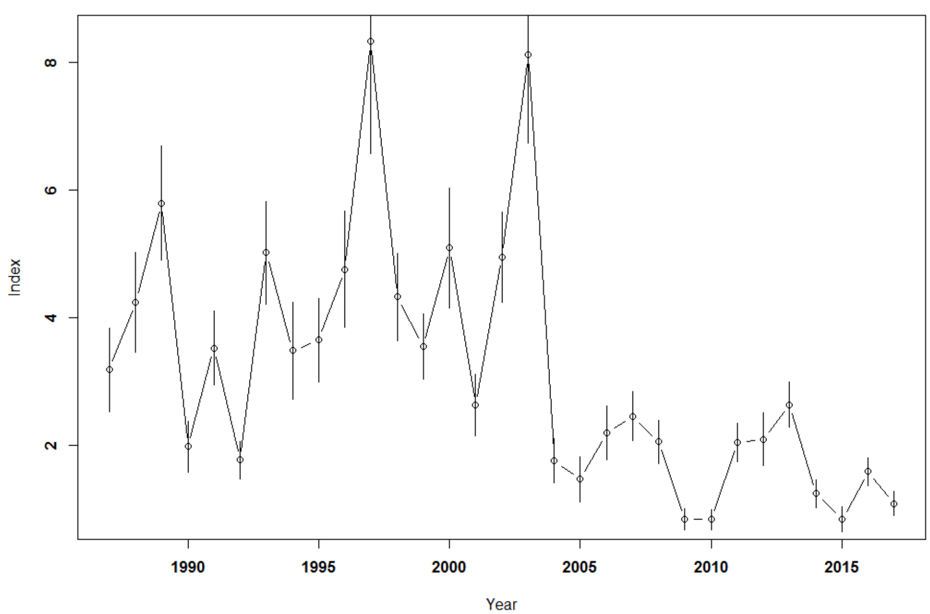


Figure 38. Index of relative abundance of horseshoe crab (delta mean catch per tow) in Manhassett and Little Neck Bays developed from the spring portion of the New York Seine Survey with 95% confidence intervals.

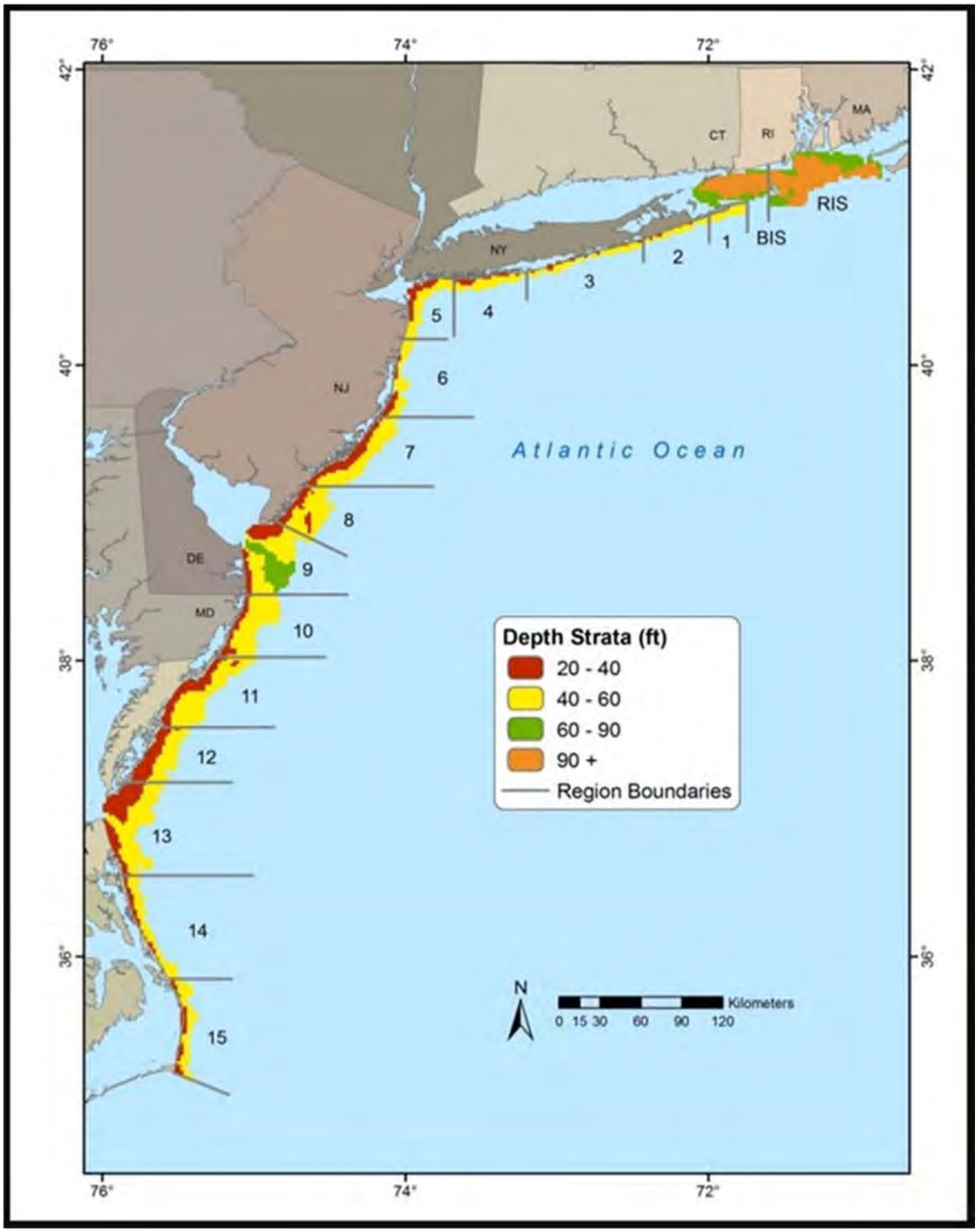


Figure 39. Map of the sampling strata used in the NEAMAP survey (map provided by NEAMAP and available on the website http://www.neamap.net/index.html.

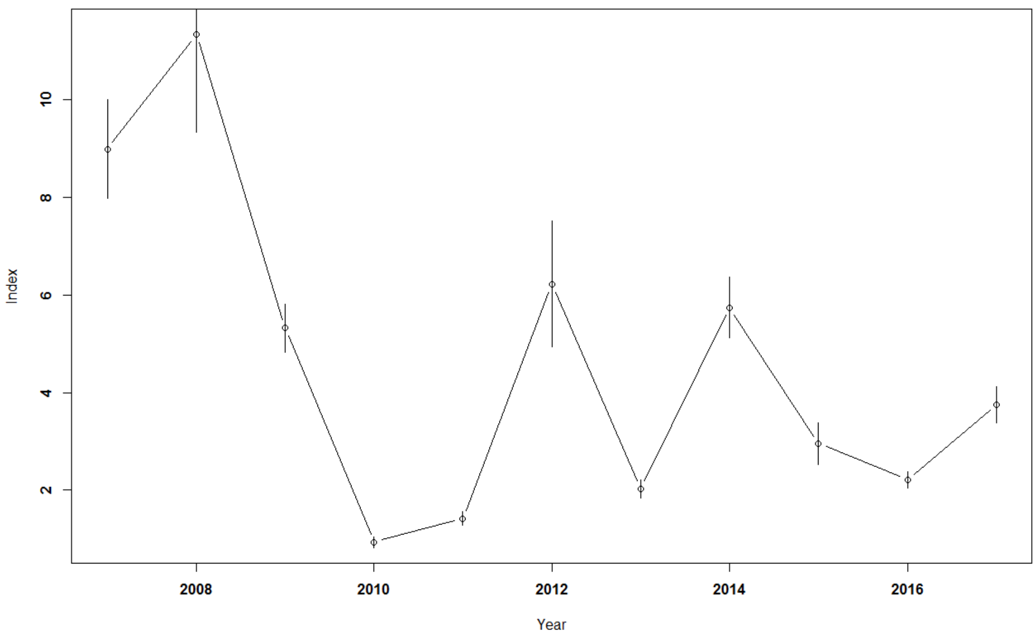


Figure 40. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of NEAMAP for the New York region with 95% confidence intervals.

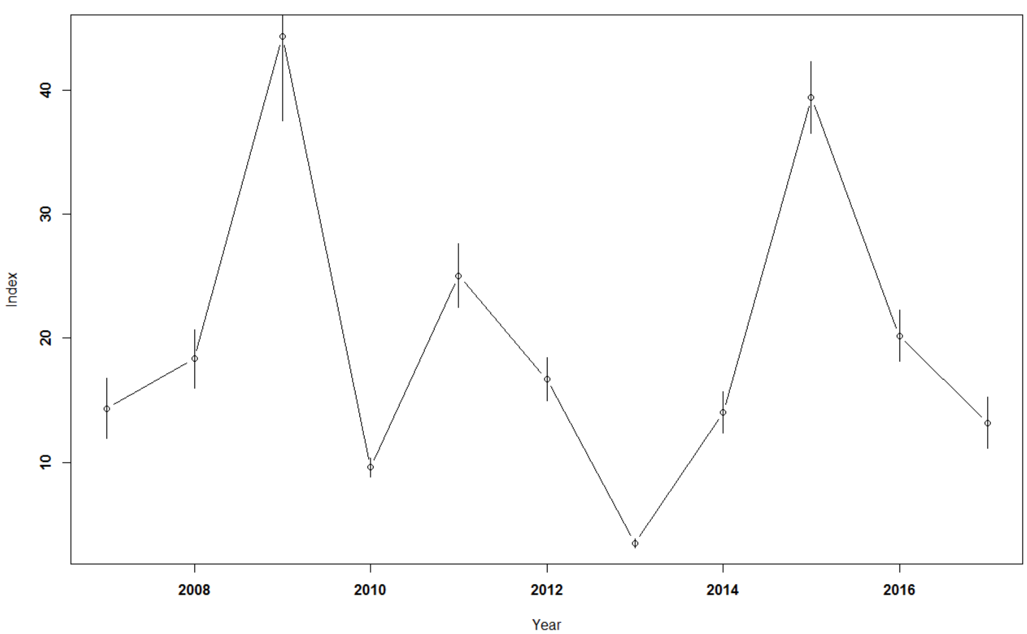


Figure 41. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the fall portion of NEAMAP for the Delaware Bay region with 95% confidence intervals.

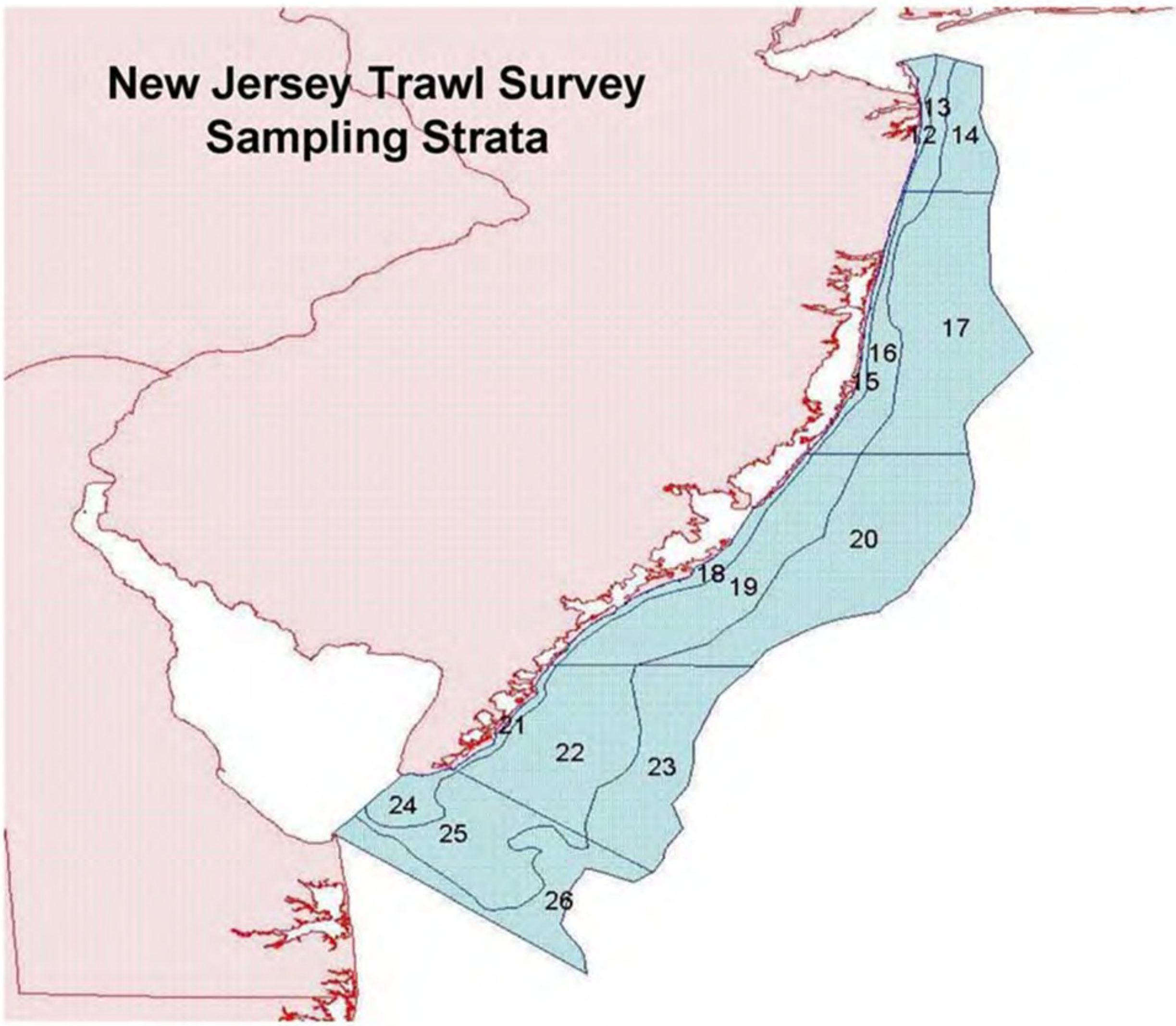


Figure 42. New Jersey Ocean Trawl Survey sampling area with survey strata defined.

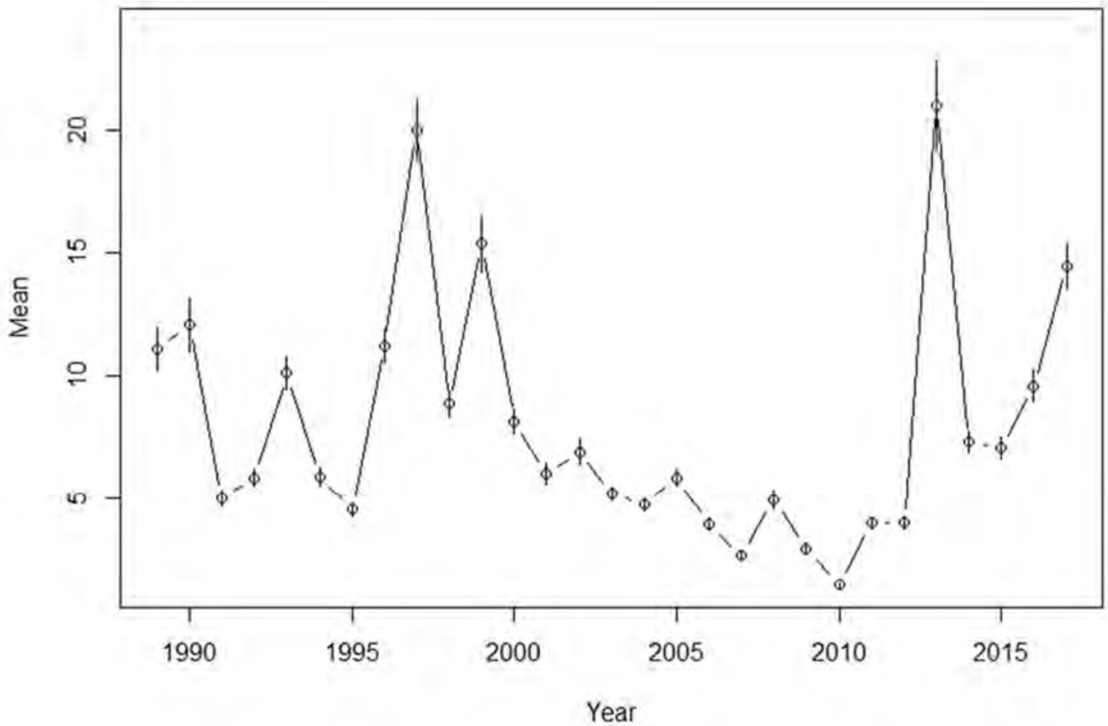


Figure 43. Abundance index for all horseshoe crabs in the spring (April and August) samples from New Jersey's Ocean Trawl Survey.

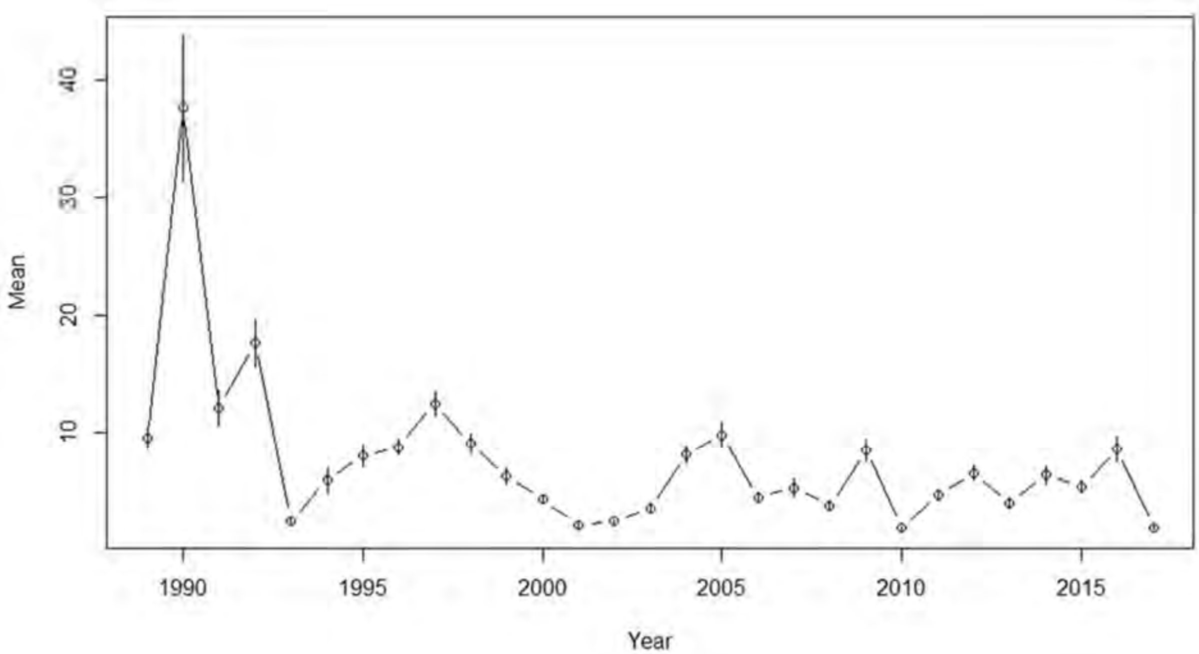


Figure 44. Abundance index for all horseshoe crabs in the fall (October) samples from New Jersey's Ocean Trawl Survey.

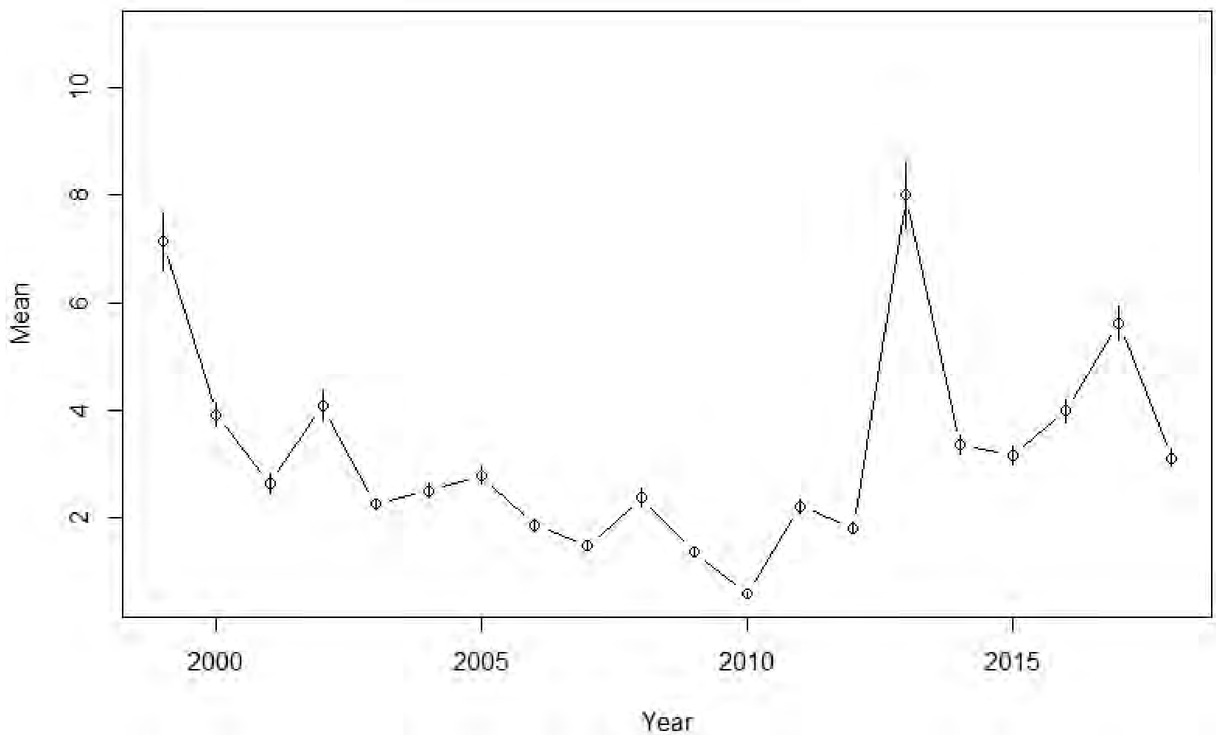


Figure 45. Abundance index for adult female horseshoe crabs (>= 19 cm pw) in the spring (April and August) from New Jersey's Ocean Trawl Survey.

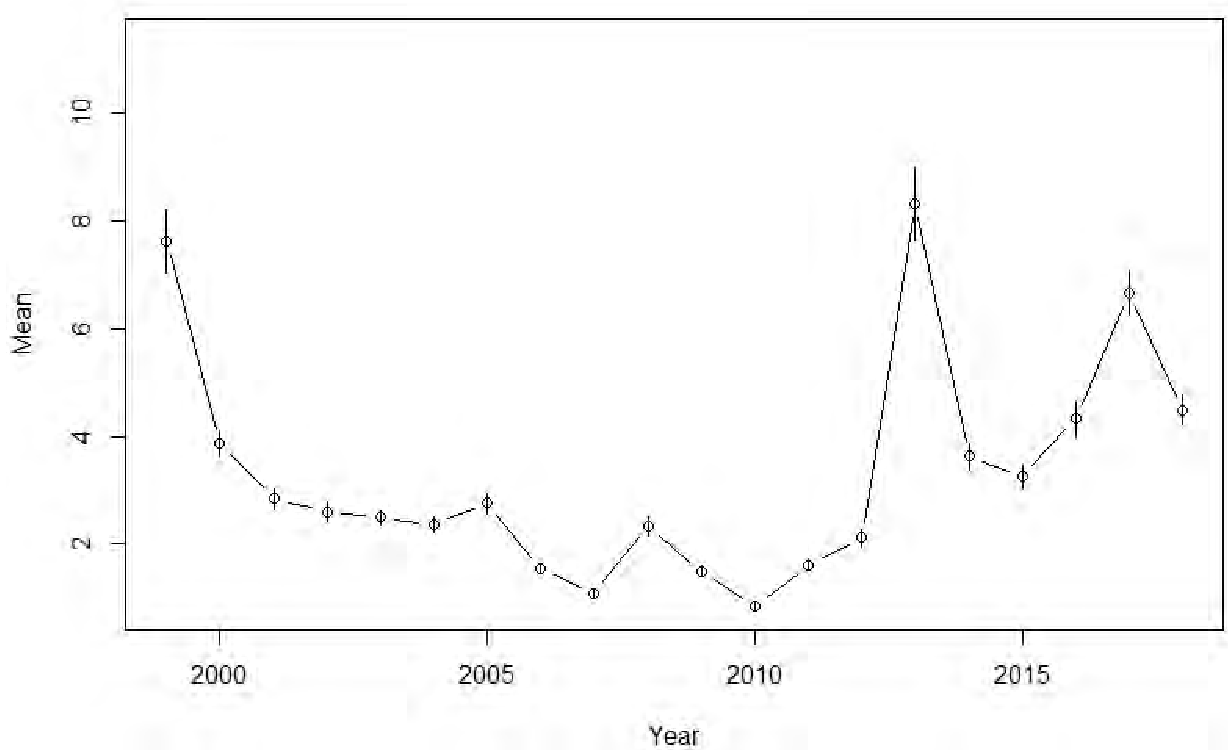


Figure 46. Abundance index for adult male horseshoe crabs in the spring (April and August) from New Jersey's Ocean Trawl Survey.

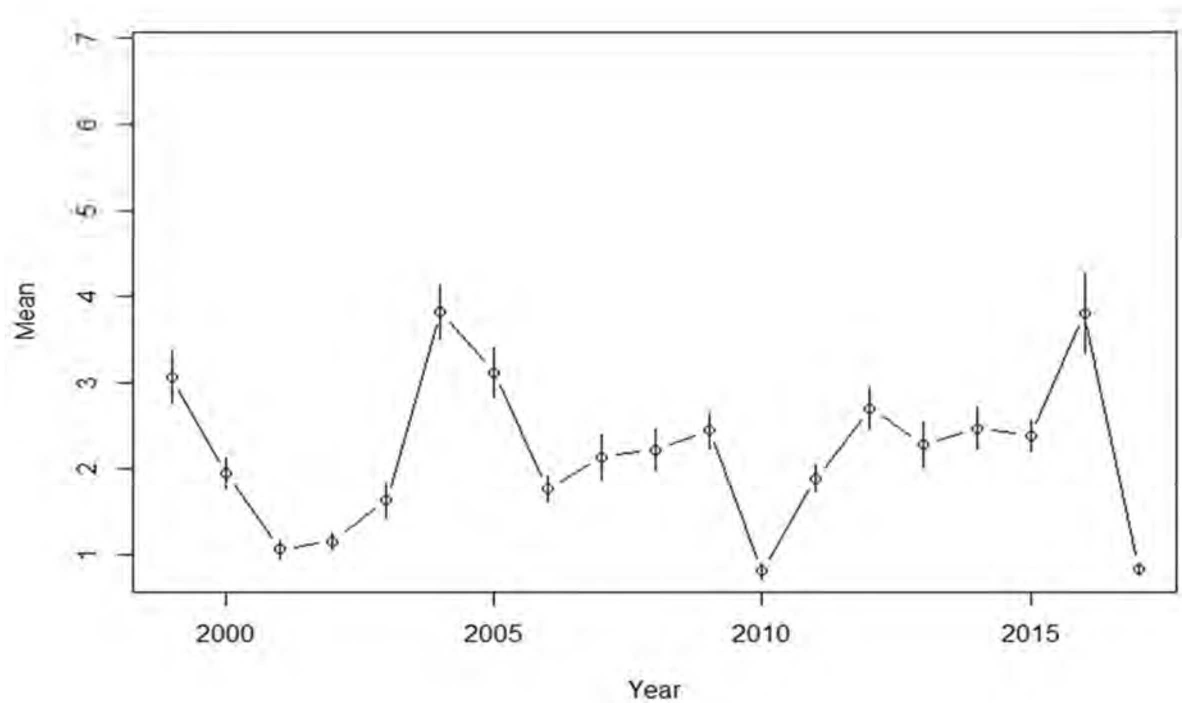


Figure 47. Abundance index for adult female horseshoe crabs (>= 19 cm pw) in the fall (October) from New Jersey's Ocean Trawl Survey.

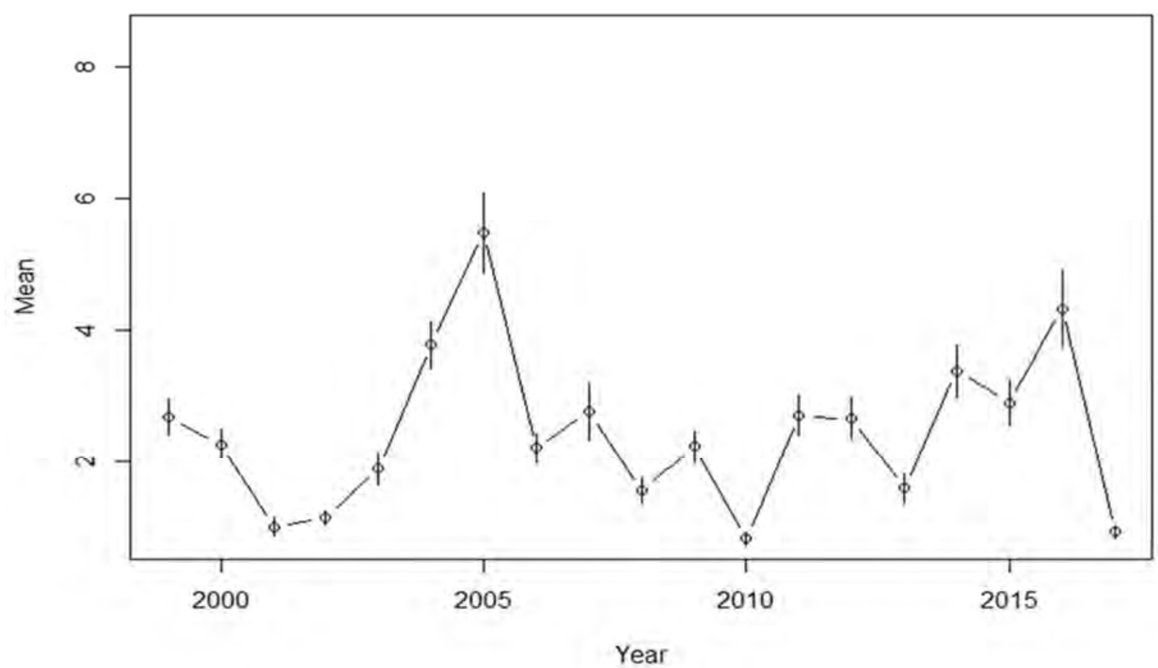


Figure 48. Abundance index for adult male horseshoe crabs in the fall (October) from New Jersey's Ocean Trawl Survey.

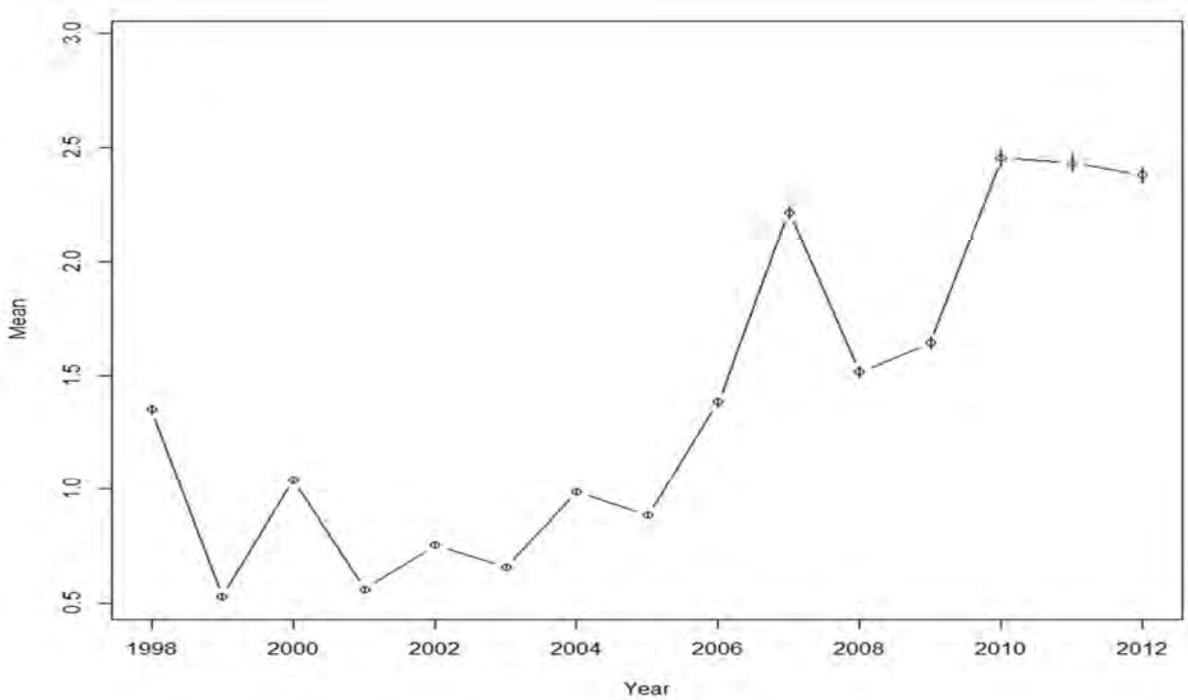


Figure 49. Abundance index for all horseshoe crabs combined in New Jersey's Surf Clam Dredge Survey (June, July, August).

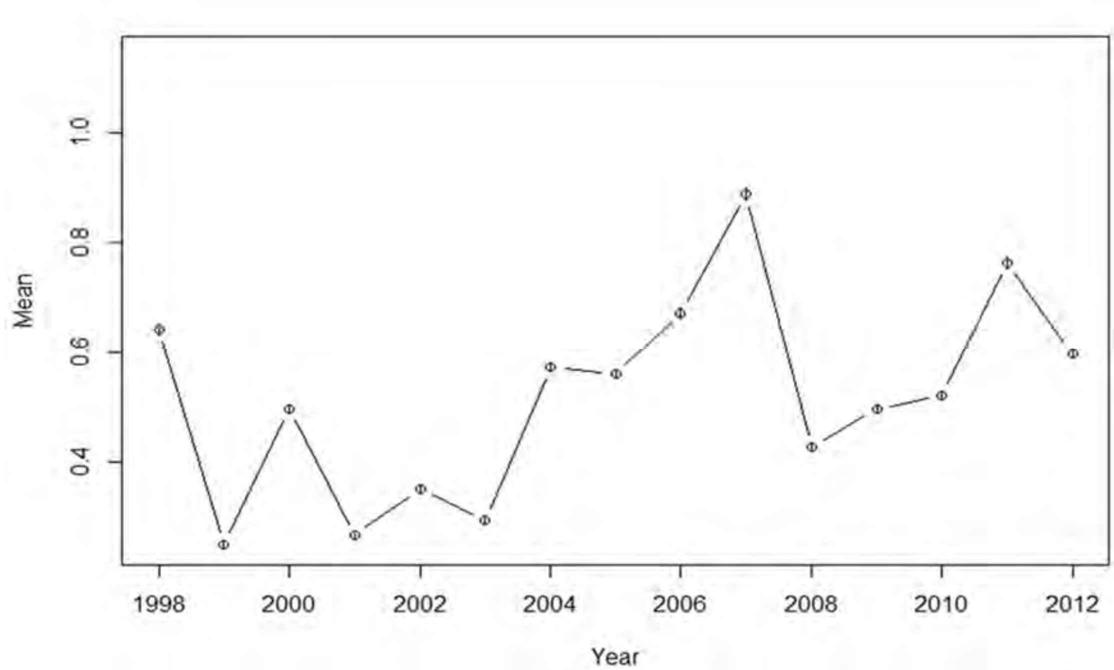


Figure 50. Abundance index for adult female horseshoe crabs (> 180 mm pw) in New Jersey's Surf Clam Dredge Survey (June, July, August).

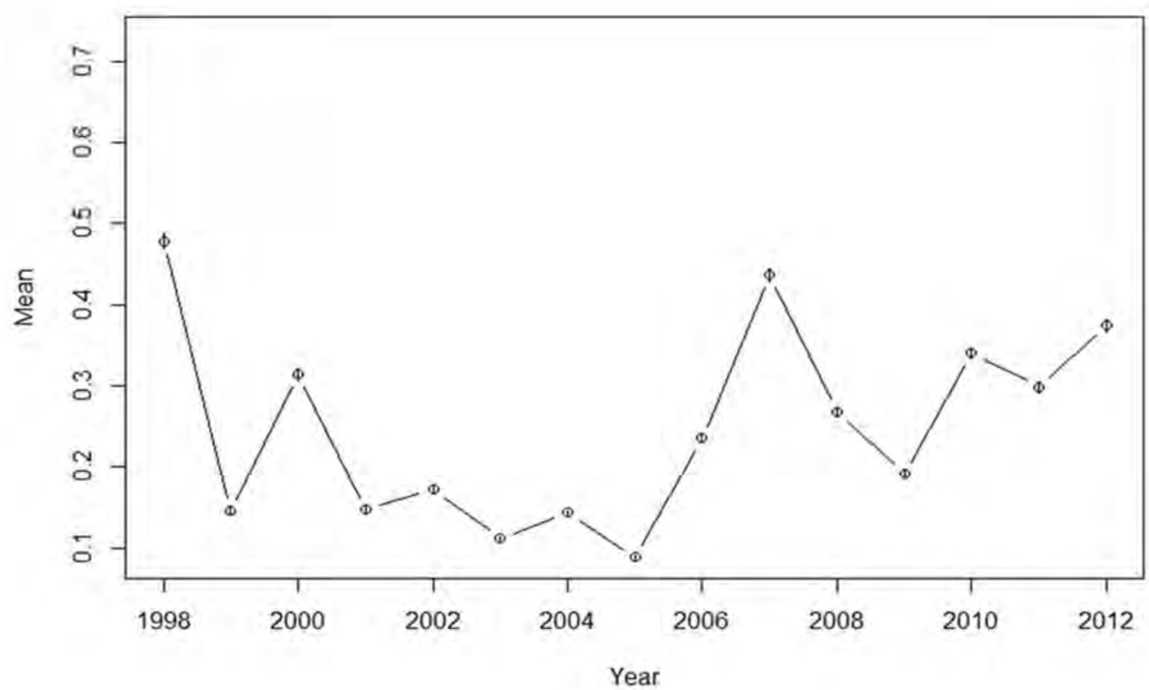


Figure 51. Abundance index for adult male horseshoe crabs (possessing male pedipalps) in New Jersey's Surf Clam Dredge Survey (June, July, August).

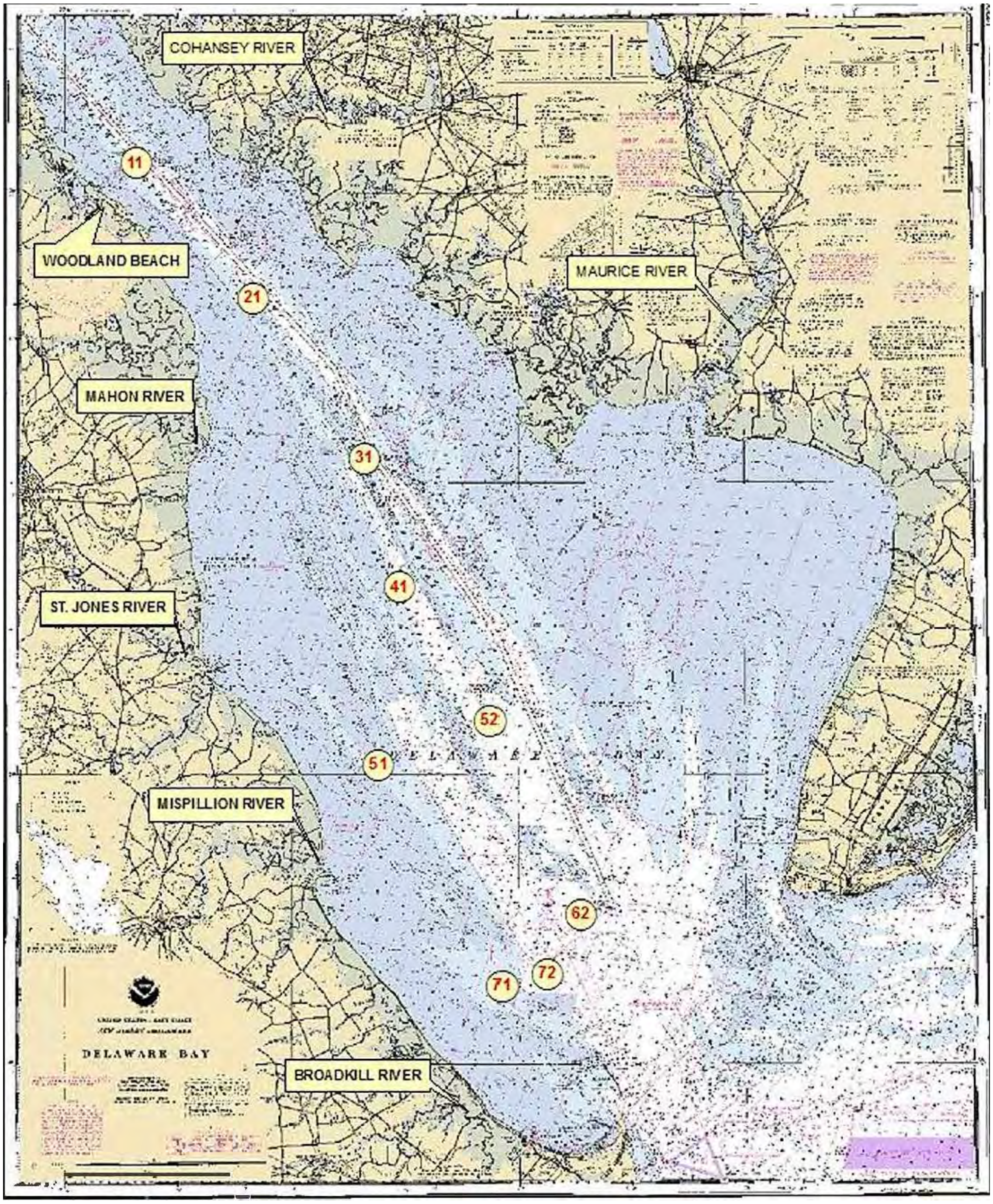


Figure 52. Delaware Fish & Wildlife Adult Trawl Survey sampling area and stations.

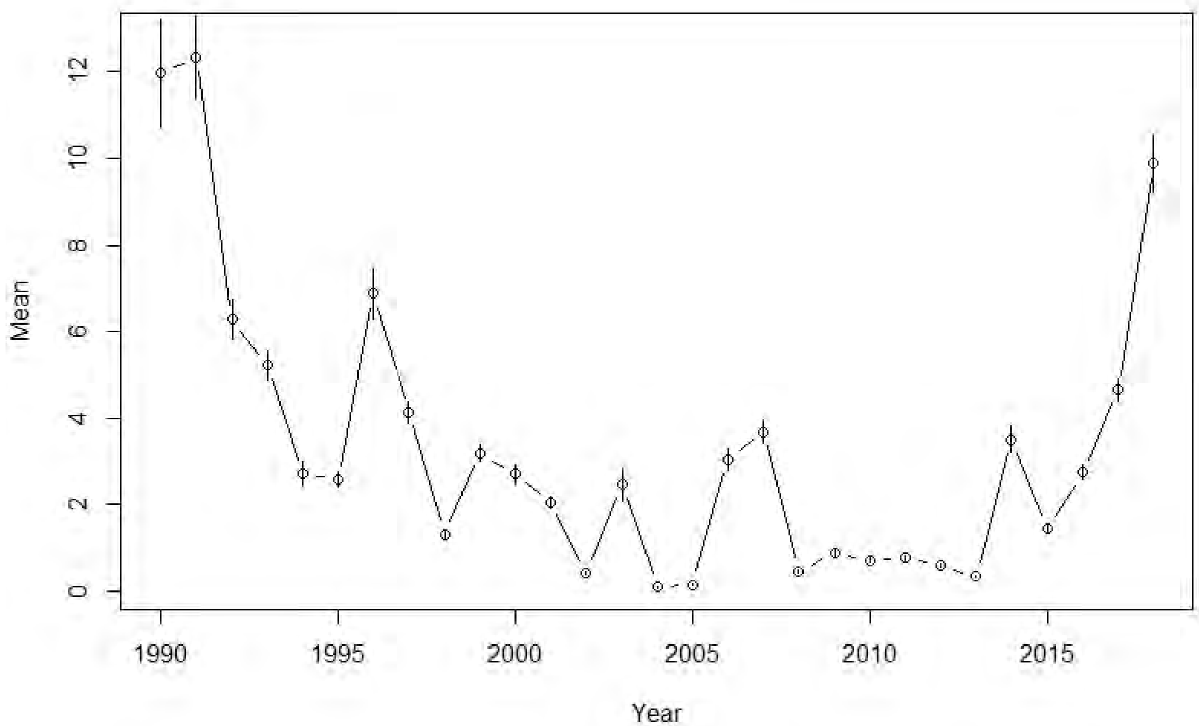


Figure 53. Delaware Fish and Wildlife Adult Trawl Survey abundance index for all adult horseshoe crabs combined in spring (March through August).

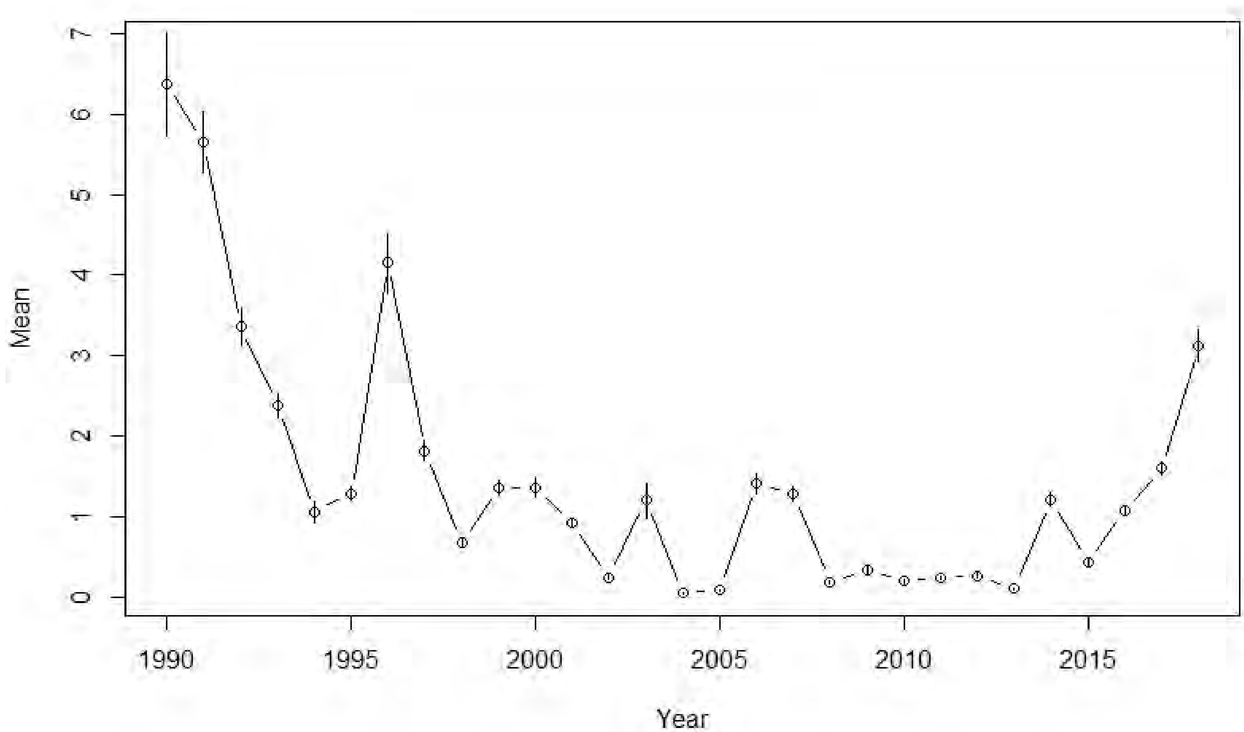


Figure 54. Delaware Fish and Wildlife Adult Trawl Survey abundance index for all adult female horseshoe crabs in spring (March through August).

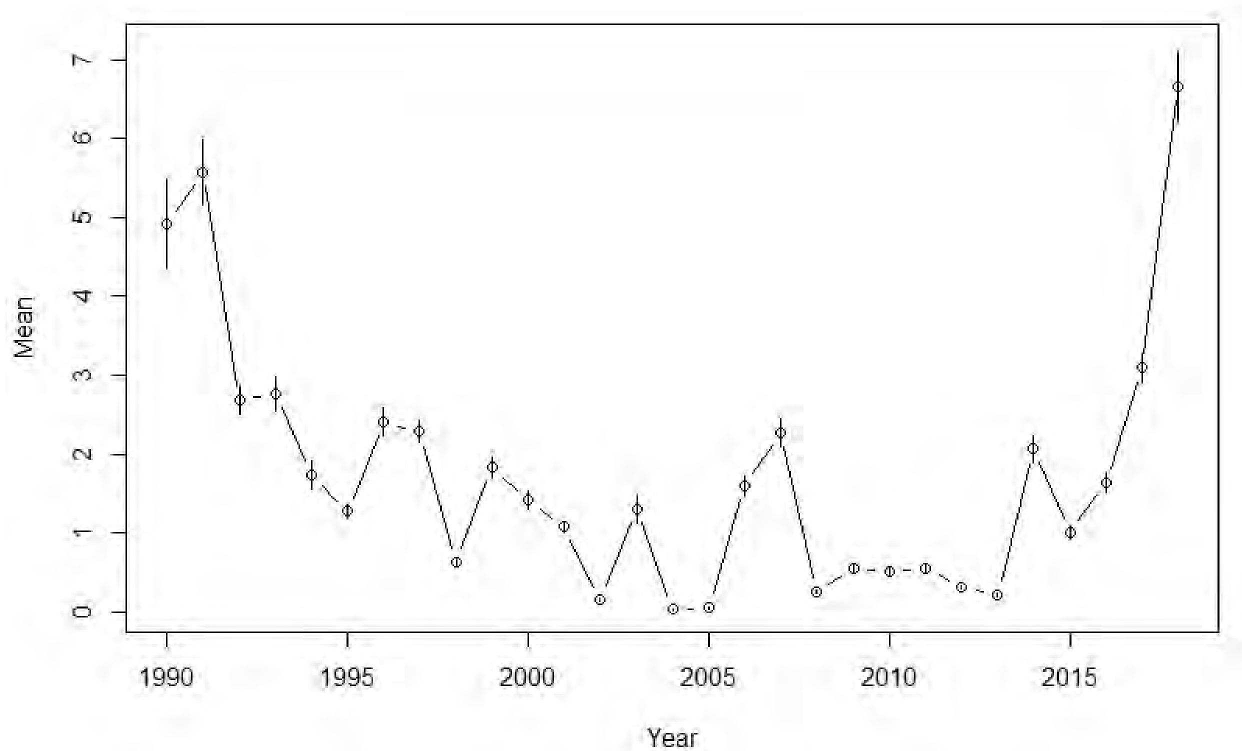


Figure 55. Delaware Fish and Wildlife Adult Trawl Survey abundance index for all adult male horseshoe crabs in spring (March through August).

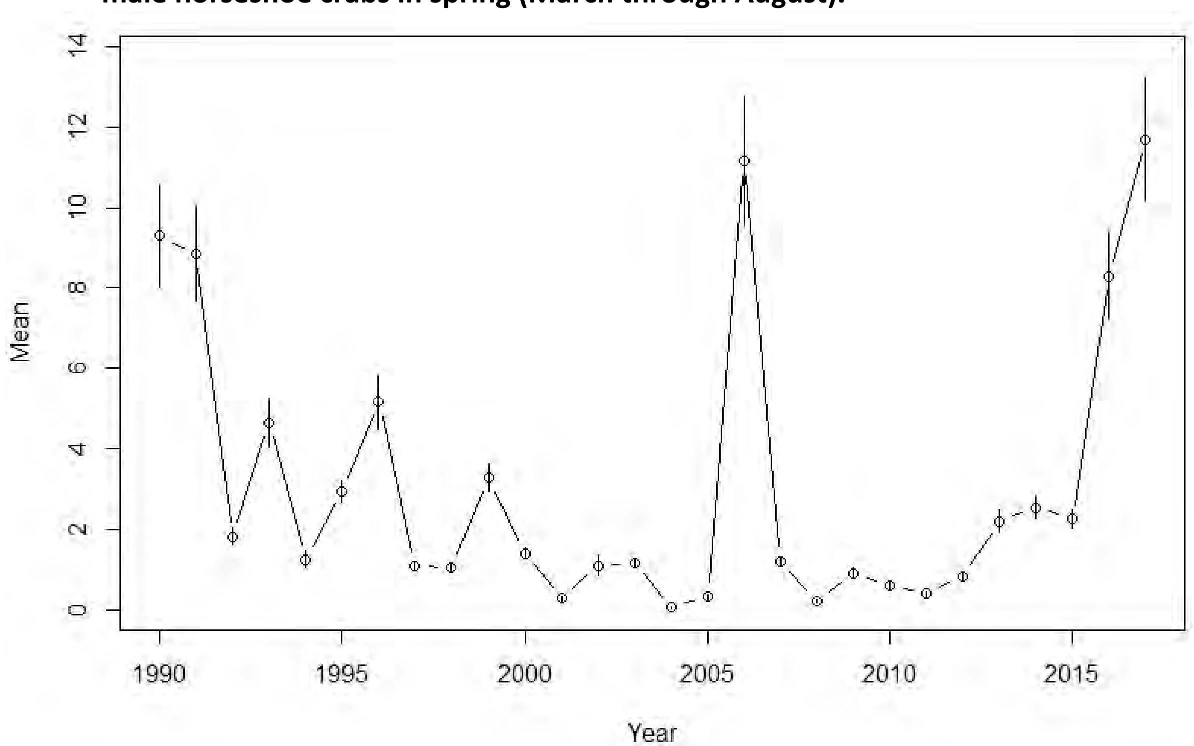


Figure 56. Delaware Fish and Wildlife Adult Trawl Survey abundance index for all adult horseshoe crabs combined in fall (September through December).

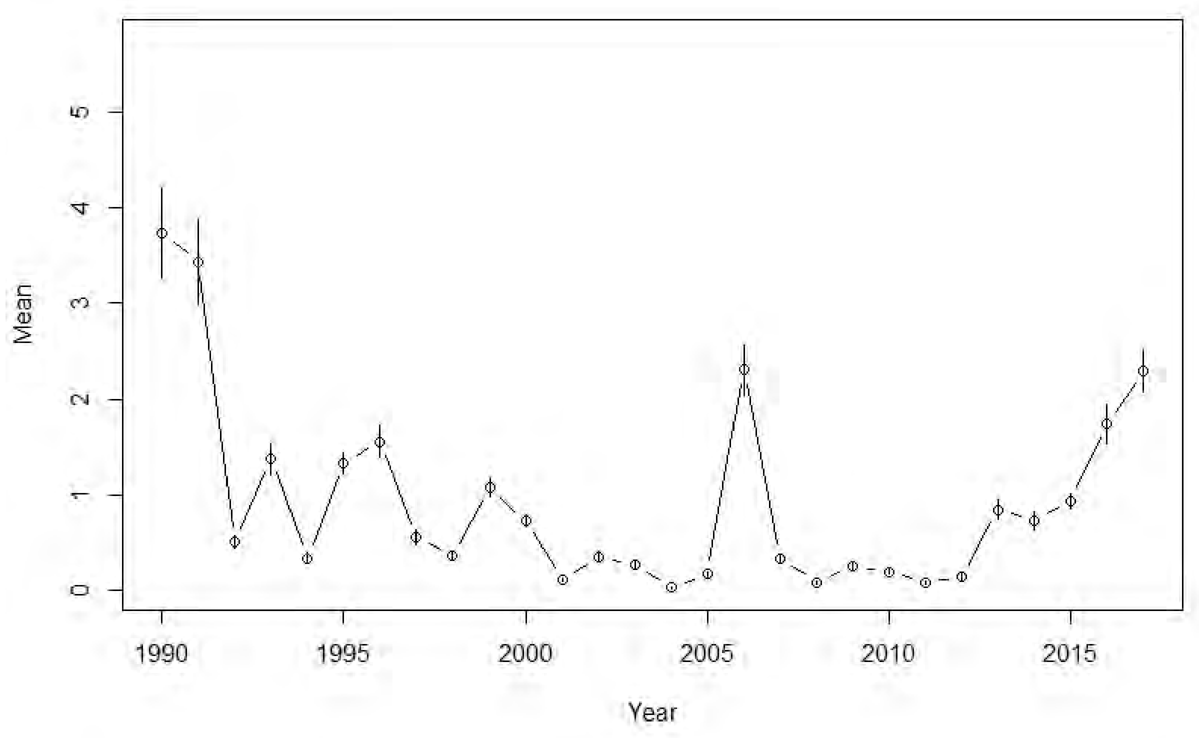


Figure 57. Delaware Fish and Wildlife Adult Trawl Survey abundance index for adult female horseshoe crabs in fall (September through December).

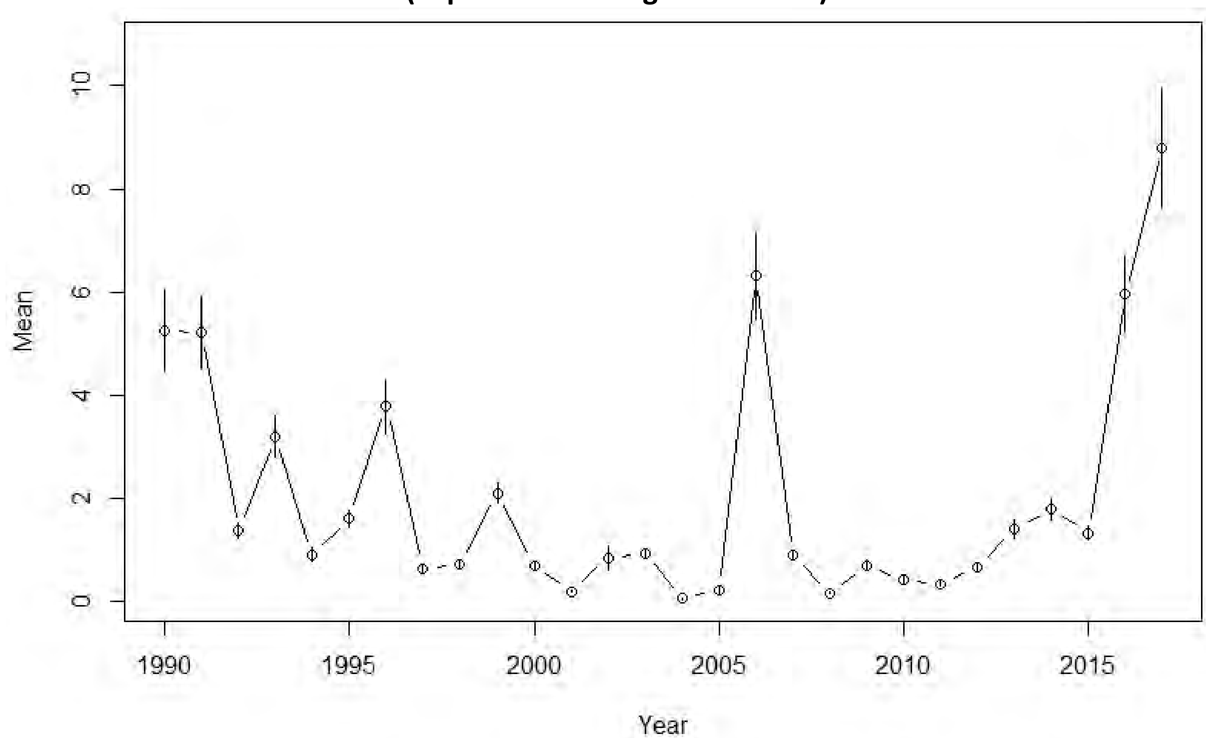


Figure 58. Delaware Fish and Wildlife Adult Trawl Survey abundance index for adult male horseshoe crabs in fall (September through December).

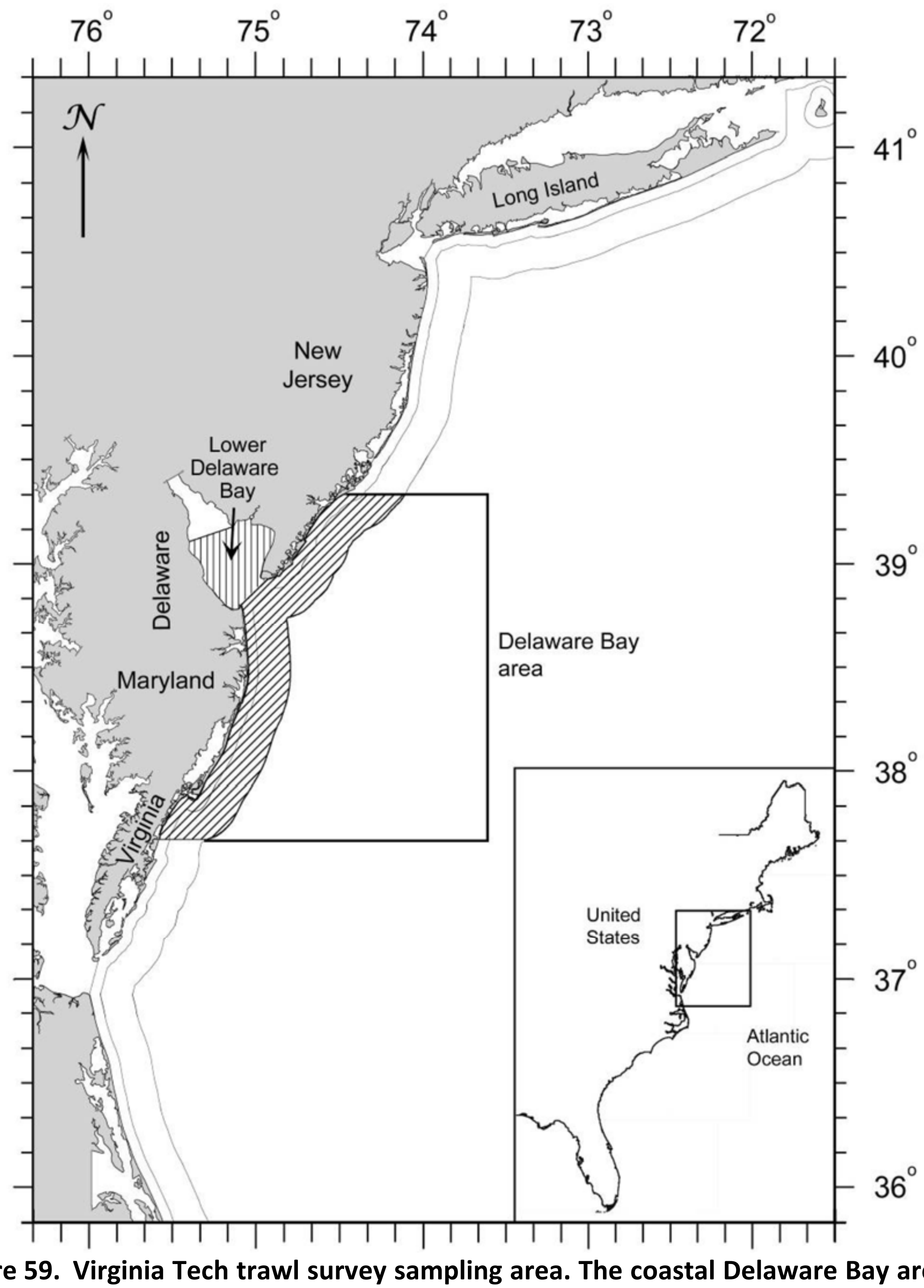


Figure 59. Virginia Tech trawl survey sampling area. The coastal Delaware Bay area (DBA) and Lower Delaware Bay (LDB) survey areas are indicated. Mean catches among years were compared using stations within the shaded portions of the survey area in the annual report (map provided by Virginia Tech).

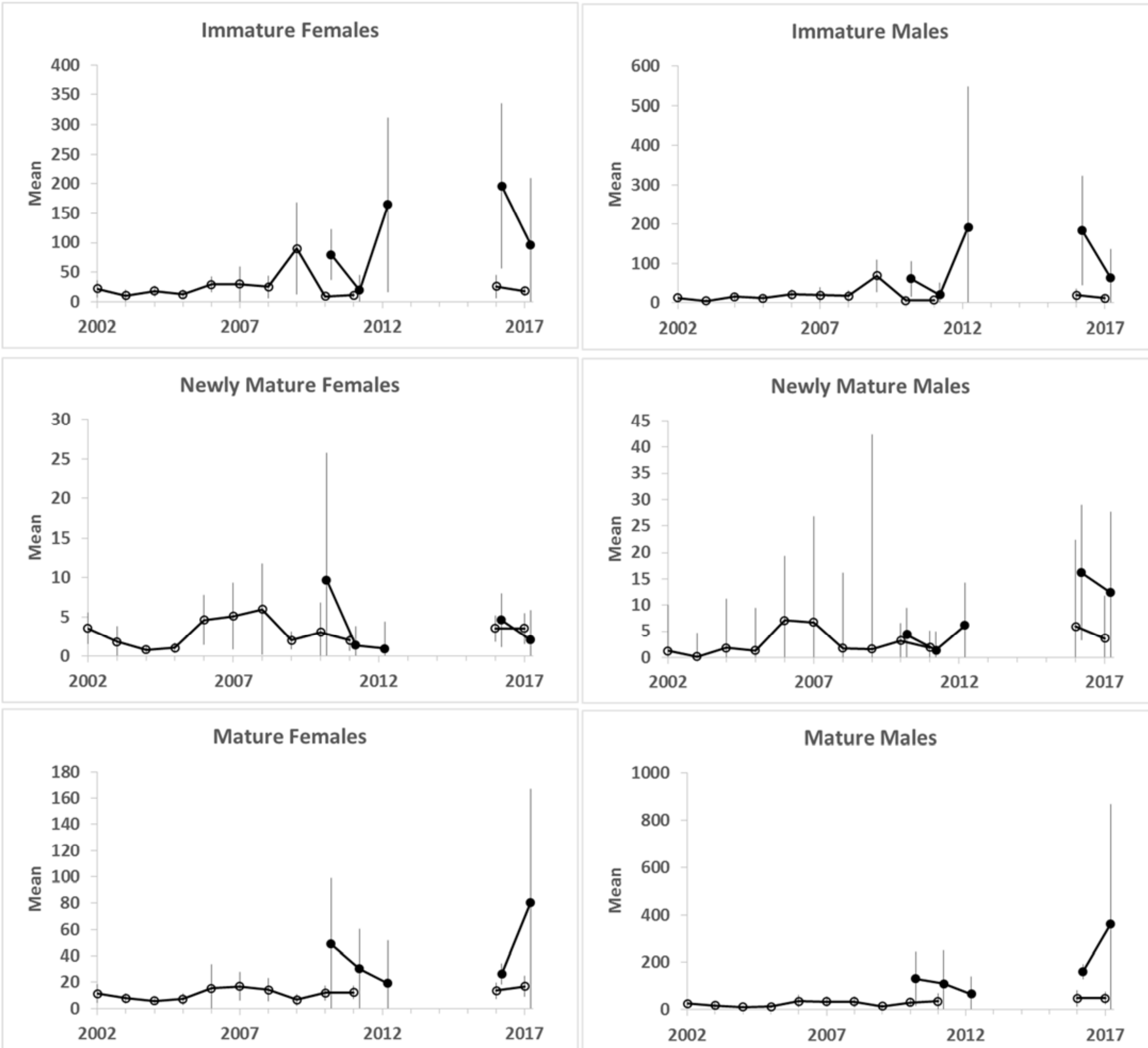


Figure 60. Delta distribution model mean catches per tow of horseshoe crabs in the lower Delaware Bay survey by demographic group with coastal Delaware Bay area survey means for comparion. Vertical lines indicate 95% confidence limits. Solid symbols indicate the lower Delaware Bay survey. Open symbols indicate the coastal Delaware Bay area survey. Note differences in y-axis scales.

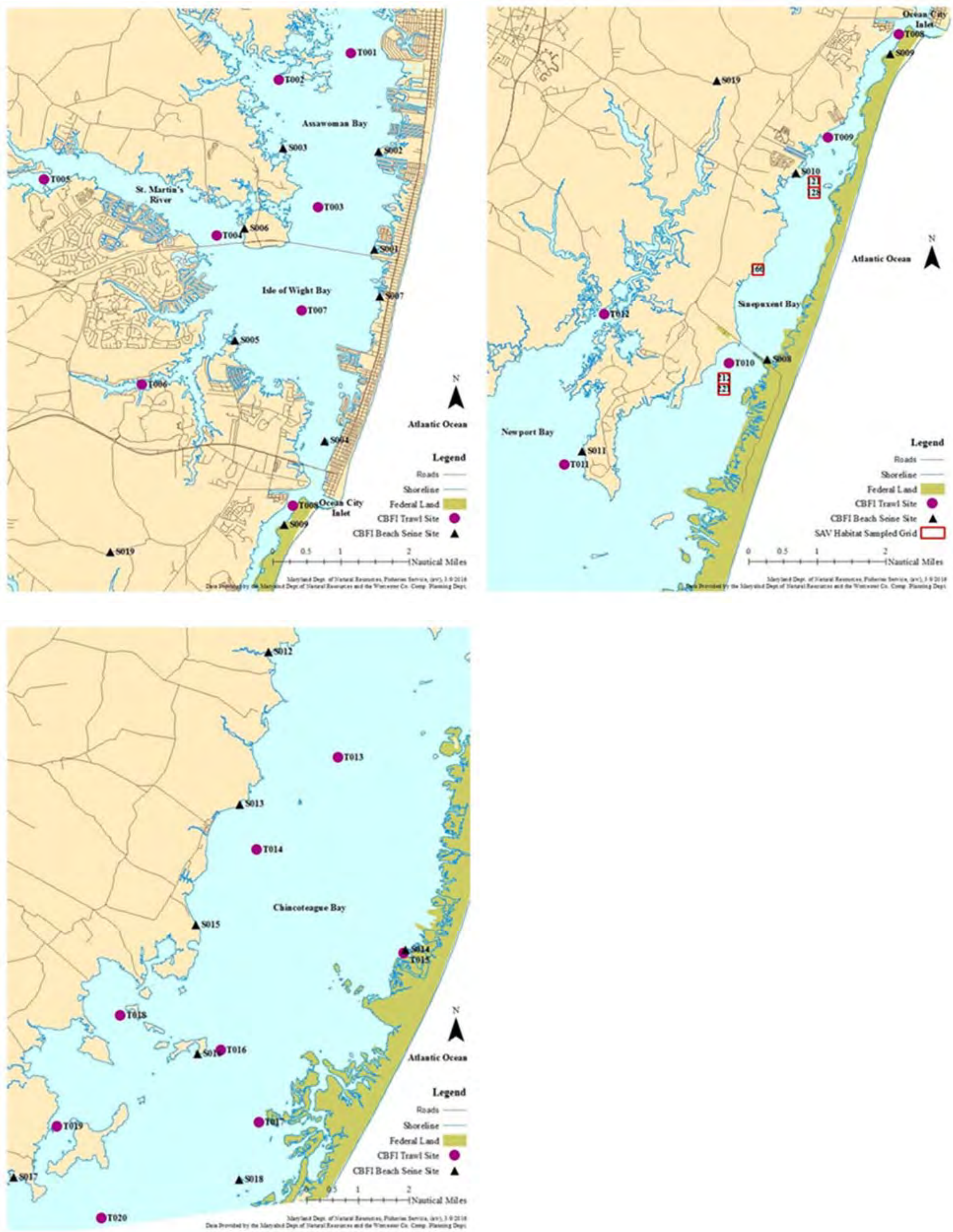


Figure 61. Map of the Maryland Coastal Bays Survey sampling sites. Trawl sites are labled with the prefix of "T" (map from MD DNR).

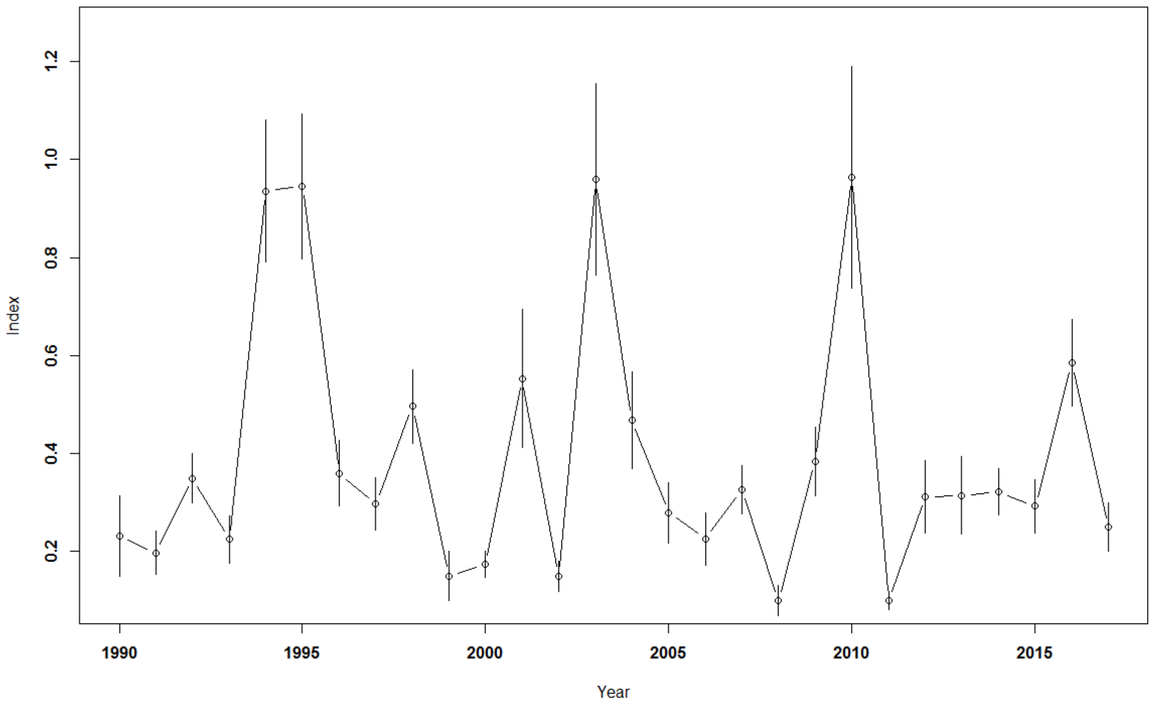


Figure 62. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the spring portion of Maryland's Coastal Bays Survey with 95% confidence intervals.

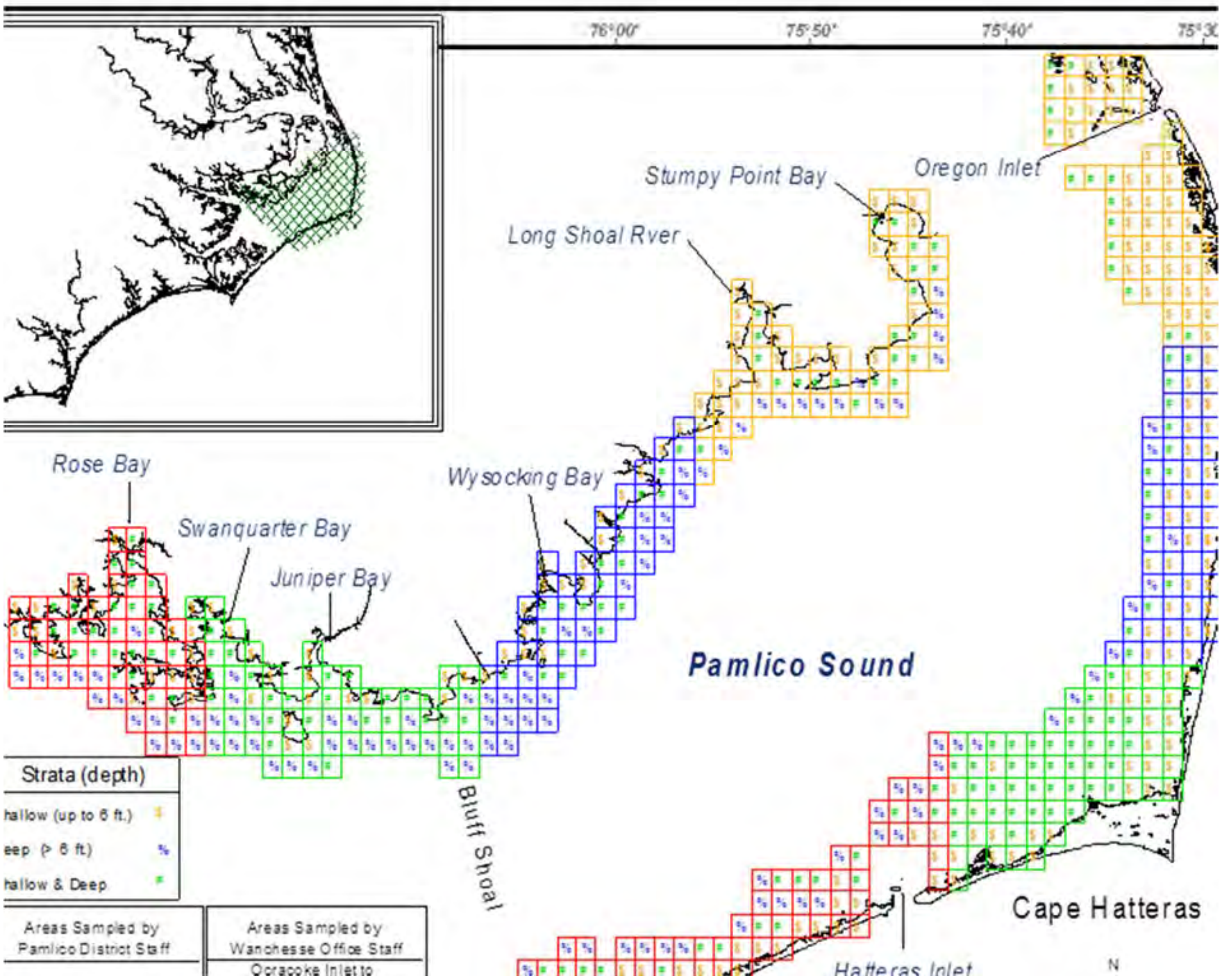


Figure 63. Map of the sampling sites for North Carolina's Estuarine Gillnet fishery independent survey. This survey also operates in several rivers, but only the Pamlico Sound sites were used for developing an index of horseshoe crab abundance for this region (map provided by NC DNR).

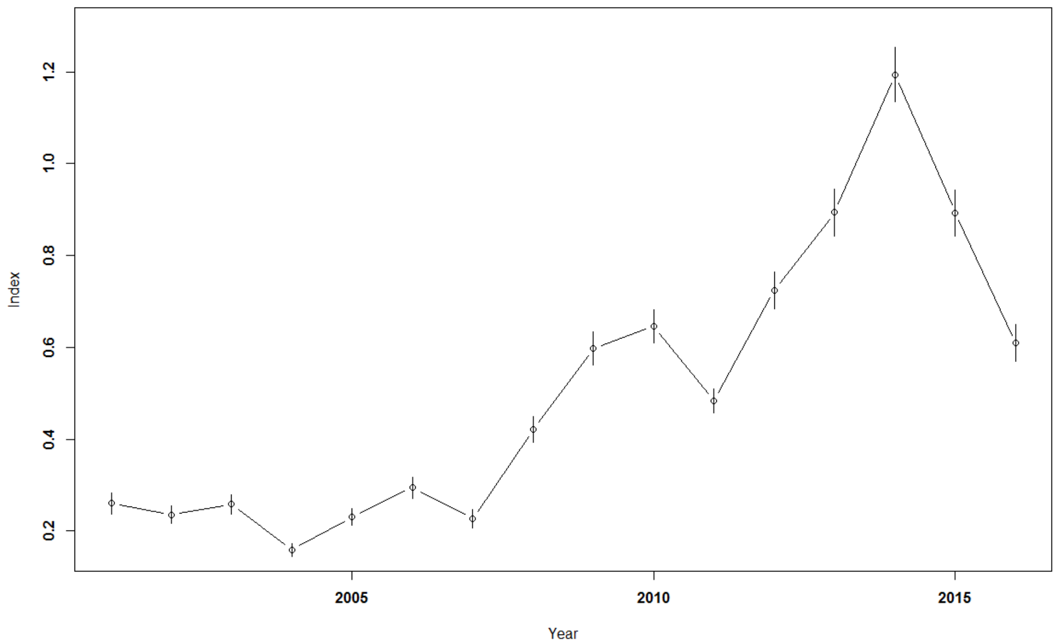


Figure 64. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the spring portion of North Carolina's Estuarine Gill Net Survey with 95% confidence intervals.

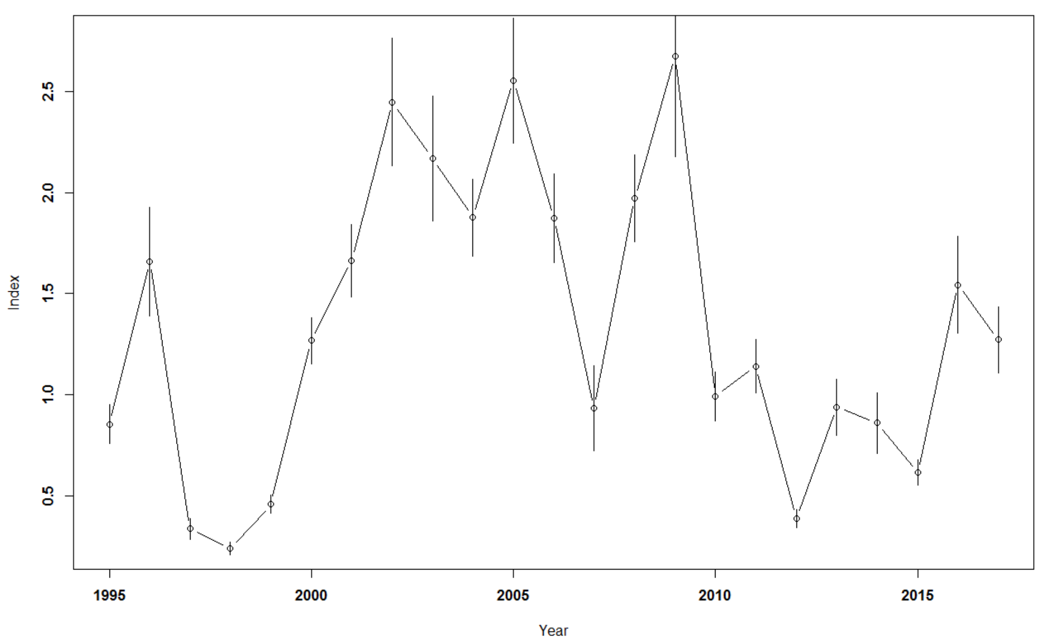


Figure 65. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the spring portion of South Carolina's CRMS with 95% confidence intervals.

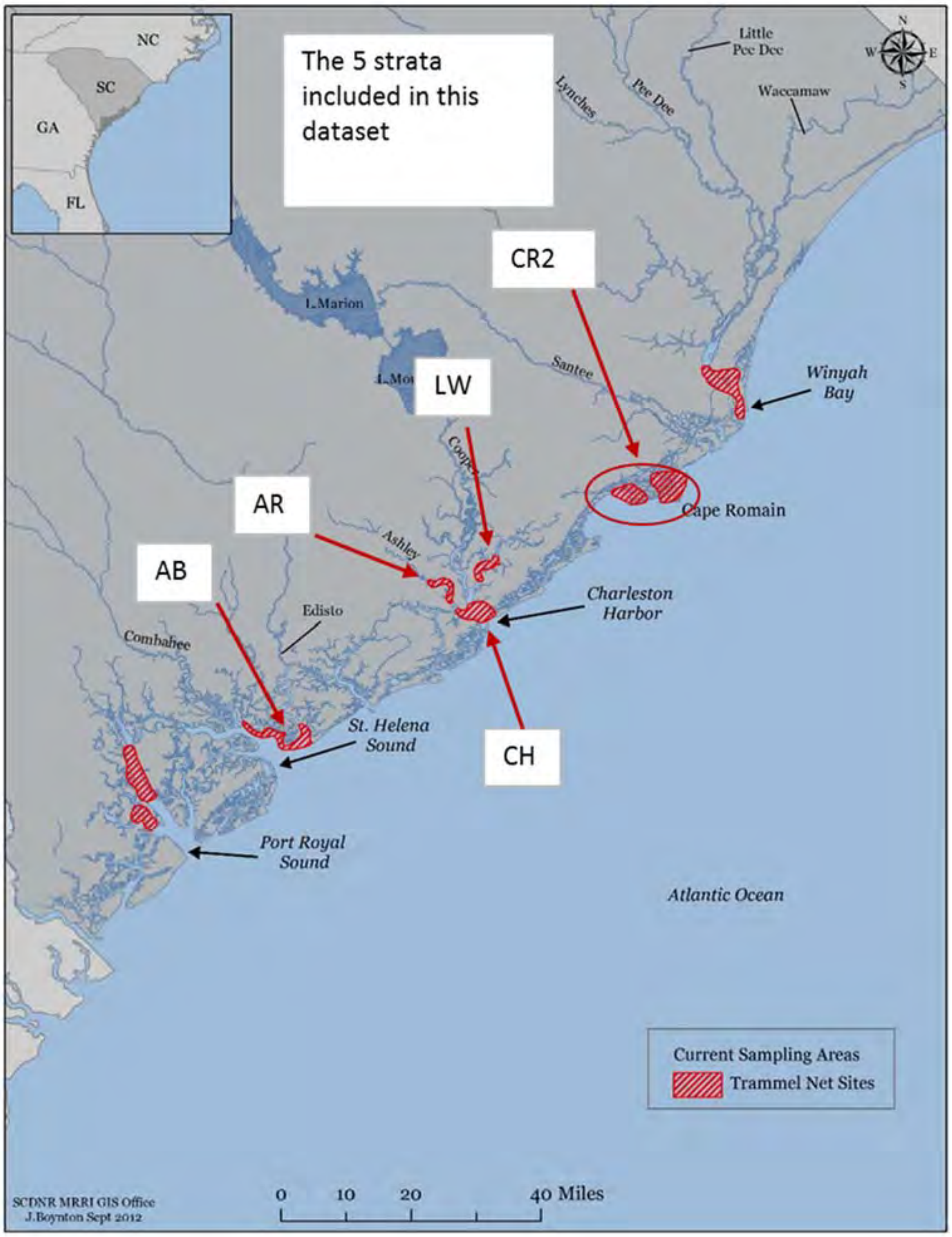


Figure 66. Areas samples by the trammel net, electrofishing, and long-line surveys of the SC DNR Inshore Fisheries Section. Trammel net strata used for analyses in this report: AB - ACE Basin; AR - Ashley River; CH - Charleston Harbor; LW - Lower Wando River; CR2 - Cape Romain (map provided by SC DNR).

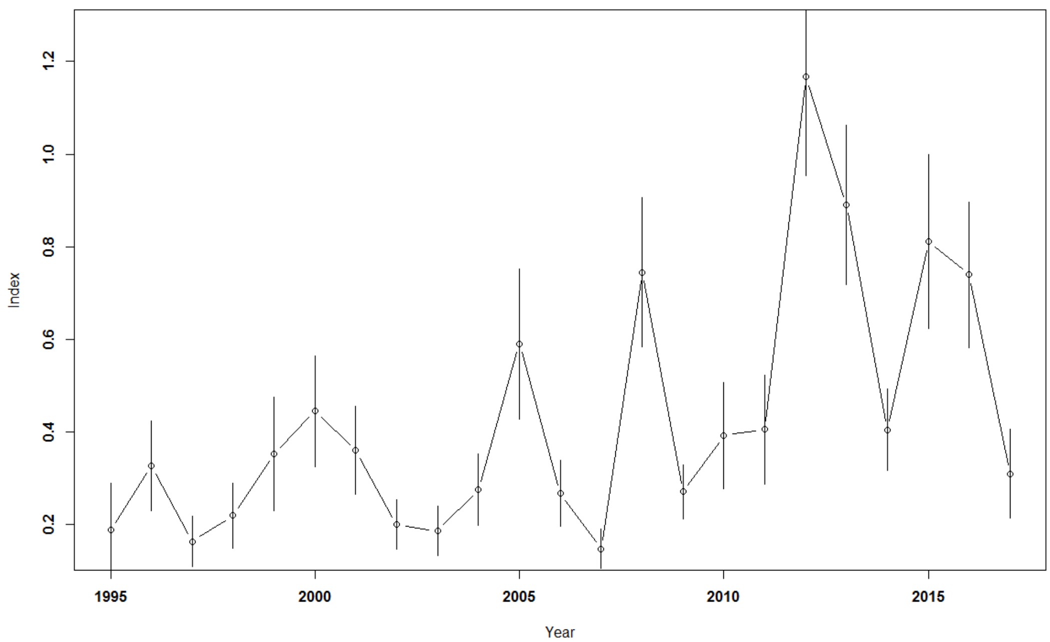


Figure 67. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the spring portion of South Carolina's Trammel Net Survey with 95% confidence intervals.

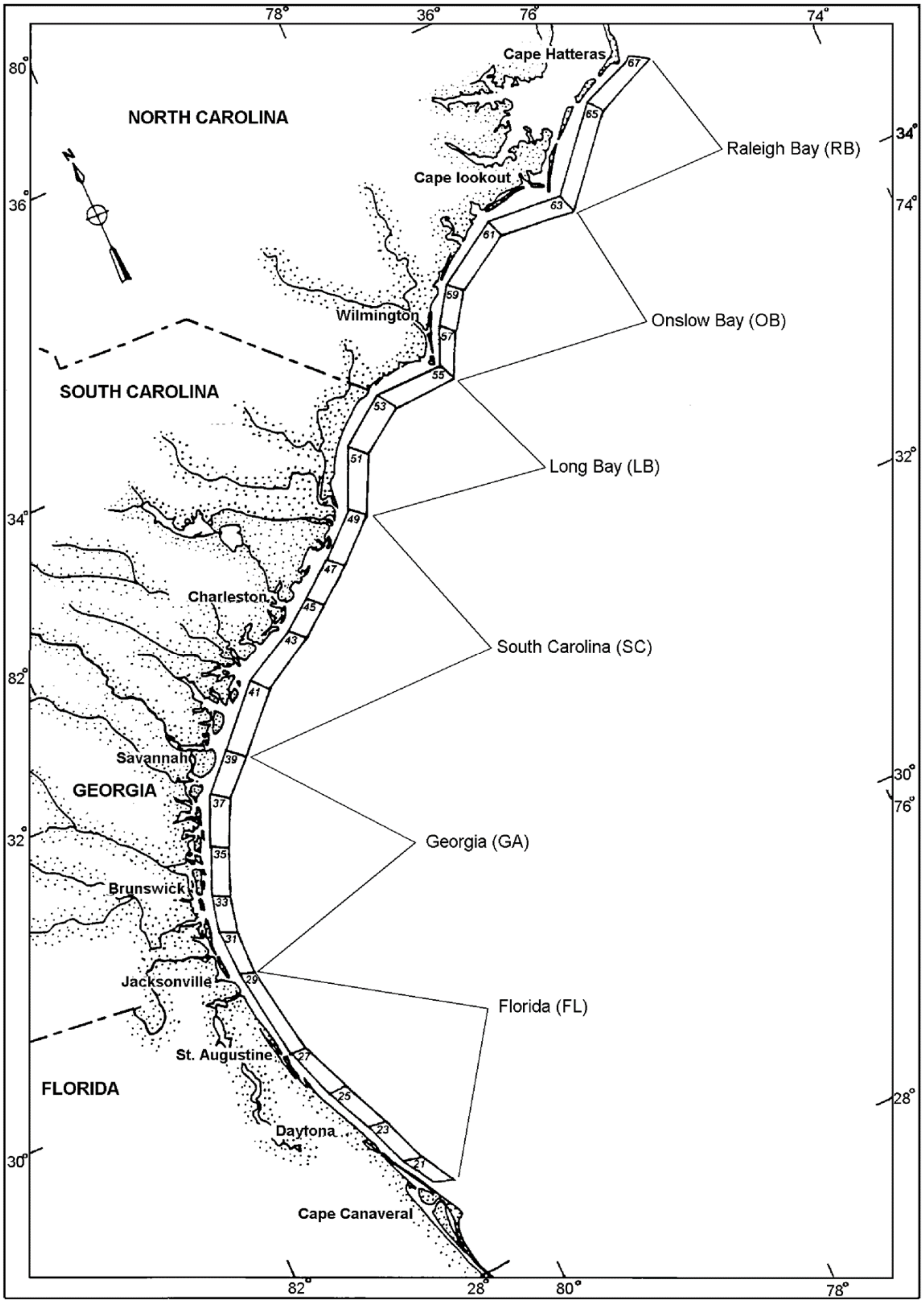


Figure 68. States and stations sampled as part of the SEAMAP trawl survey (map provided by SC DNR and SEAMAP).

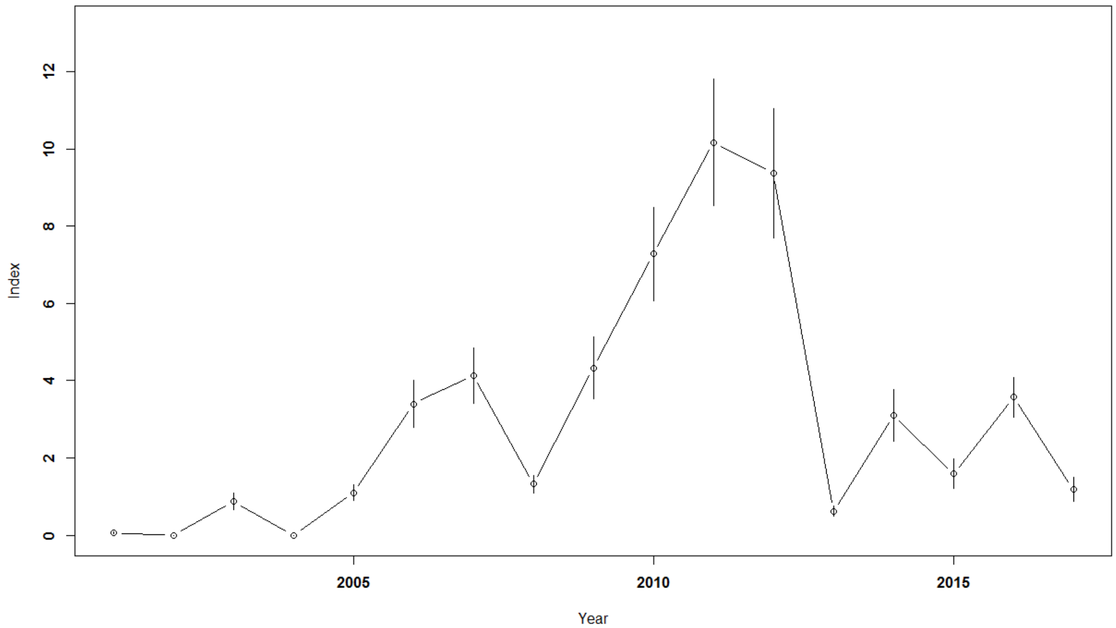


Figure 69. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the South Carolina and fall portion of the SEAMAP survey with 95% confidence intervals.

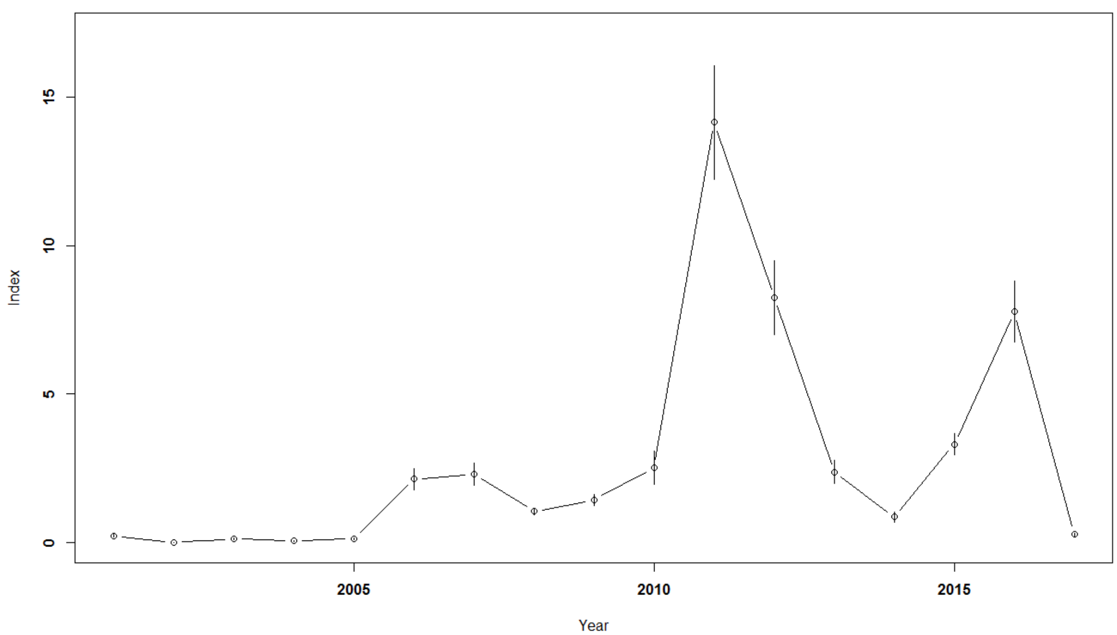


Figure 70. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the Georgia-Florida and fall portion of the SEAMAP survey with 95% confidence intervals.

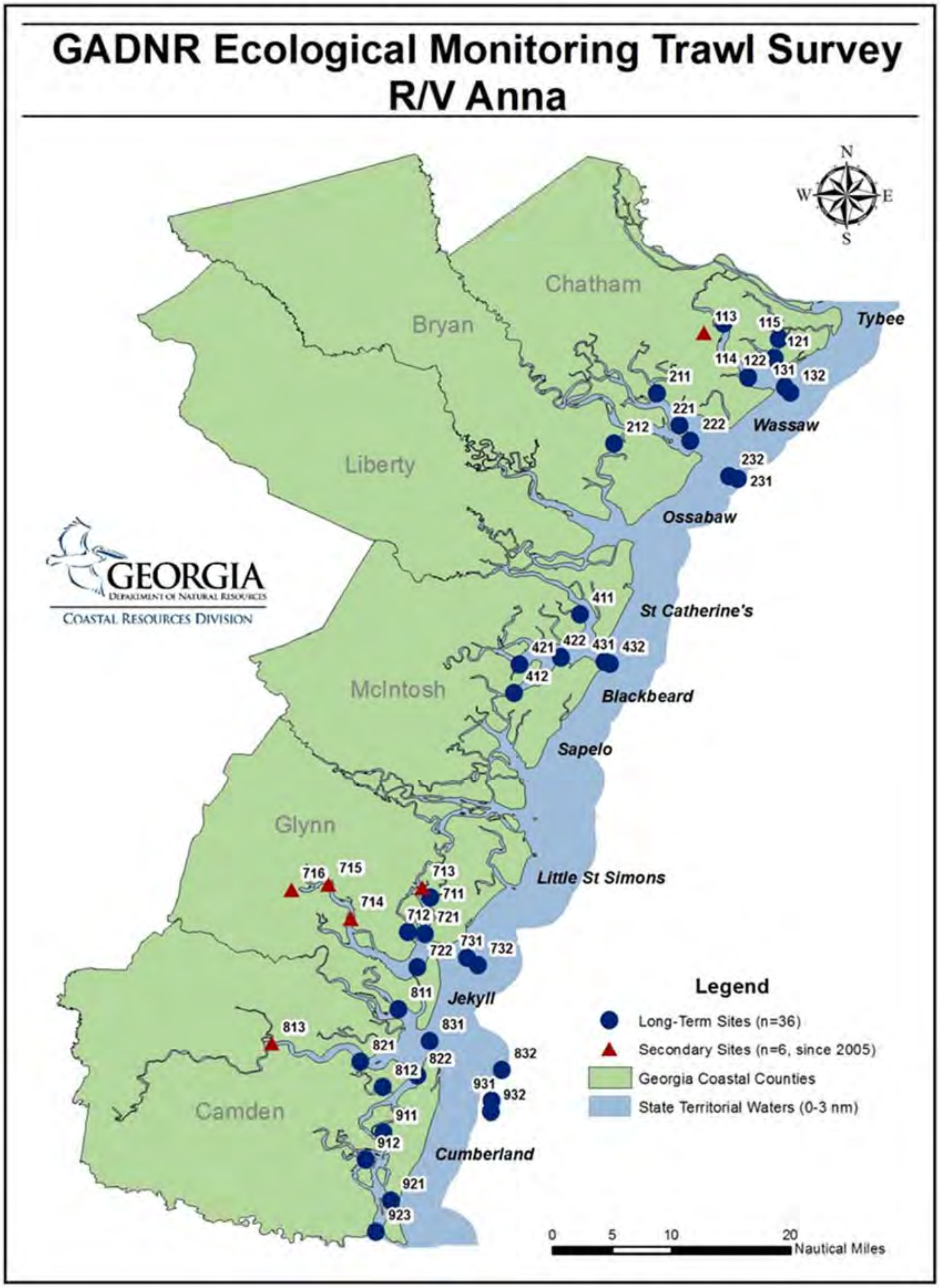


Figure 71. Map of the survey sites for Georgia's Ecological Monitoring Trawl Survey (map provided by GA DNR).

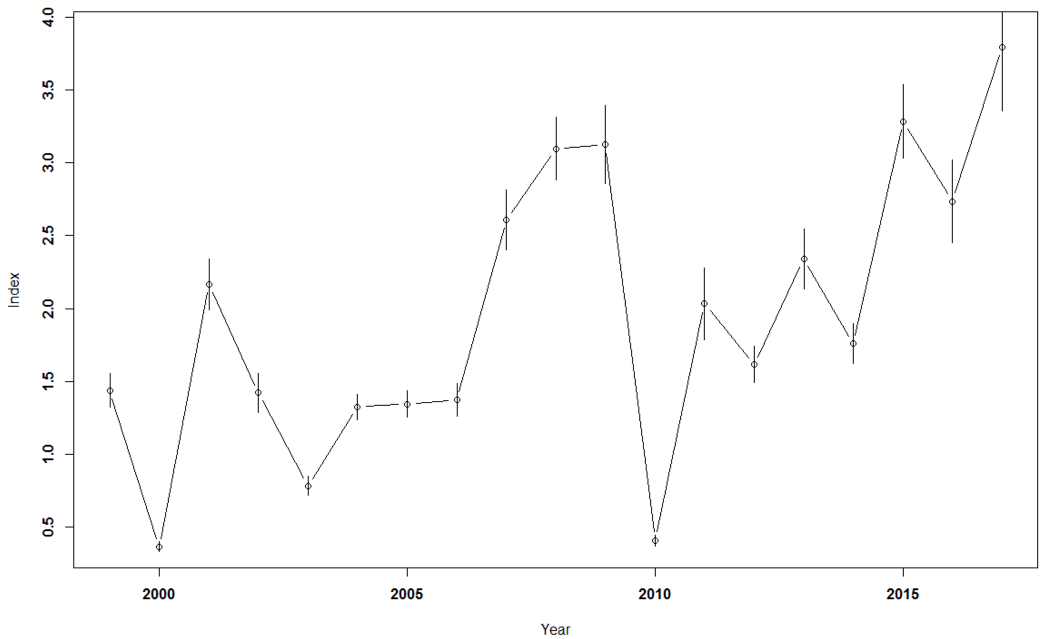


Figure 72. Index of relative abundance of horseshoe crab (delta mean catch per tow) developed from the Georgia Trawl survey with 95% confidence intervals.

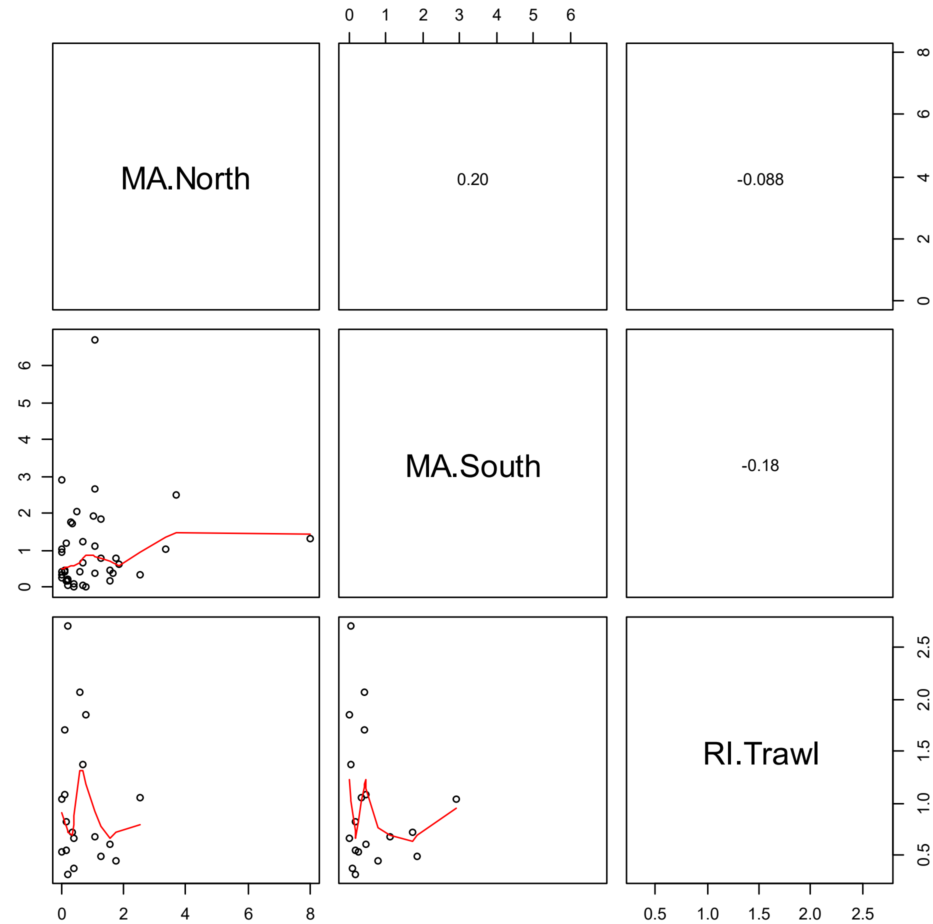


Figure 73. Correlation coefficients and scatter plots for the horseshoe crab abundance indices in the Northeast Region for 1978-2017. All correlations are insignificant (*P*>0.05).

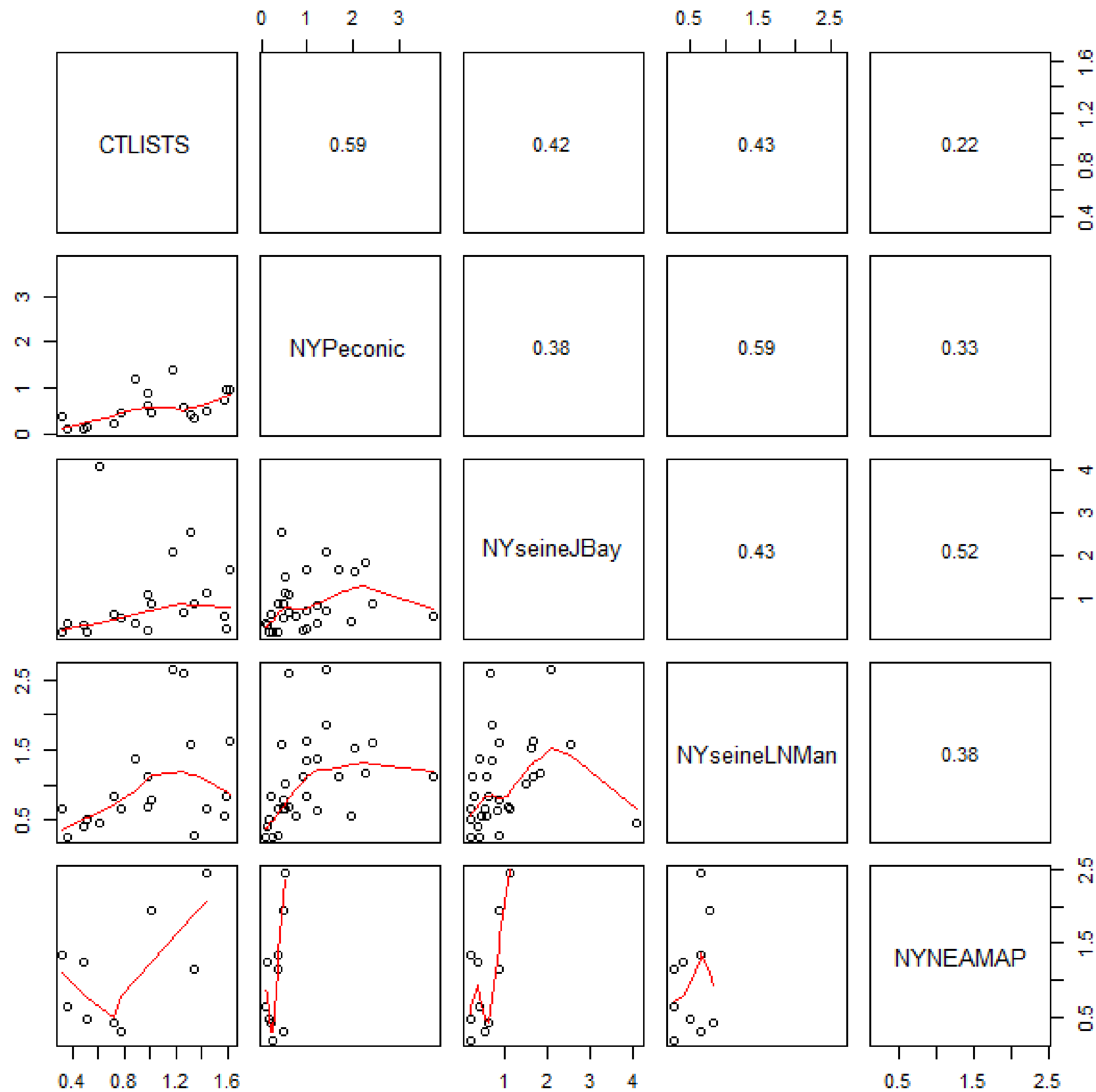


Figure 74. Correlation coefficients and scatter plots for the horseshoe crab abundance indices in the New York Region for 1987-2016. All correlations are insignificant (*P*>0.05) except for the positive correlation between the Connecticut Long Island Sound Trawl Survey and New York's Peconic Bays (*P*=0.020) and New York's NEAMAP portion and the New York Seine Jamaica Bay (*P*=0.026).

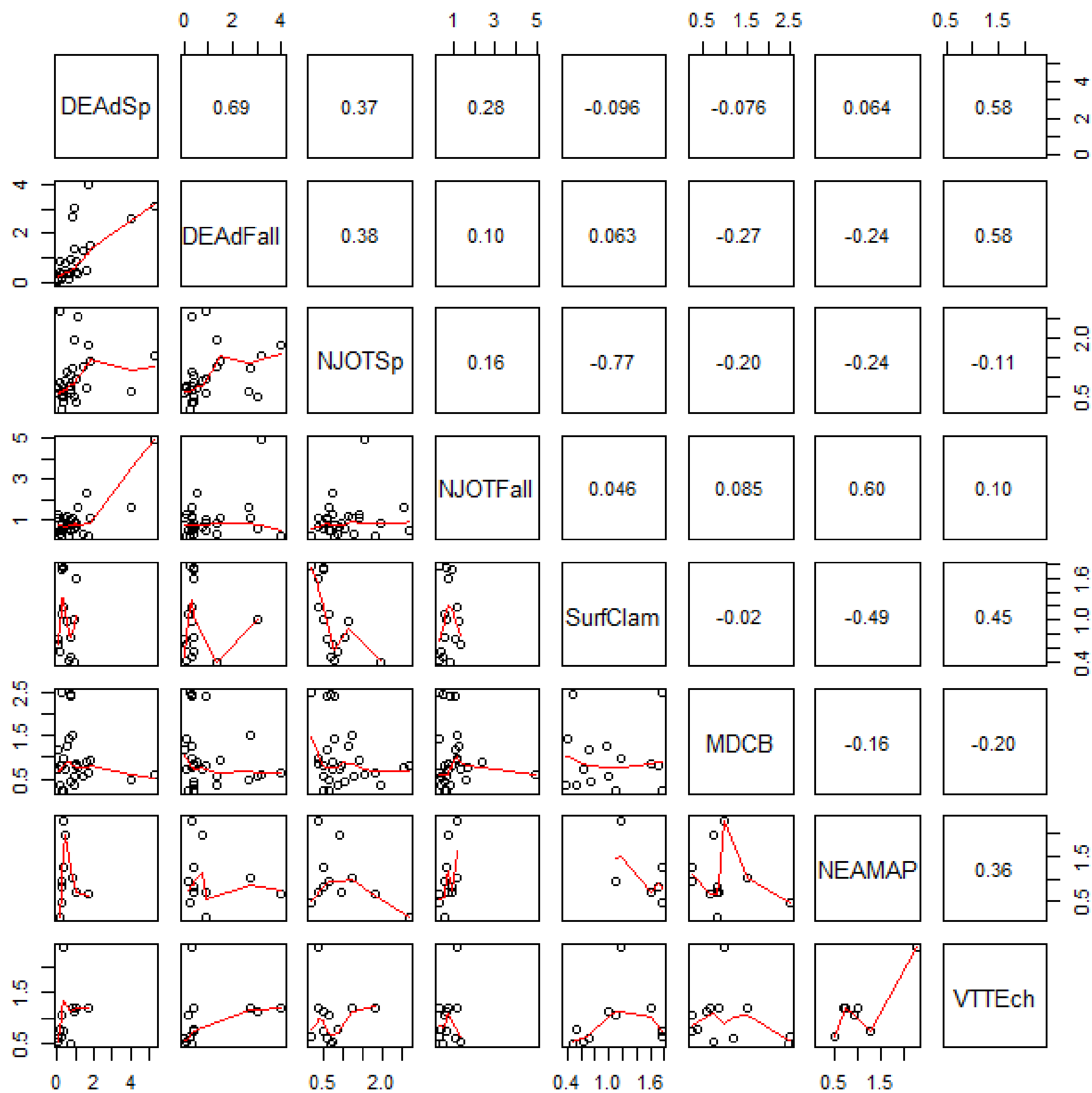


Figure 75. Correlation coefficients and scatter plots for the horseshoe crab abundance indices in the Delaware Bay Region for 1989-2017. All correlations are insignificant (*P*>0.05) except for the correlations between the Delaware Adult Trawl spring and fall indices (*P*<0.001), Delaware Adult Trawl spring and New Jersey Ocean Trawl fall (*P*<0.001), New Jersey Ocean Trawl spring and Surf Clam surveys (*P*=0.011), and NEAMAP and the Virginia Tech Trawl (*P*=0.020).

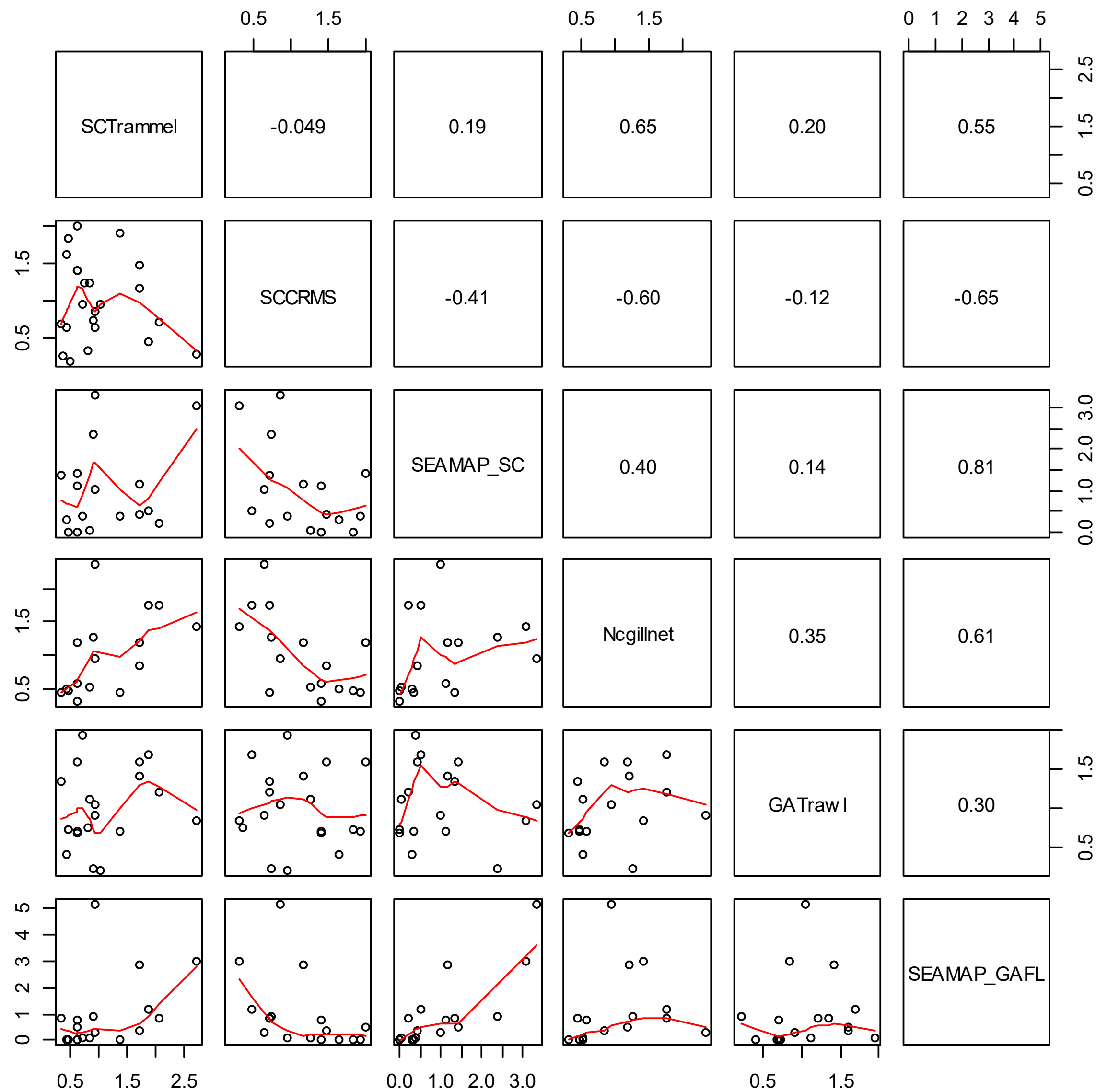


Figure 76. Correlation coefficients and scatter plots for the horseshoe crab abundance indices in the Southeast Region for 1995-2017. All correlations are insignificant (*P*>0.05) except for the correlations between the North Carolina Gill Net and South Carolina Trammel indices (*P*=0.036), the North Carolina Gill Net and South Carolina CRMS indices (*P*=0.010), and SEAMAP's South Carolina and Georgia-Florida indices (*P*<0.001).

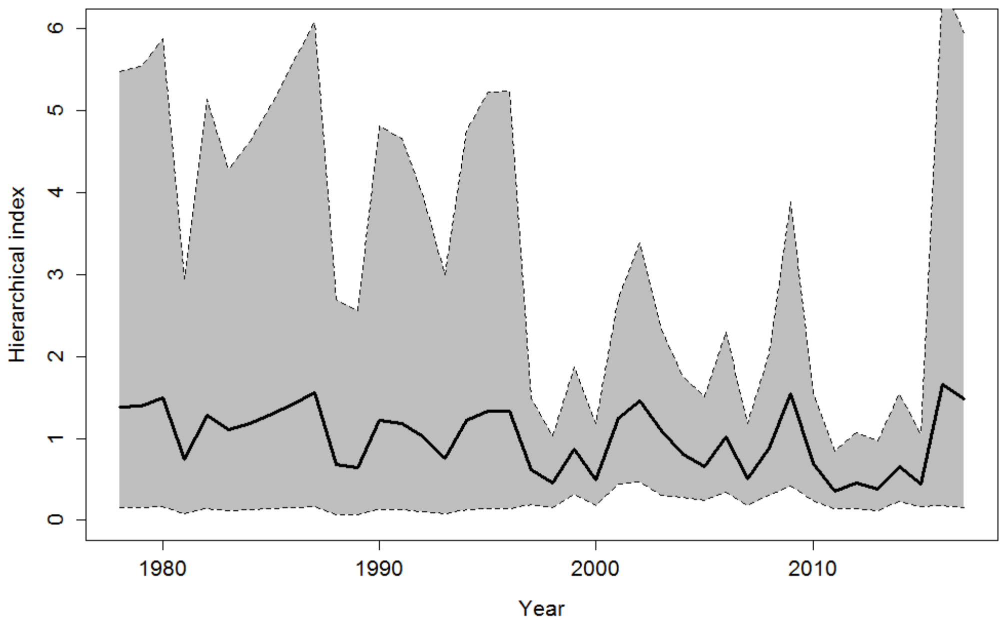


Figure 77. Time series of horseshoe crab relative abundance in the Northeast region as estimated from hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

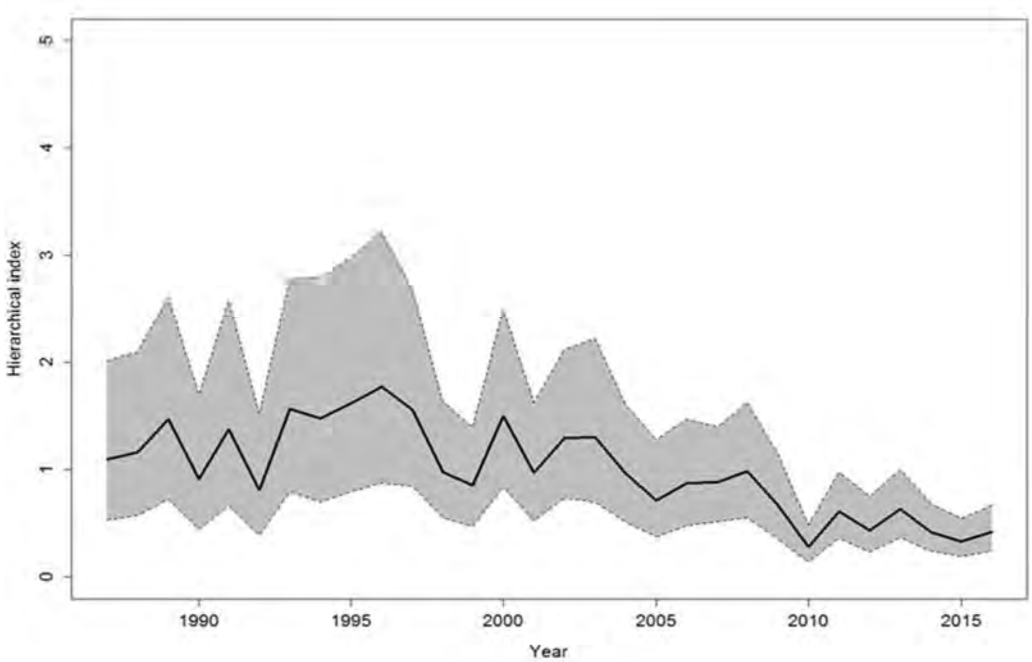


Figure 78. Time series of horseshoe crab relative abundance in the New York region as estimated from hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

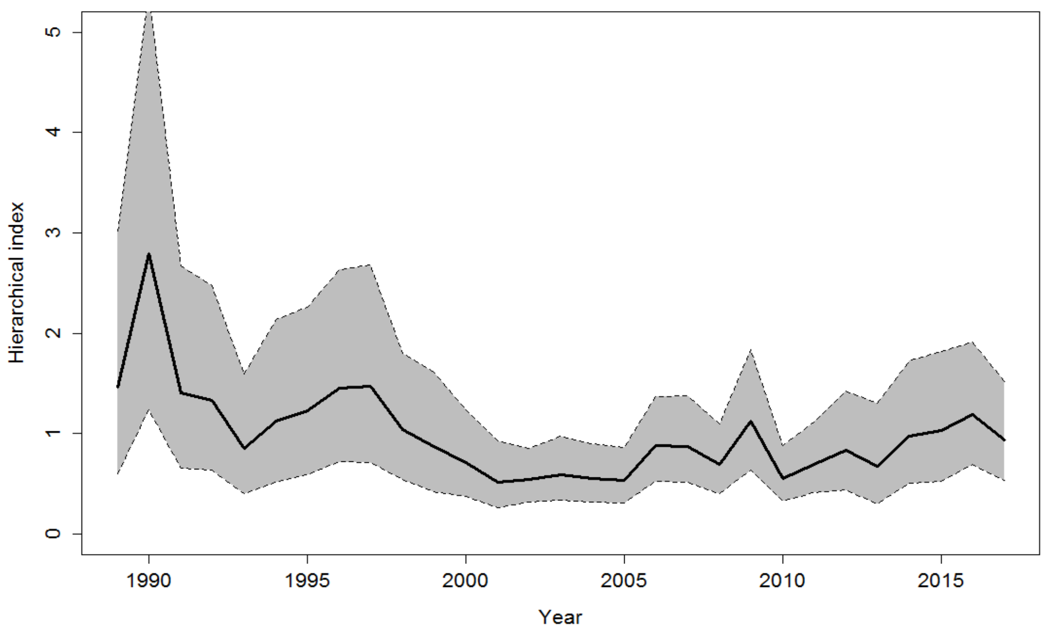


Figure 79. Time series of horseshoe crab relative abundance in the Delaware Bay region as estimated from the hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

Figure 80. Time series of female horseshoe crab relative abundance in the Delaware Bay region as estimated from the hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

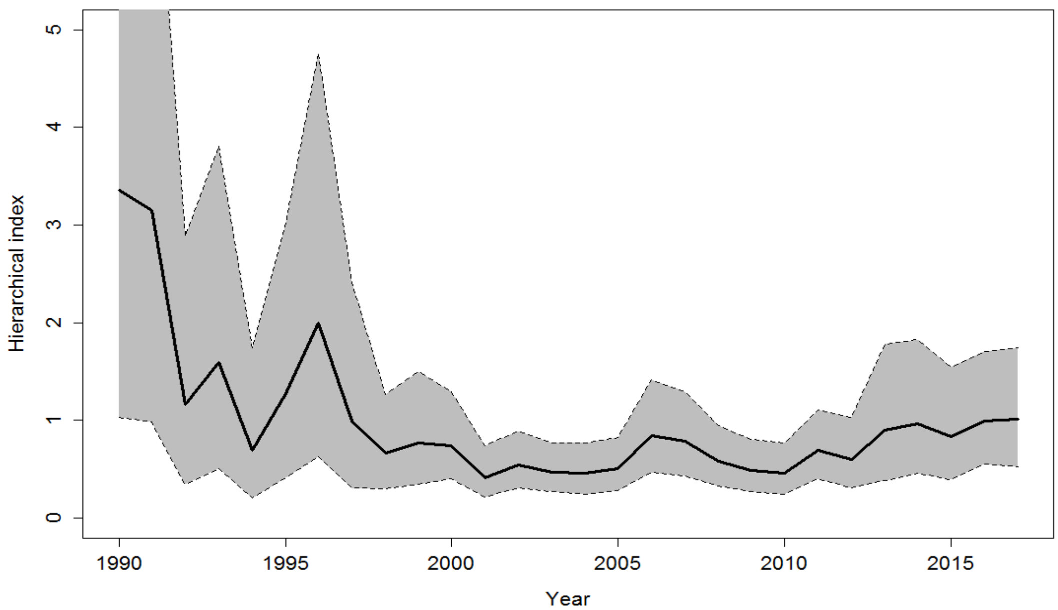


Figure 81. Time series of male horseshoe crab relative abundance in the Delaware Bay region as estimated from the hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

Figure 82. Time series of horseshoe crab relative abundance in the Southeast region as estimated from hierarchical analysis. The black line gives the posterior mean and the grey, shaded area represents a 95% credible interval about the time series.

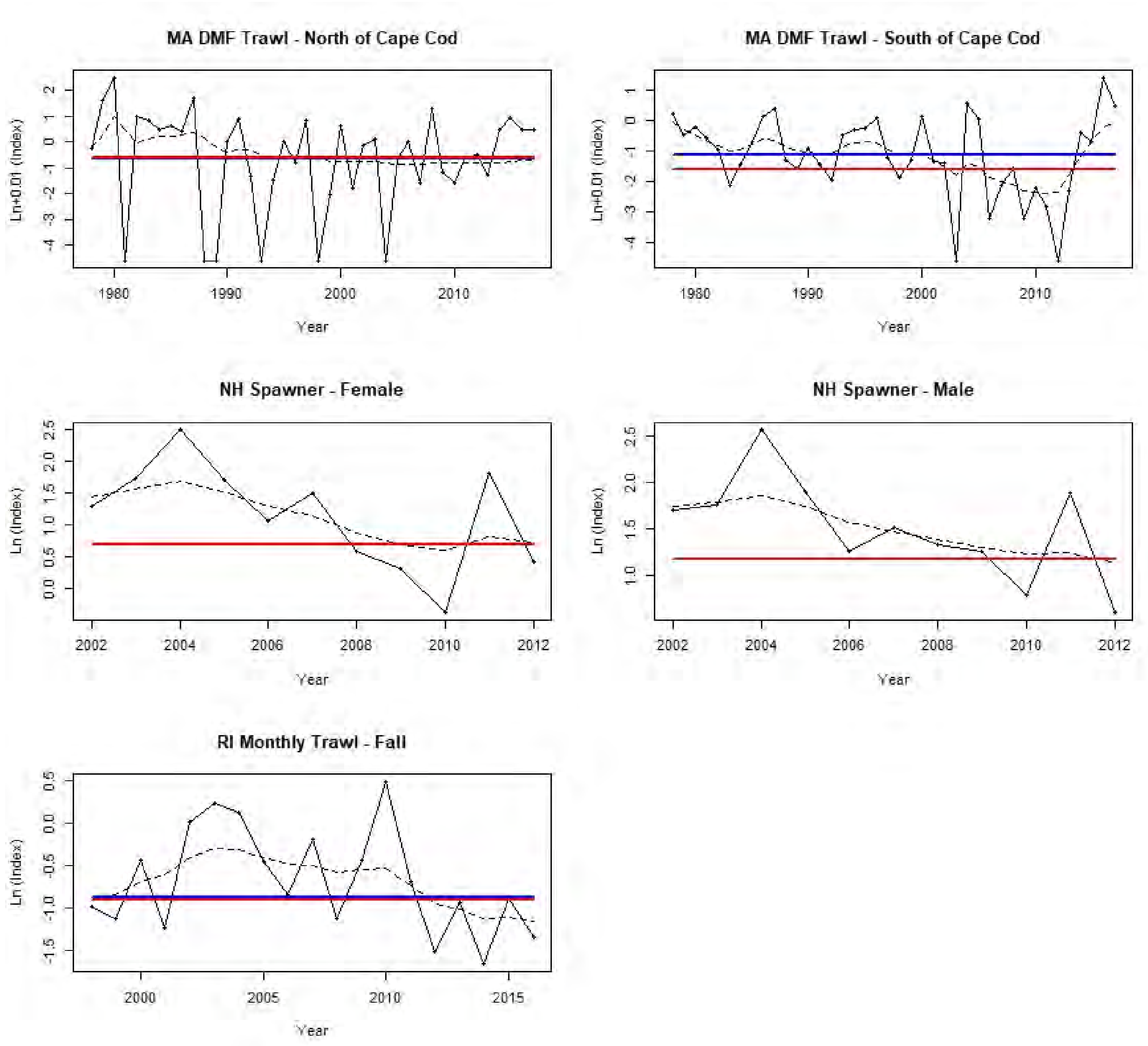


Figure 83. Northeast Region horseshoe crab survey ARIMA model fits. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point. Note: The residuals from the ARIMA model fit to the MA DMF Trawl – North of Cape Cod were not normally distributed.

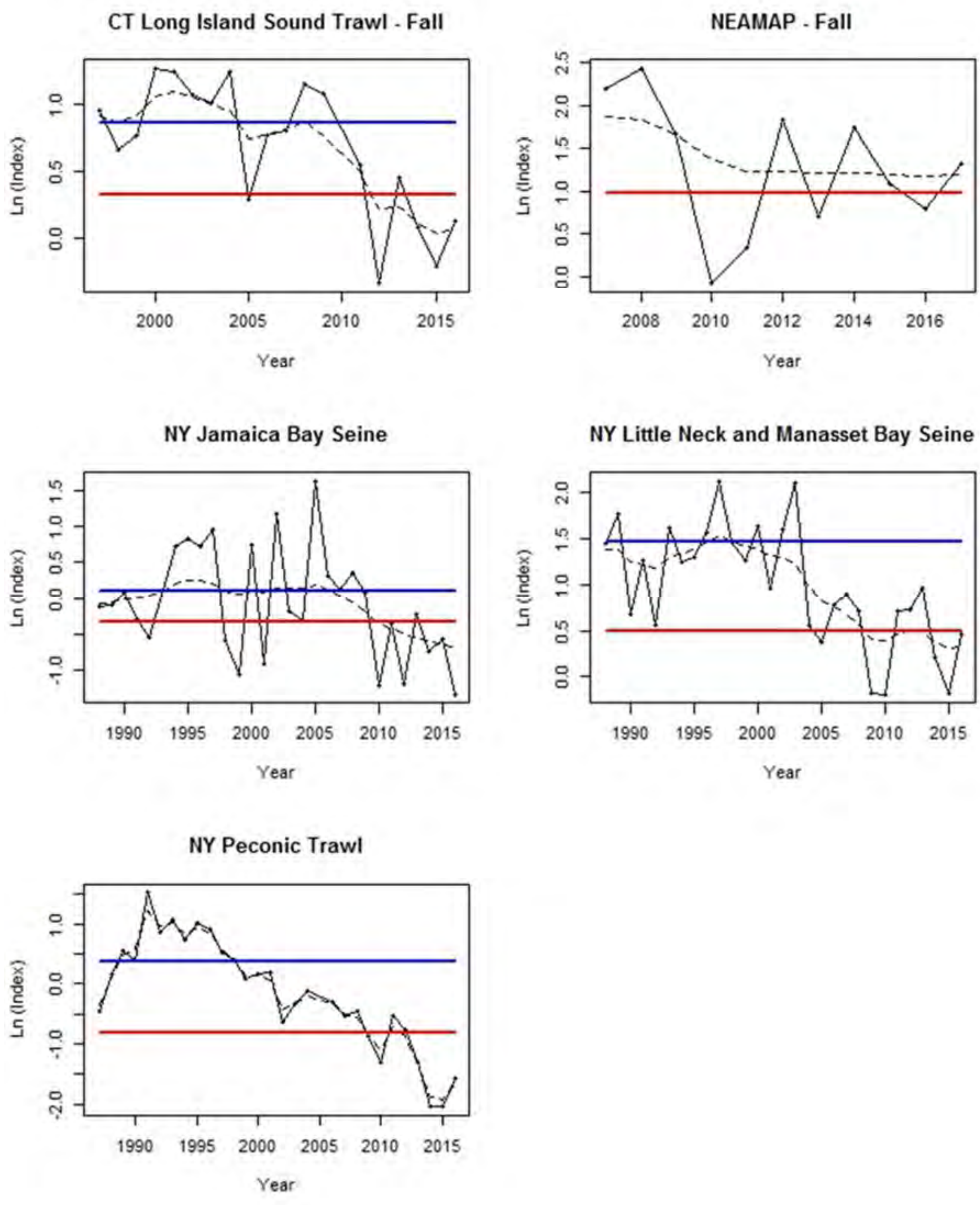


Figure 84. New York Region horseshoe crab survey ARIMA model fits. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point.

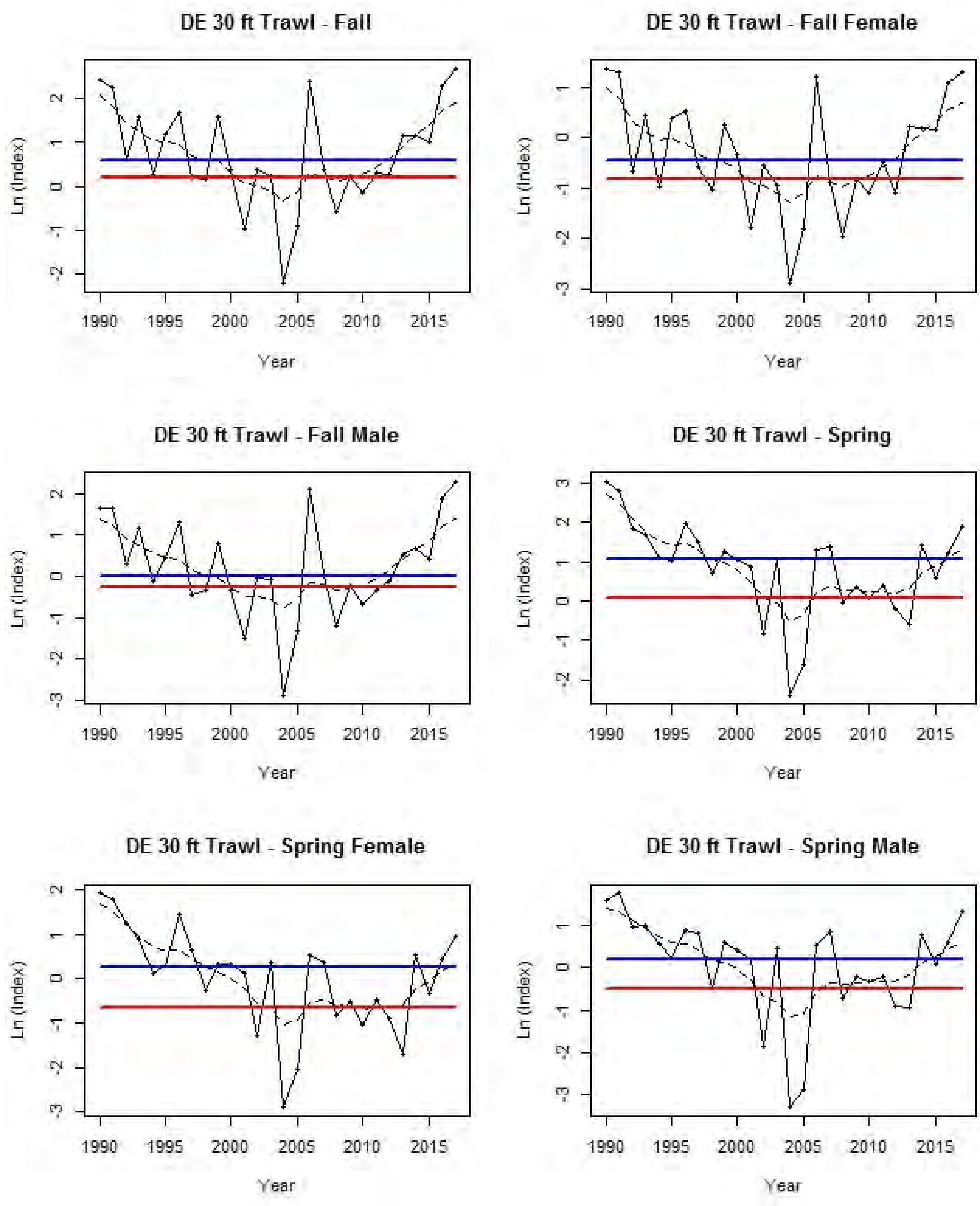


Figure 85. ARIMA model fits to horseshoe crab indices from the DE 30 ft. Trawl survey in the Mid-Atlantic Region. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point.

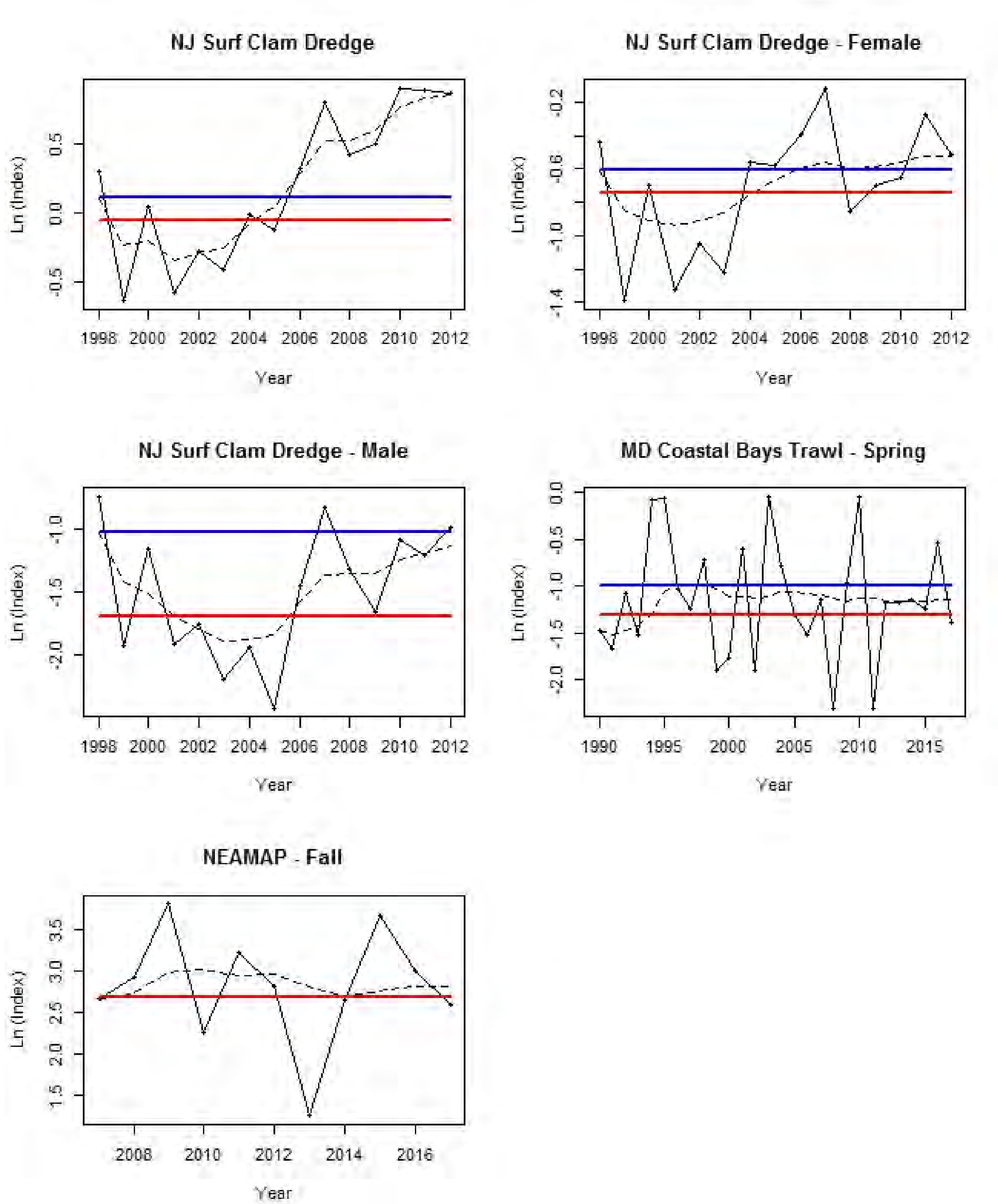


Figure 86. ARIMA model fits to horseshoe crab indices from various surveys in the Mid-Atlantic Region. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point.

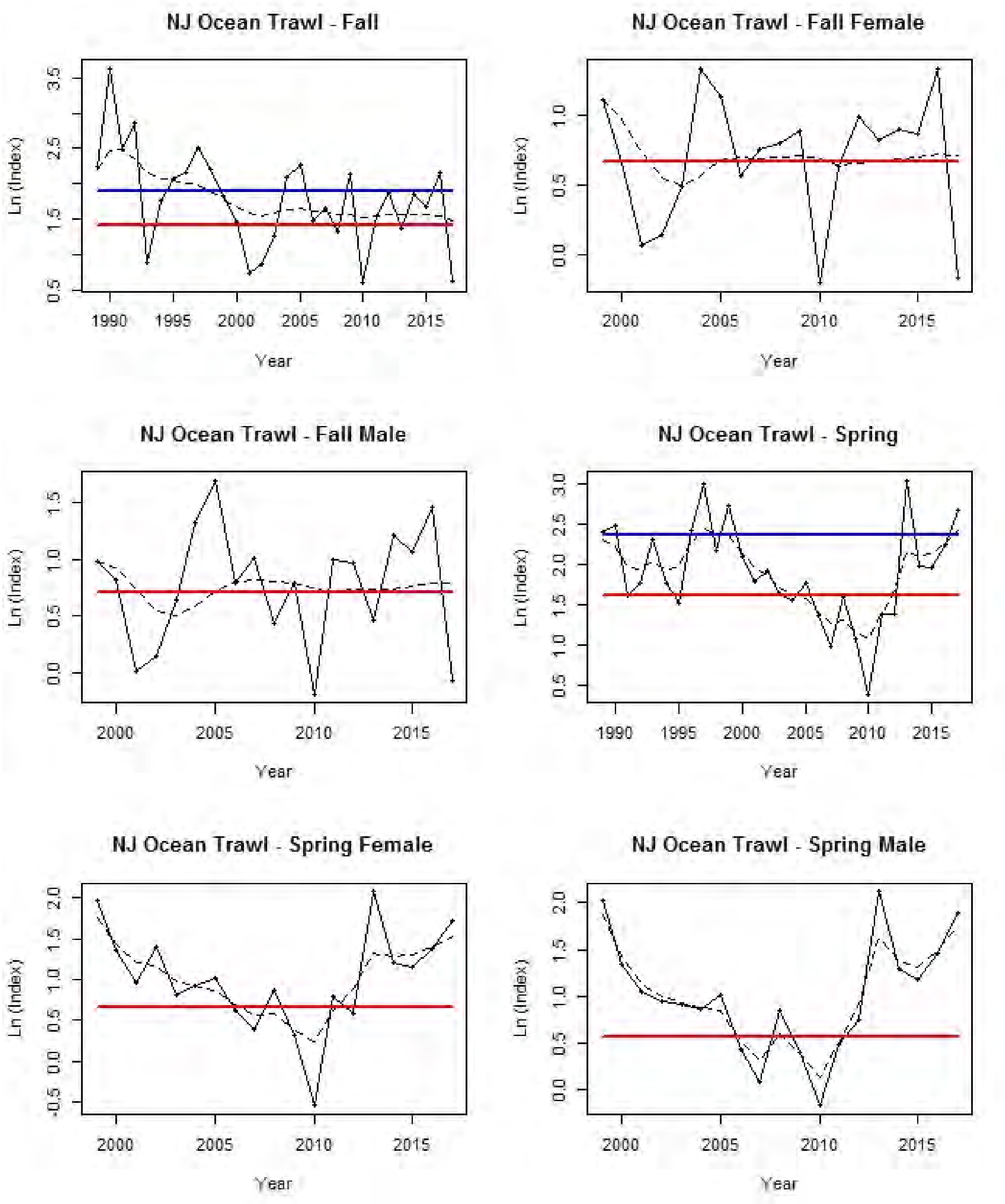


Figure 87. ARIMA model fits to horseshoe crab indices from the NJ Ocean Trawl survey in the Mid-Atlantic Region. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point.

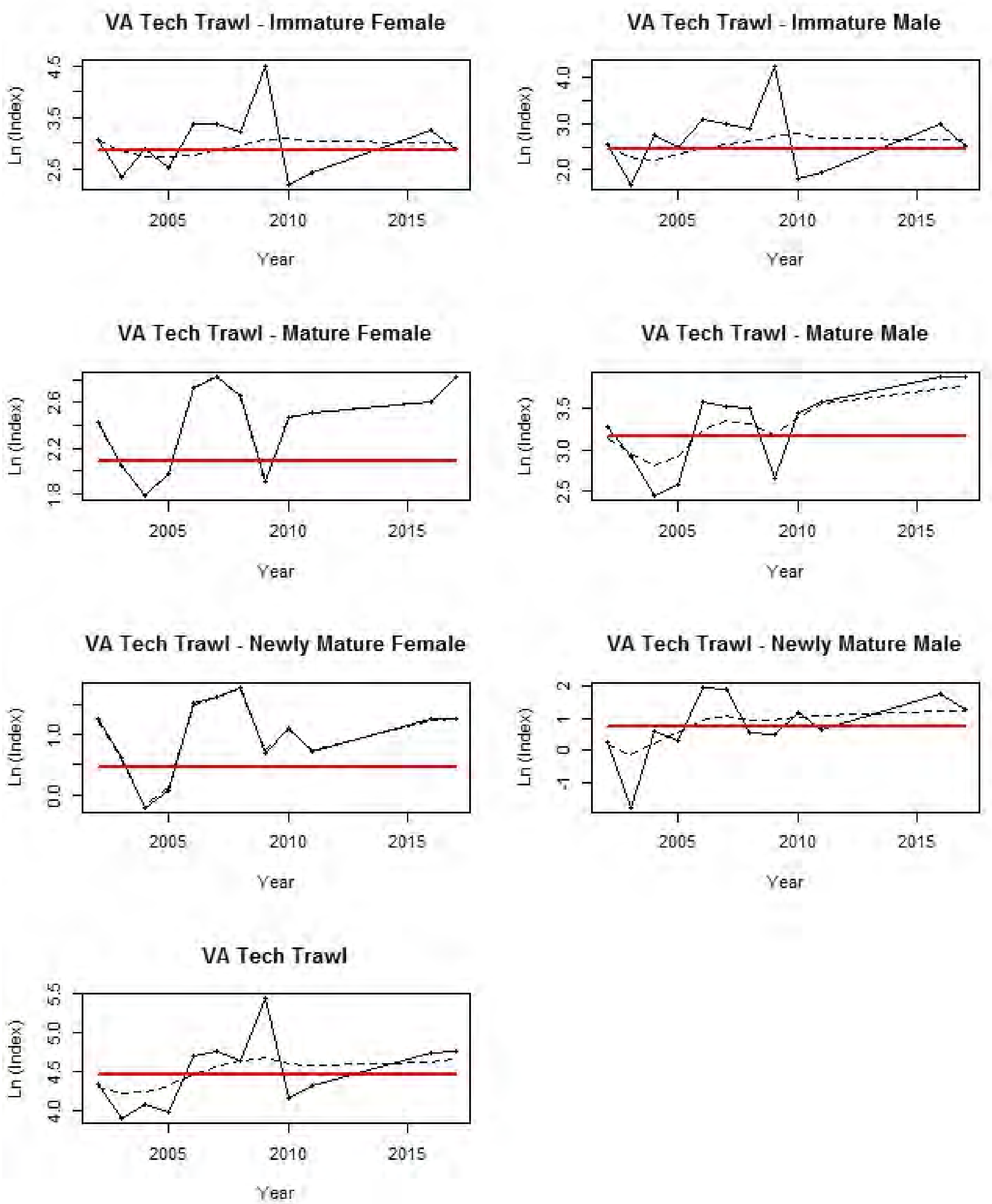


Figure 88. ARIMA model fits to horseshoe crab indices from the VA Tech Trawl survey in the Mid-Atlantic Region. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point.

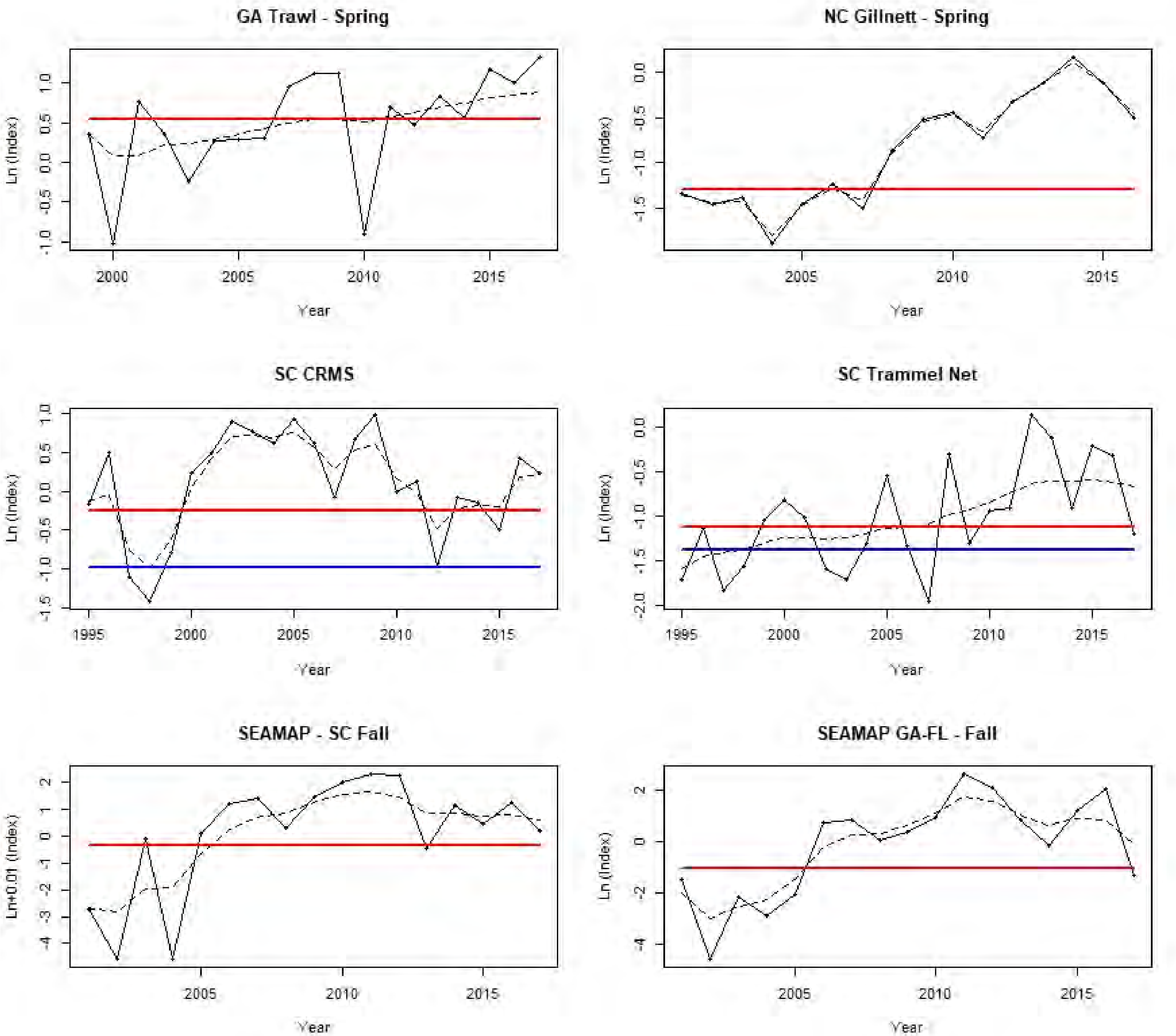


Figure 89. Southeast Region horseshoe crab survey ARIMA model fits. The solid line represents the observed ln transformed indices and the dashed line represents the fitted indices. The red horizontal line represents the Q_{25} reference point and the blue horizontal line represents the 1998 reference point. Note: The residuals from the ARIMA fit to the GA Trawl were not normally distributed.

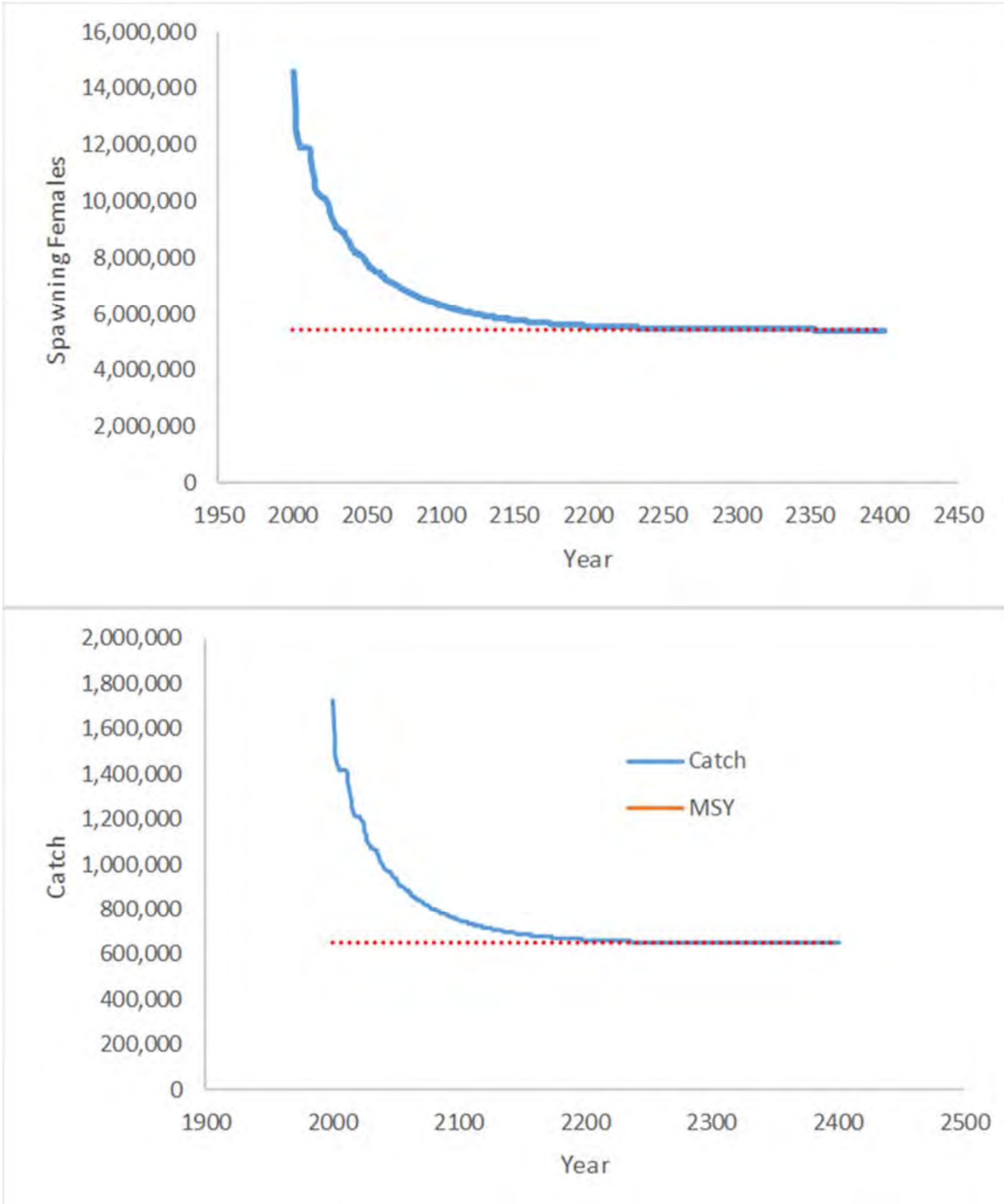


Figure 90. Projections of the horseshoe crab operating model under F_{MSY} (0.1613) showing where the population asymptotes at B_{MSY} (5,433,439) and where catch asymptotes at *MSY* (647,609 crabs).

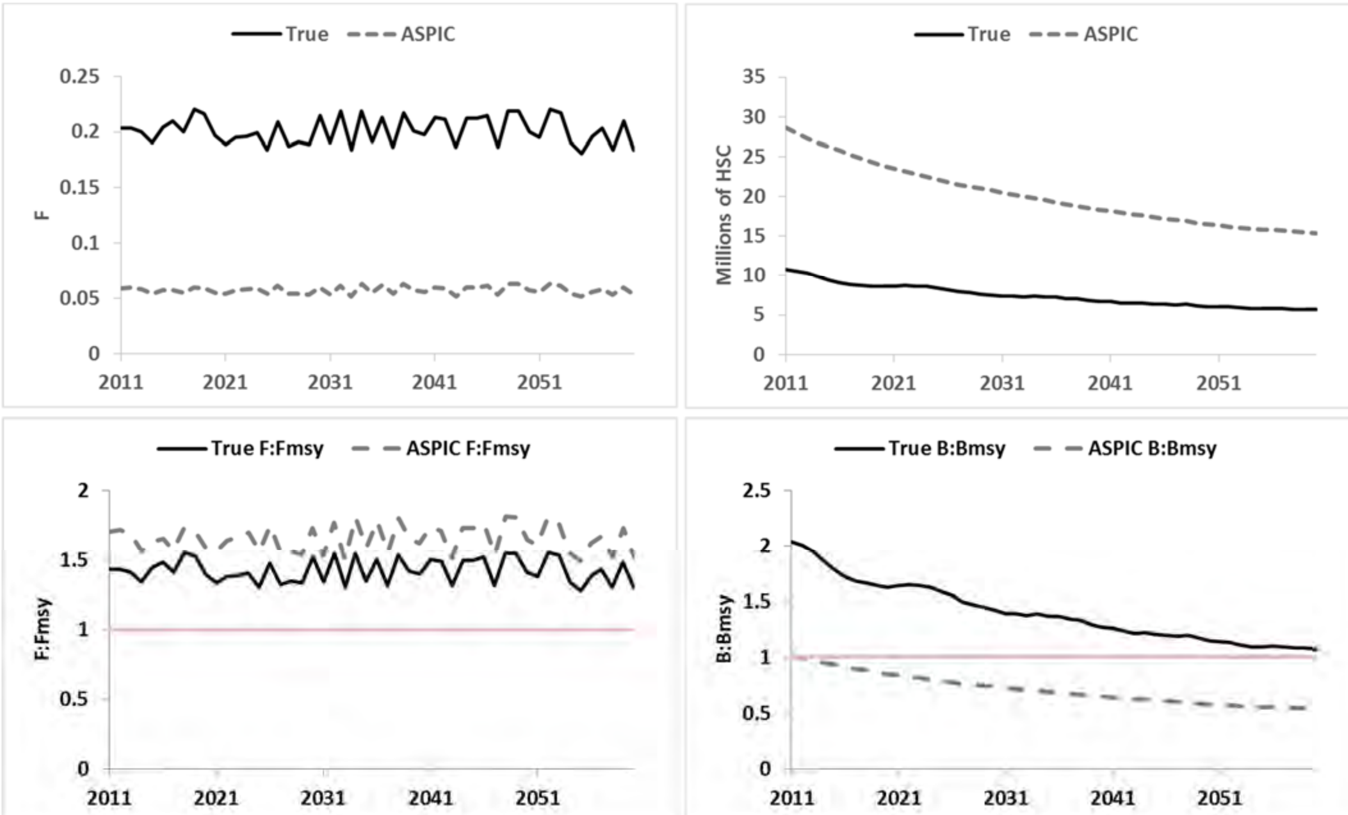


Figure 91. Comparison between simulated "true" data from the operating model and surplus production (ASPIC) results for simulation 1.

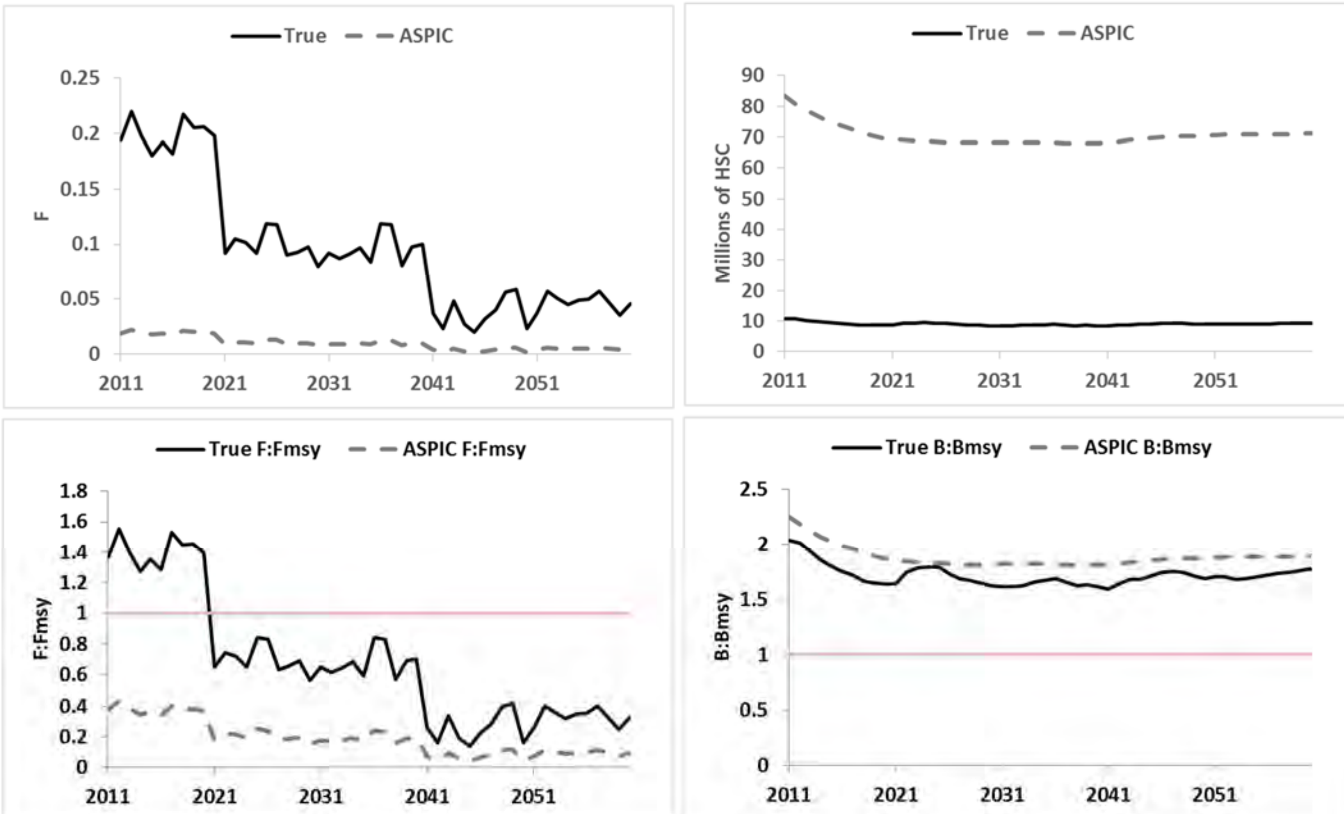


Figure 92. Comparison between simulated "true" data from the operating model and surplus production (ASPIC) results for simulation 2.

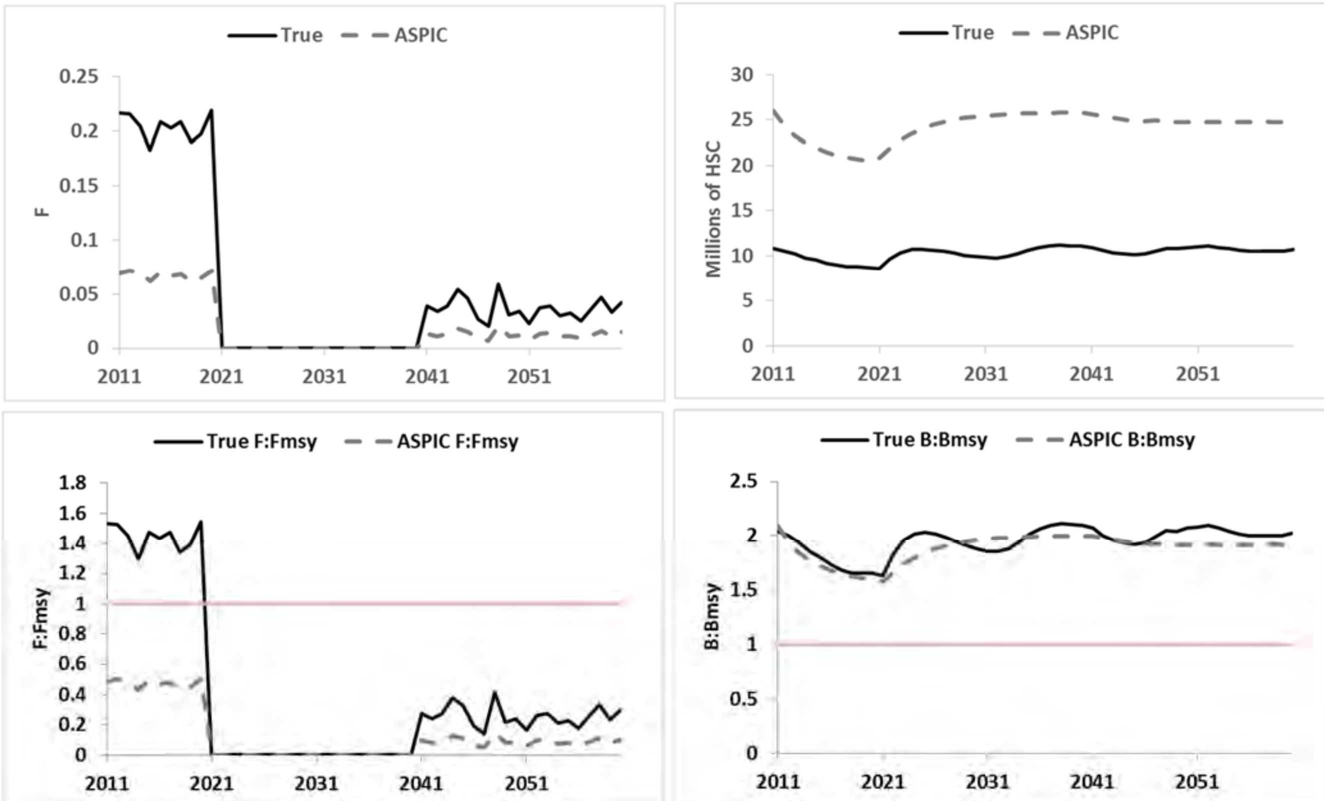


Figure 93. Comparison between simulated "true" data from the operating model and surplus production (ASPIC) results for simulation 3.

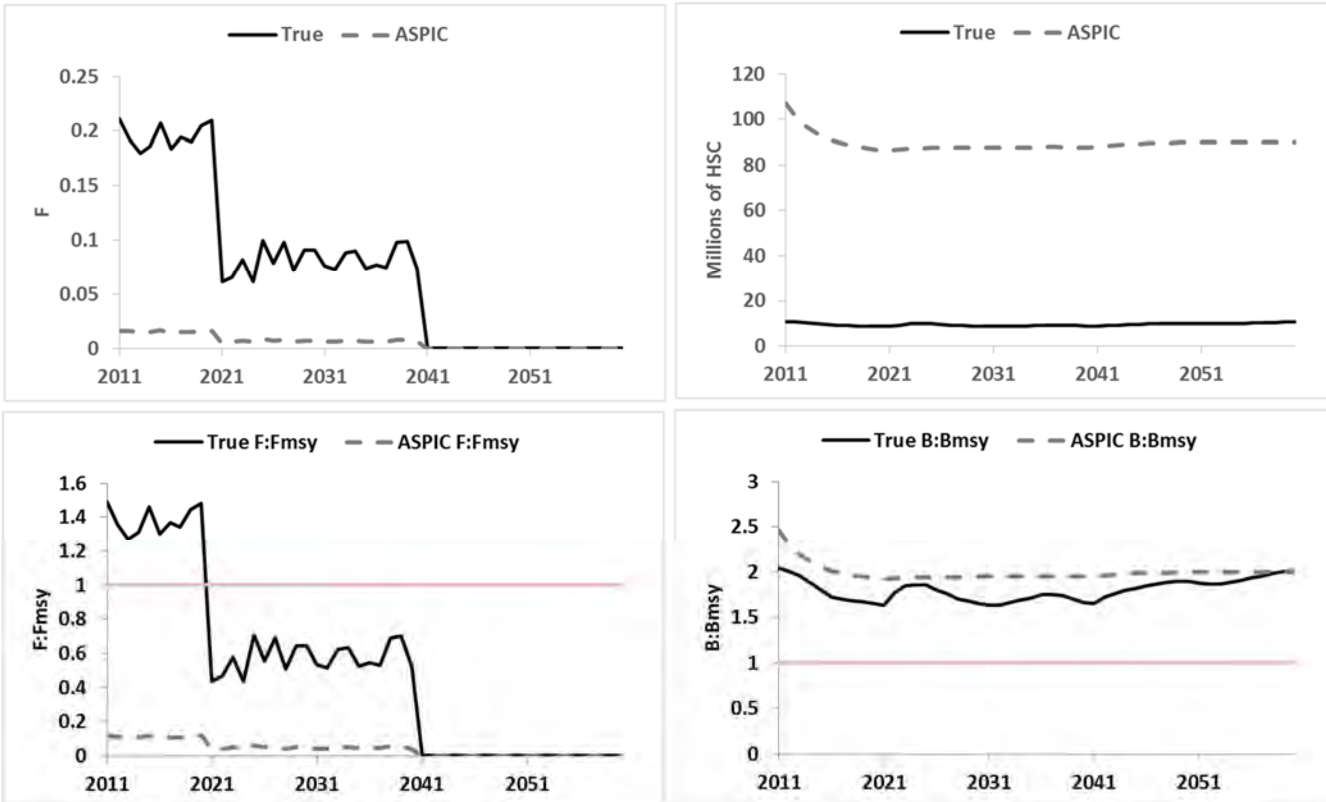


Figure 94. Comparison between simulated "true" data from the operating model and surplus production (ASPIC) results for simulation 4.

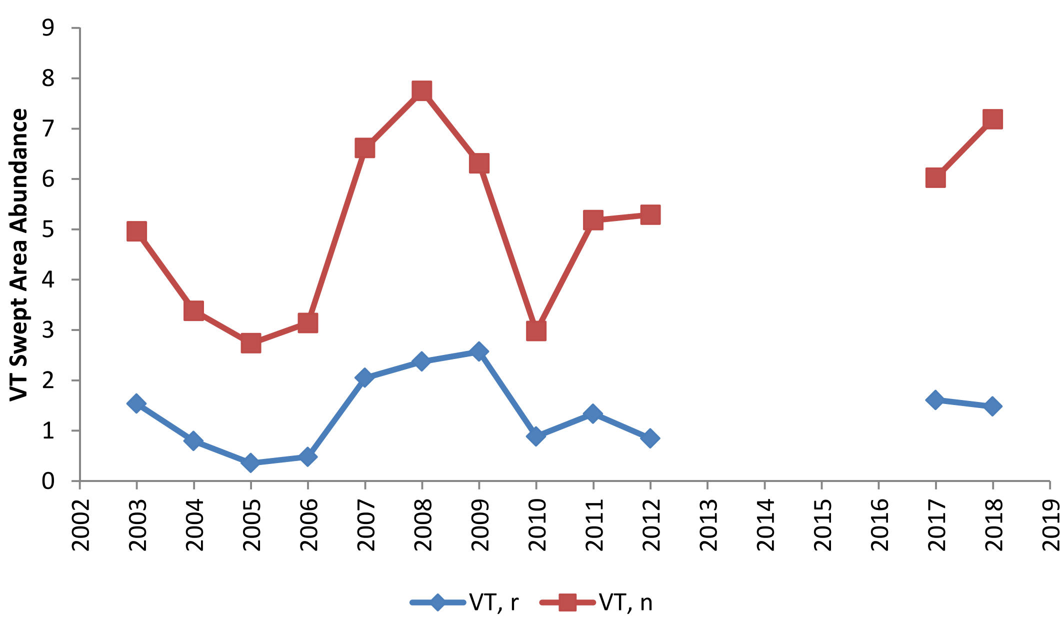


Figure 95. Primiparous and multiparous indices (in millions) from the Virginia Tech Trawl Survey.

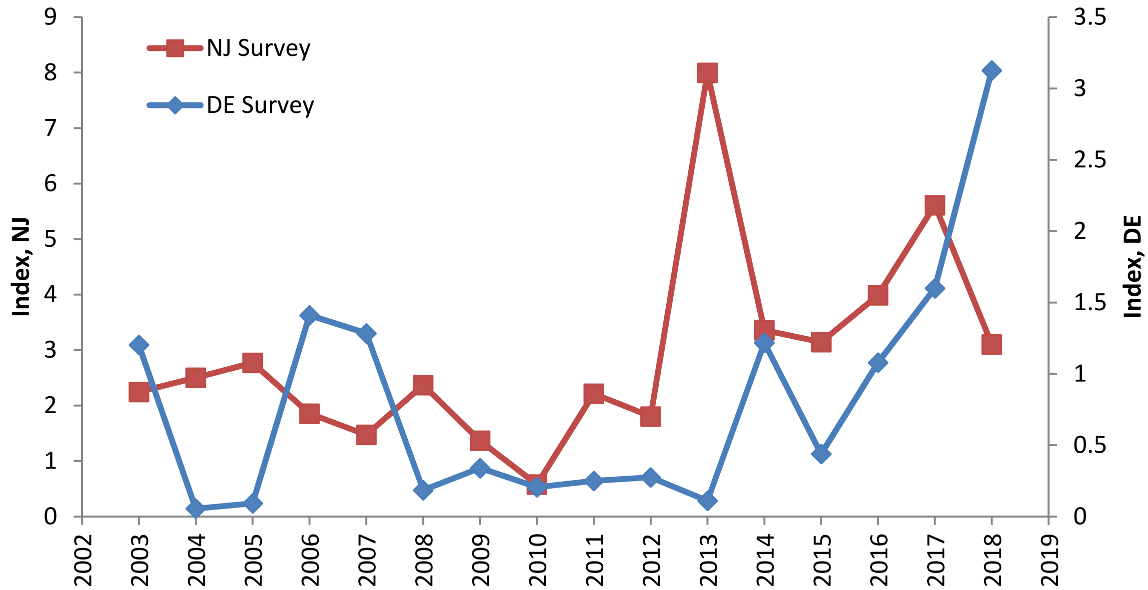


Figure 96. Aggregate stage indices from the Delaware and New Jersey trawl surveys.

[Figure Removed Due to **CONFIDENTIAL** Data]

Figure 97. Catch inputs for the base CMSA model.

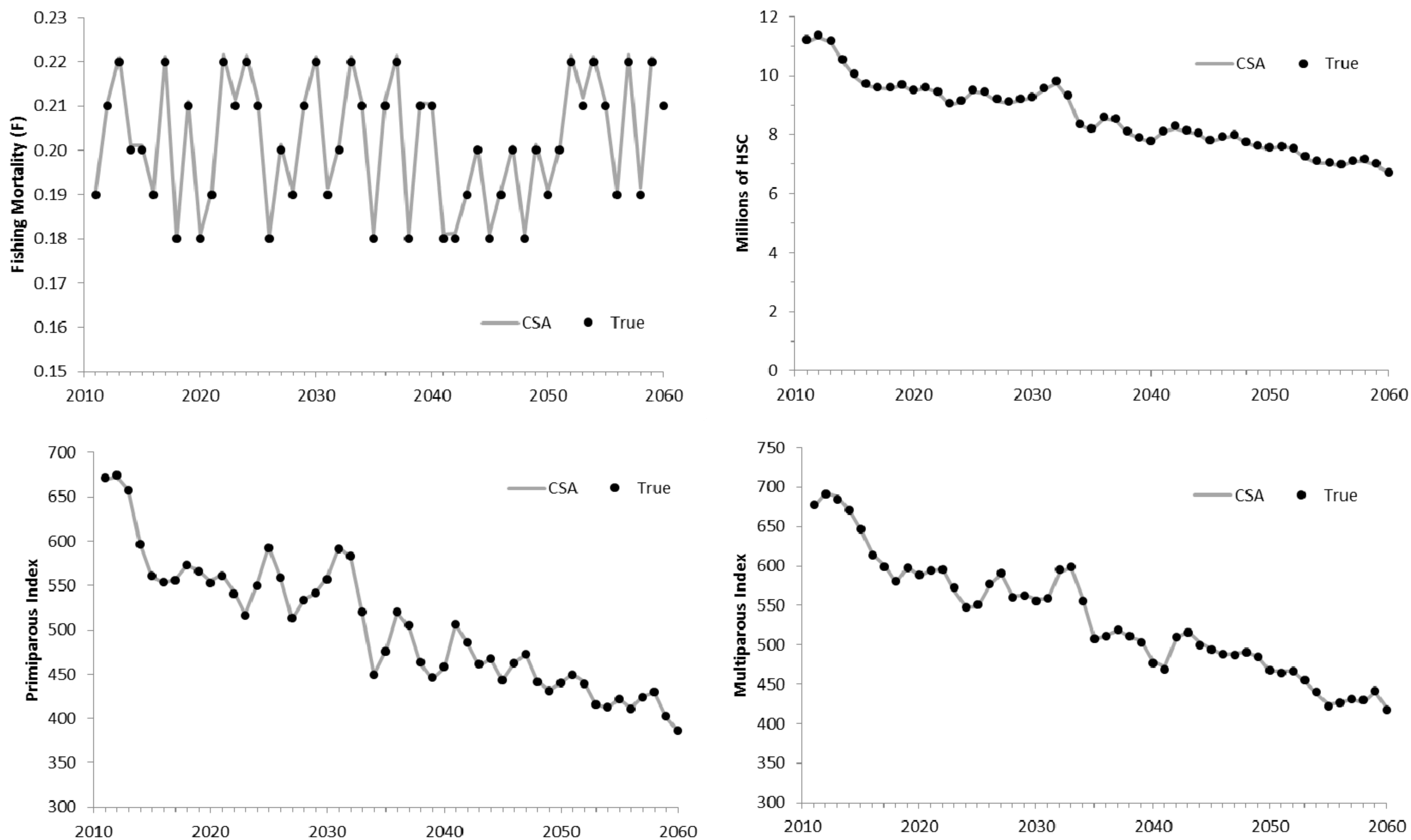


Figure 98. Comparison between simulated "true" data from the operating model and catch survey analysis (CSA) results for simulation 1.

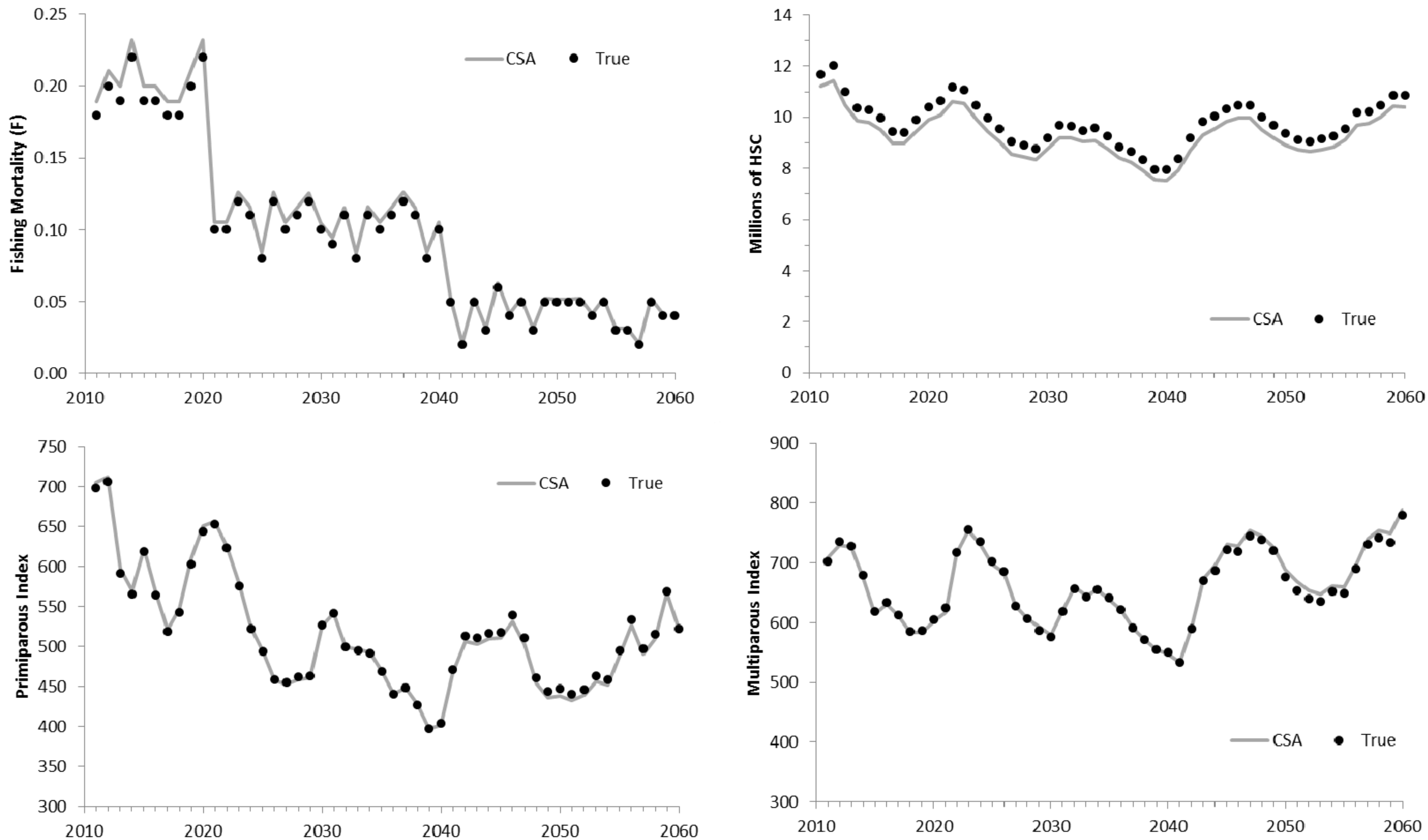


Figure 99. Comparison between simulated "true" data from the operating model and catch survey analysis (CSA) results for simulation 2.

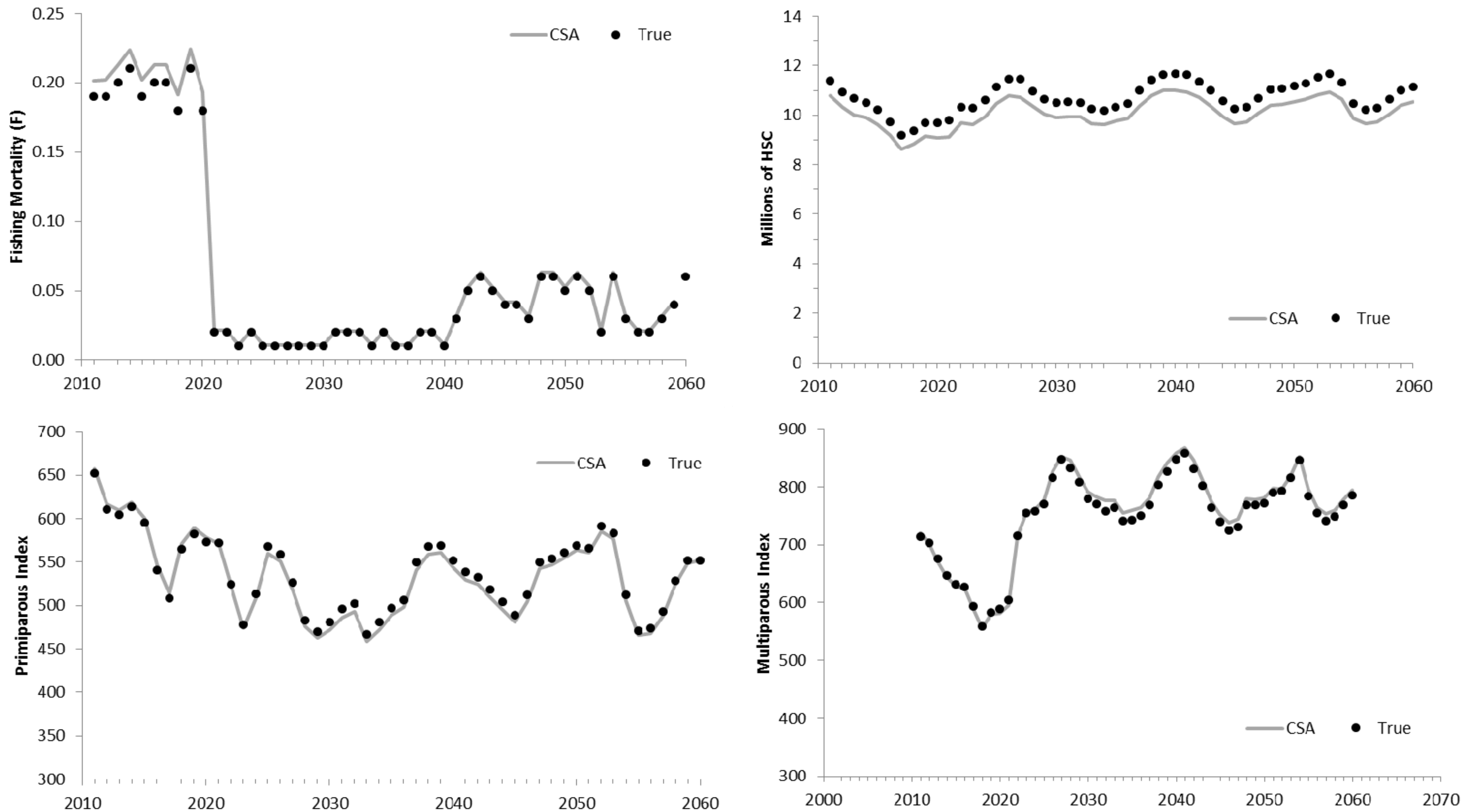


Figure 100. **Comparison between simulated "true" data from the operating model and catch survey analysis (CSA) results for simulation 3.**

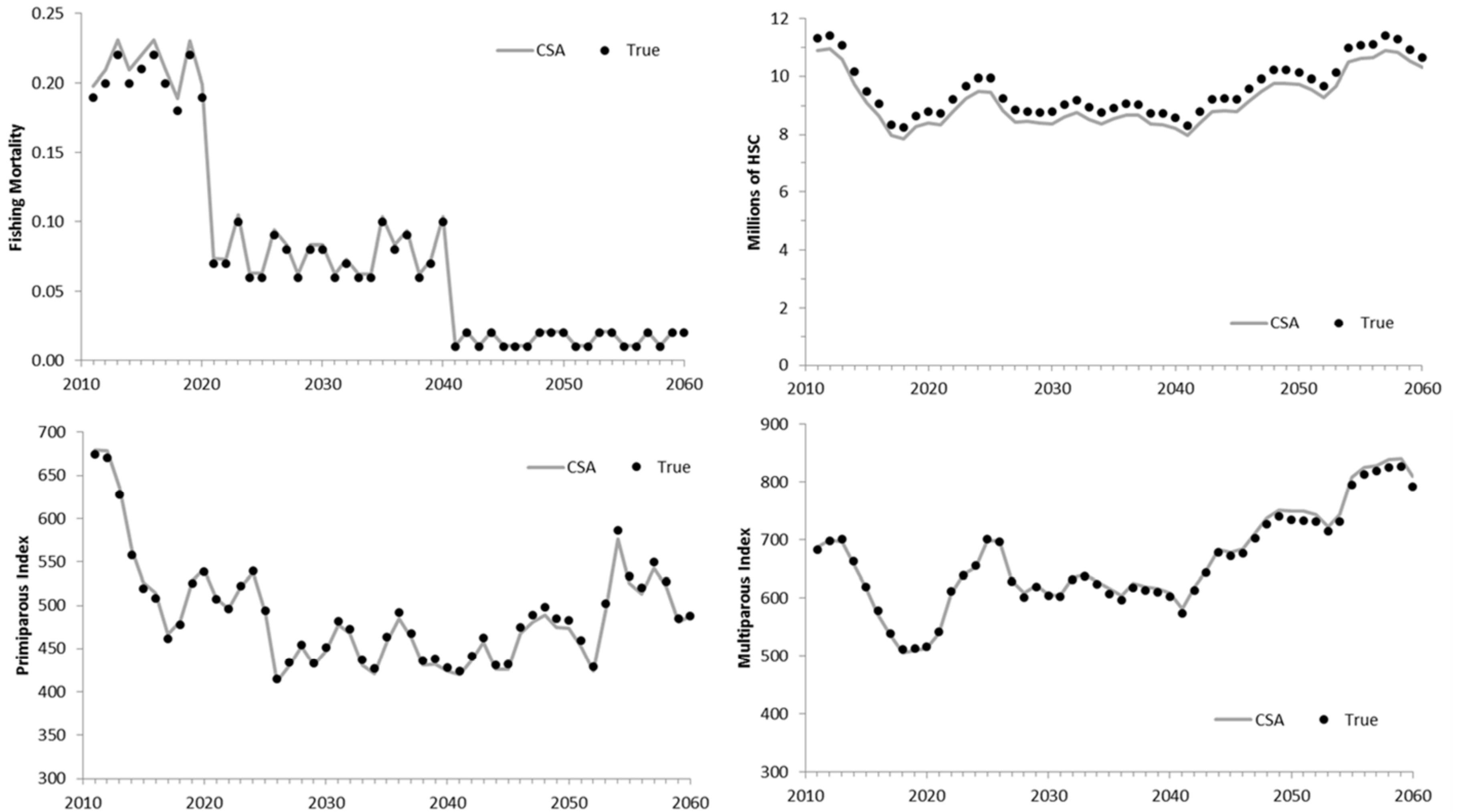


Figure 101. **Comparison between simulated "true" data from the operating model and catch survey analysis (CSA) results for simulation 4.**

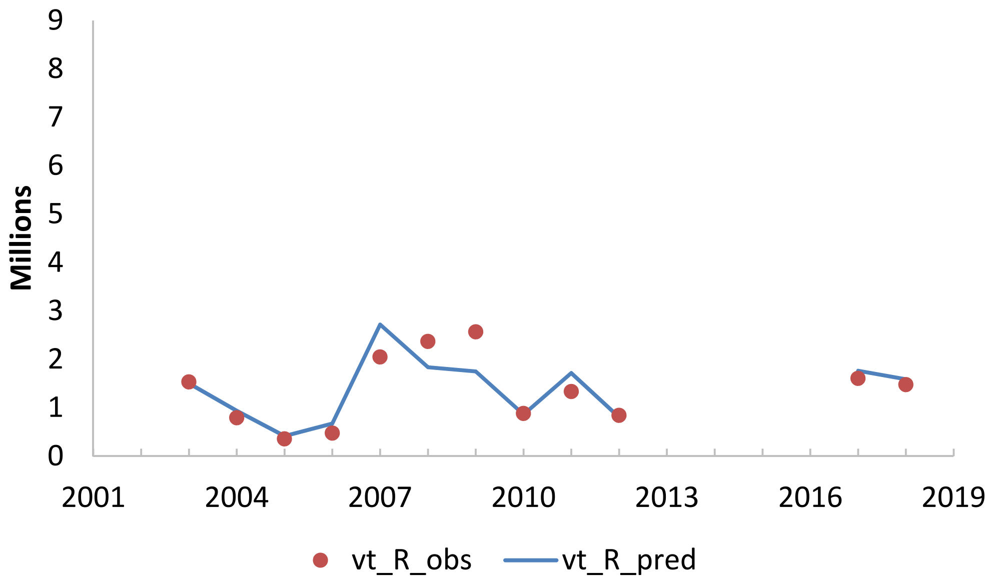


Figure 102. **CMSA model fit to the primiparous female index from the Virginia Tech Trawl Survey.**

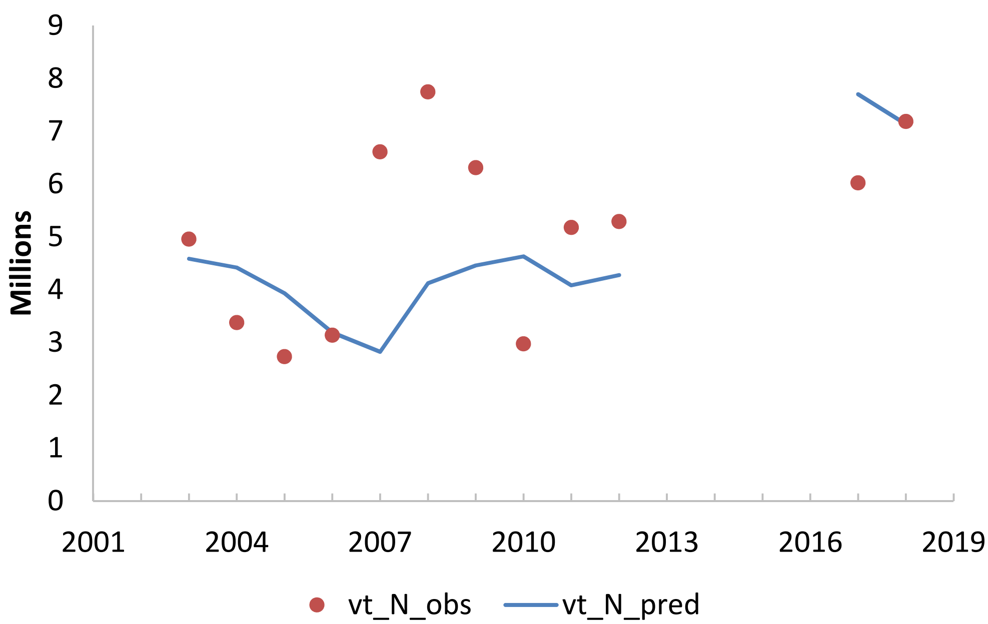


Figure 103. **CMSA model fit to multiparous female index from the Virginia Tech Trawl Survey.**

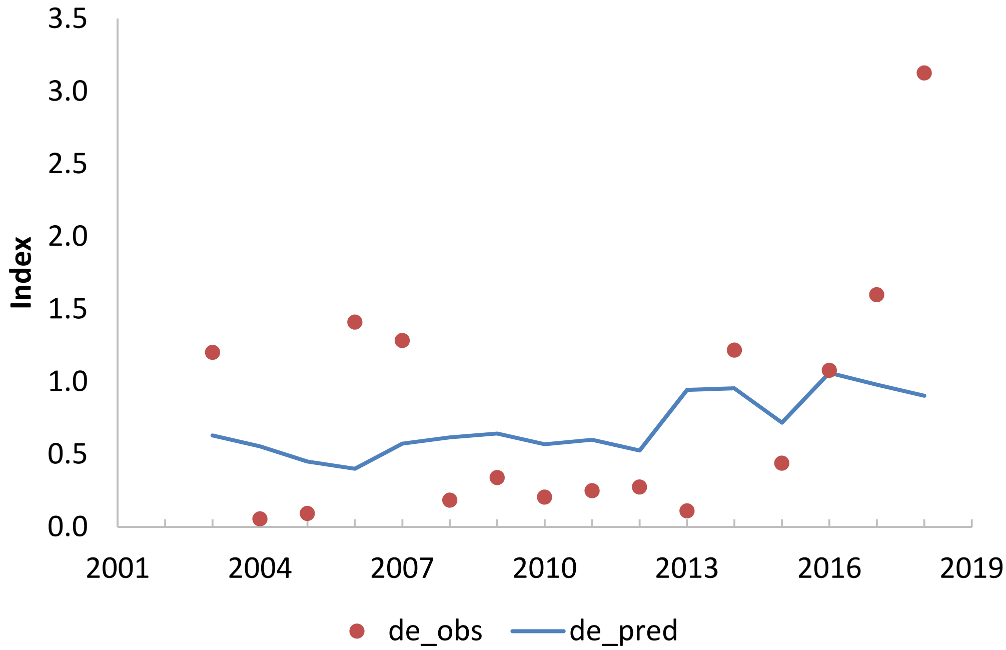


Figure 104. **CMSA model fit to Delaware Bay trawl survey aggregate adult female index.**

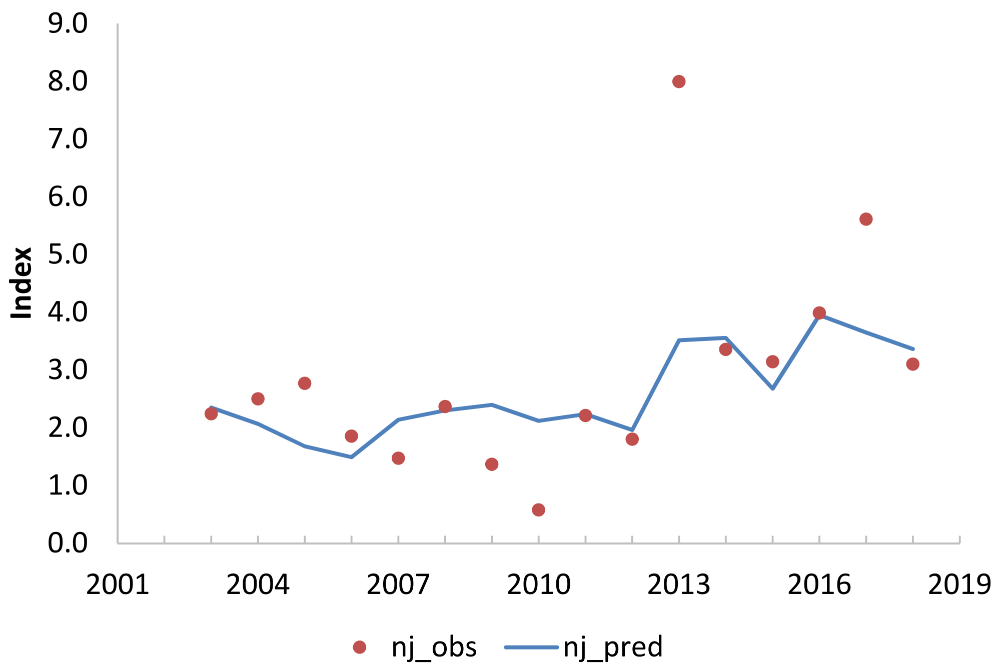


Figure 105. **CMSA model fit to New Jersey Ocean trawl survey aggregate adult female index.**

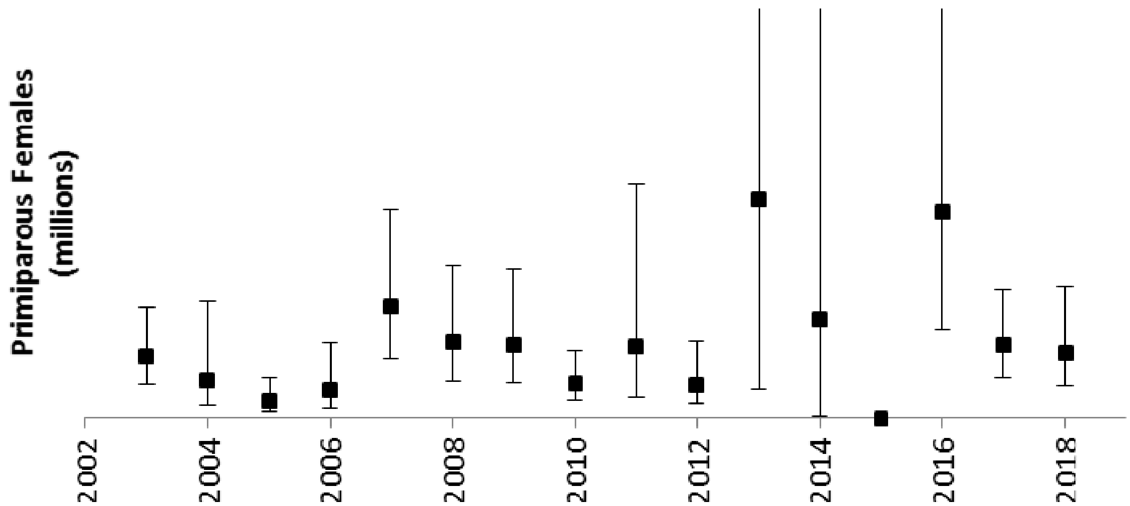


Figure 106. CMSA model estimated primiparous female abundance with lower and upper 95% confidence limits. Upper confidence limits for 2013, 2014, and 2016 extend beyond y-axis with values of CONFIDENTIAL. Y-axis values have been removed due to CONFIDENTIAL data.

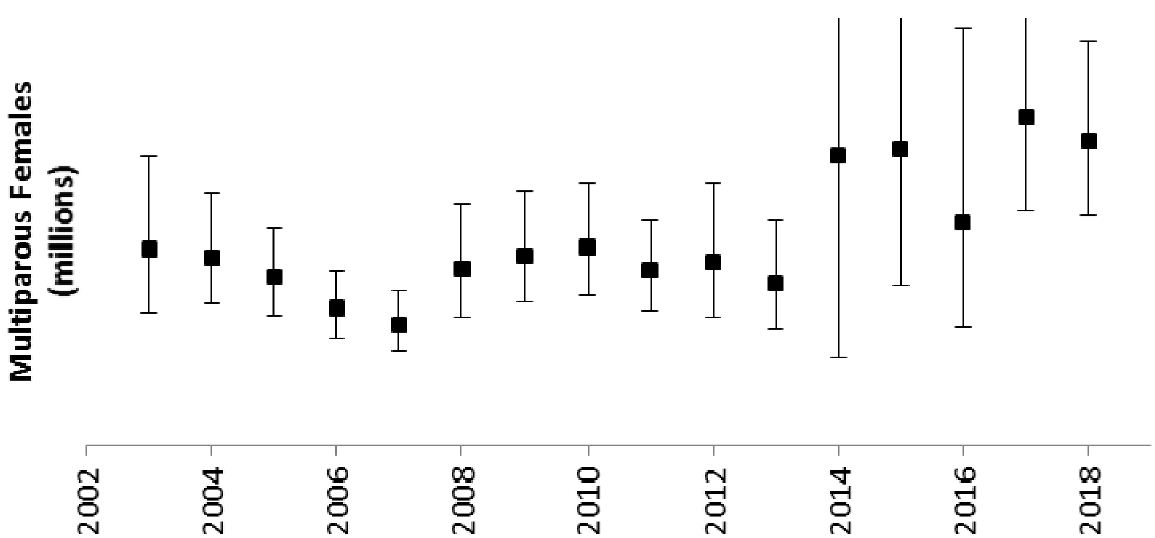


Figure 107. CMSA model estimated multiparous female abundance with lower and upper 95% confidence limits. Upper confidence limits for 2014, 2015, and 2017 extend beyond y-axis with values of CONFIDENTIAL. Y-axis values have been removed due to CONFIDENTIAL data.

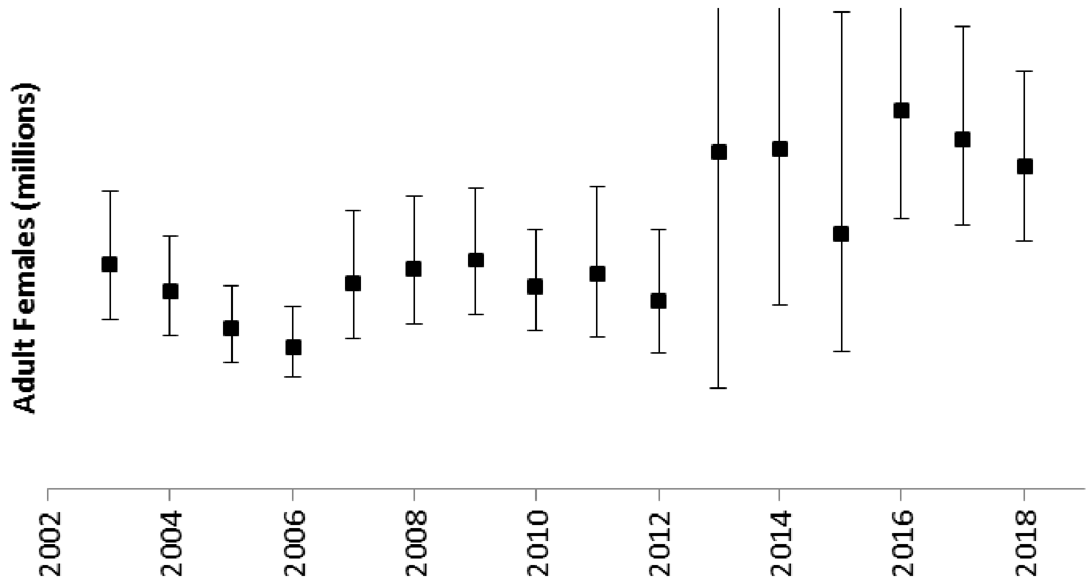


Figure 108. CMSA model estimated adult (primiparous + multiparous) female abundance with lower and upper 95% confidence limits. Upper confidence limits for 2013, 2014, and 2016 extend beyond the y-axis with values of CONFIDENTIAL. Y-axis values have been removed due to CONFIDENTIAL data.

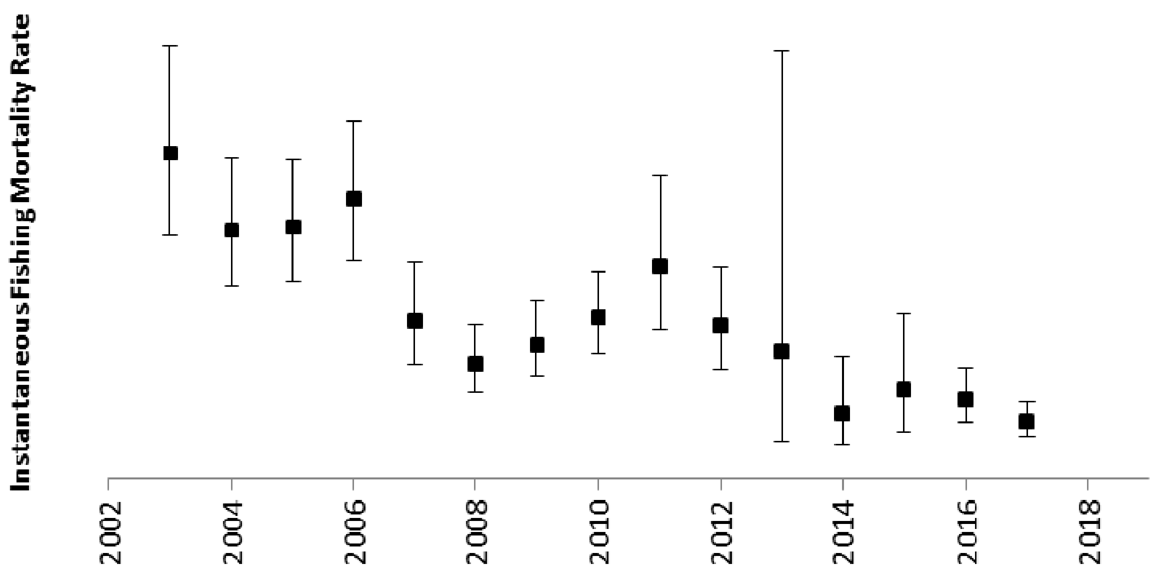


Figure 109. CMSA model estimated instantaneous fishing mortality rate F with lower and upper 95% confidence limits. Y-axis values have been removed due to CONFIDENTIAL data.

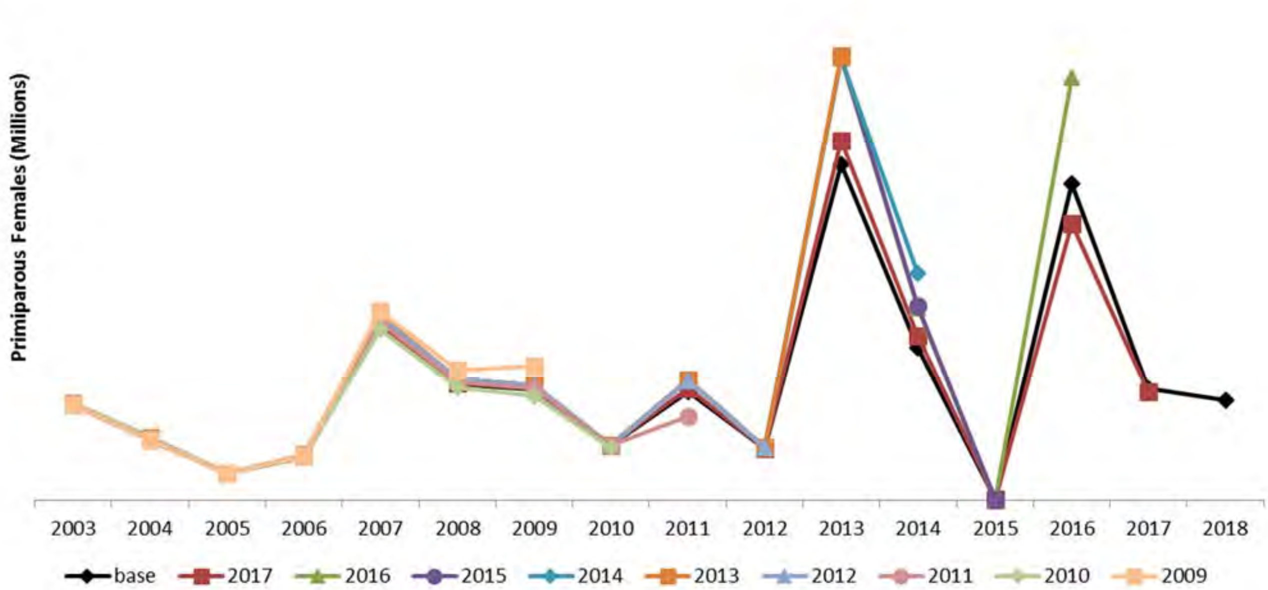


Figure 110. Retrospective peel of estimated primiparous abundance to 2009. Y-axis values have been removed due to CONFIDENTIAL data.

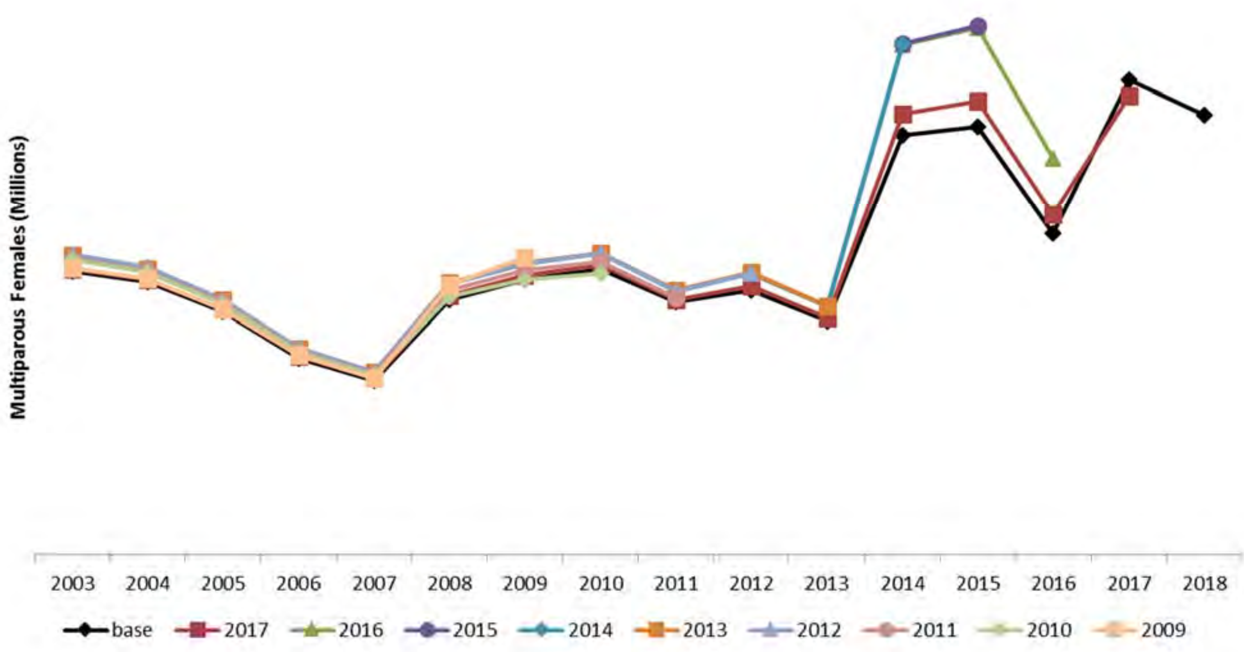


Figure 111. Retrospective peel of estimated multiparous abundance to 2009. Y-axis values have been removed due to CONFIDENTIAL data.

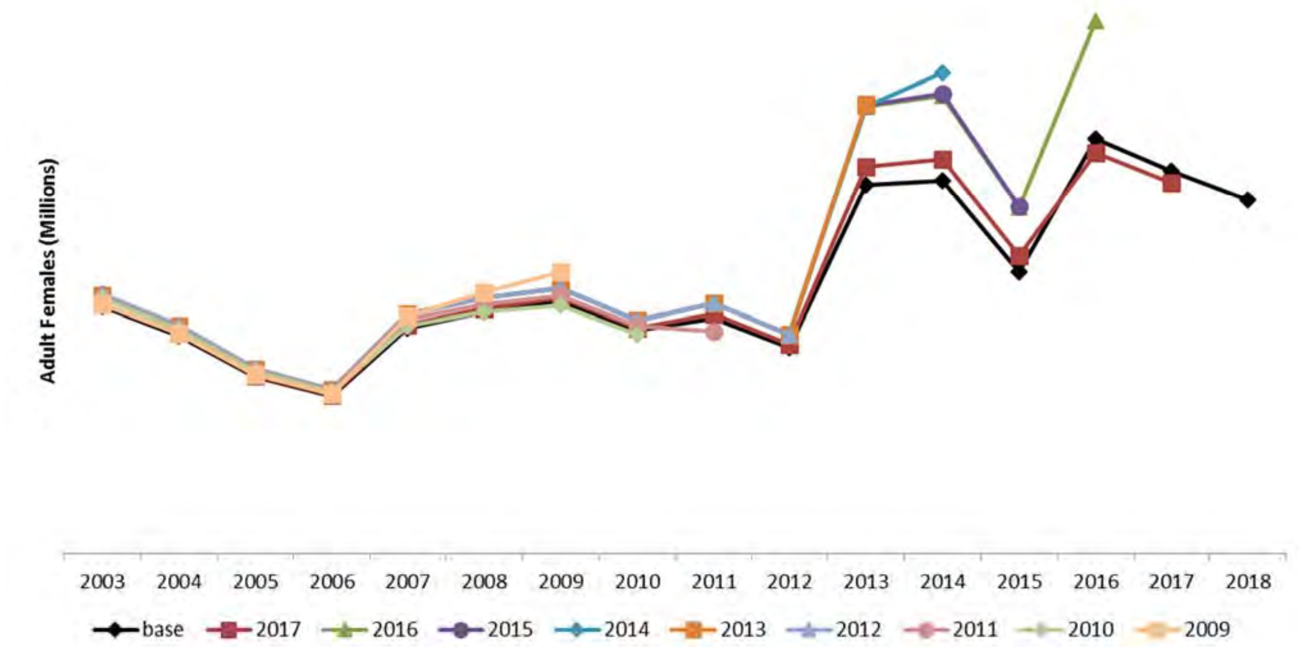


Figure 112. **Retrospective peel of estimated total adult female abundance to 2009. Y-axis values have been removed due to CONFIDENTIAL data.**

[Figure Removed Due to **CONFIDENTIAL** Data]

Figure 113. **Terminal estimates of stock size and instantaneous fishing mortality rate from sensitivity runs.**

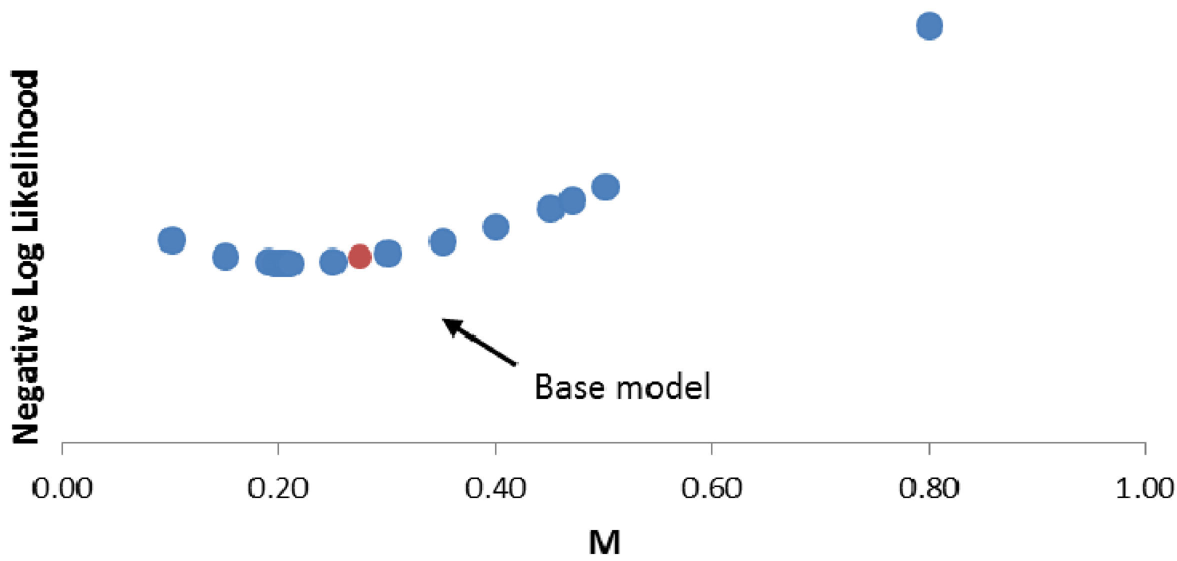


Figure 114. **Likelihood profile of base CMSA model runs with varying M inputs. Y-axis values have been removed due to CONFIDENTIAL data.**

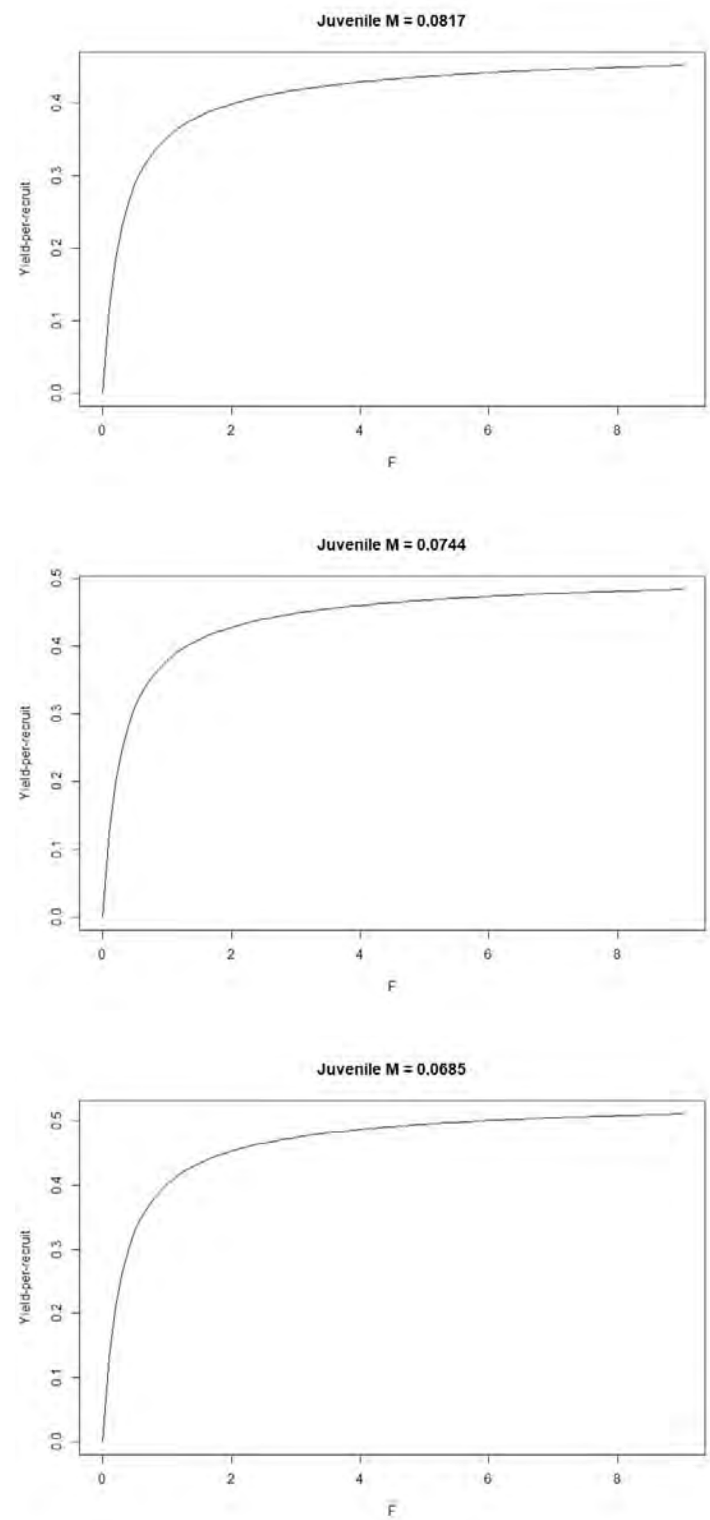


Figure 115. Yield-per-recruit model results for horseshoe crab for each level of juvenile mortality. The estimated YPR did not decline with high levels of F in any case.

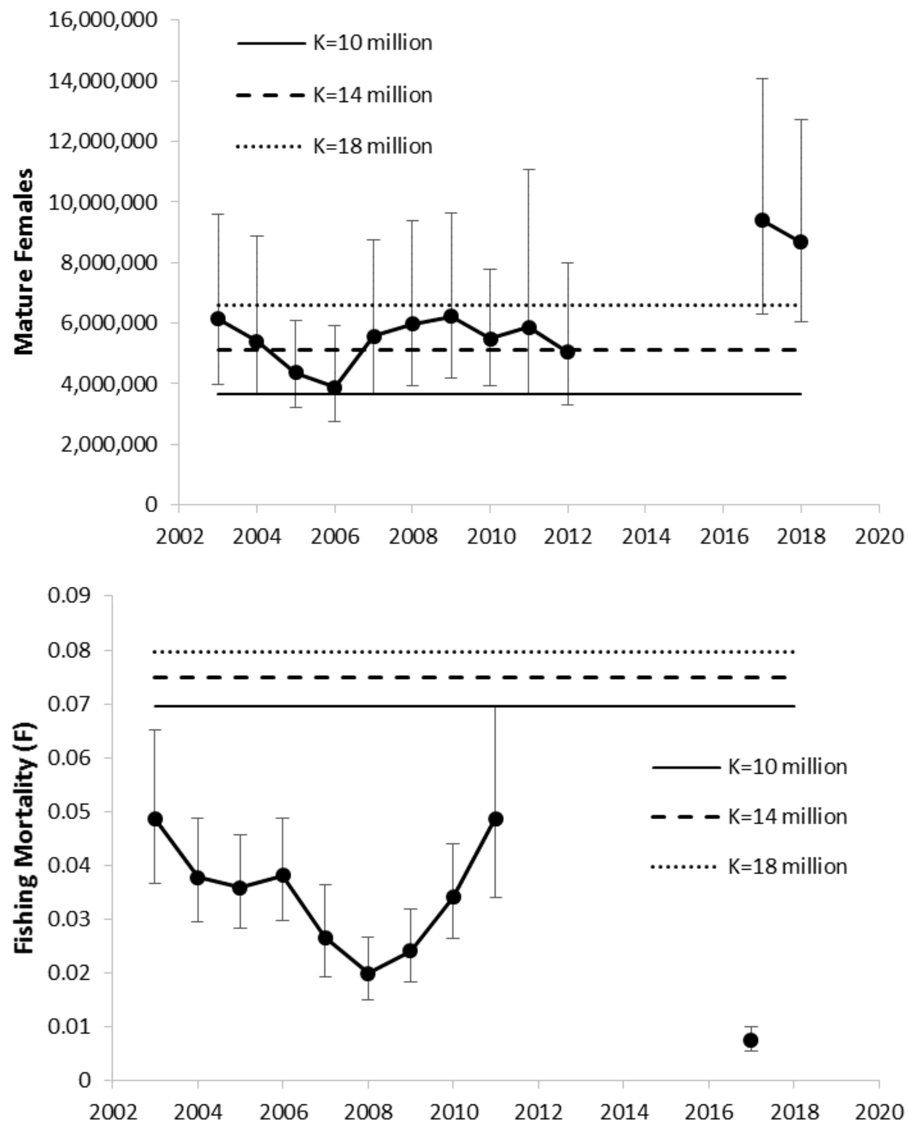


Figure 116. **Stock status of female horseshoe crabs in the Delaware Bay with biomedical data is CONFIDENTIAL. Graphs have been replaced with non-confidential data that do not include biomedical data and therefore does not represent the best data for determining stock status. Comparing terminal year estimates of the number of mature females and fishing mortality showed that females are not overfished and overfishing is not occurring. The horizontal lines on the graphs indicate the reference points (*B_{MSY}* and *F_{MSY}*) generated from the theoretical population projection model under various assumptions of carrying capacity (K).**

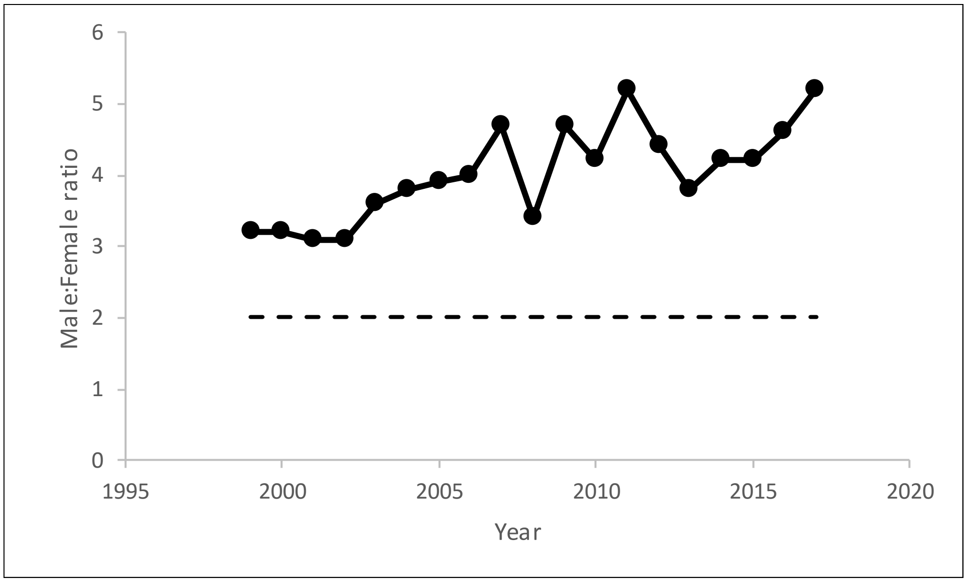


Figure 117. Sex ratio of Delaware Bay horseshoe crabs from the Delaware Bay spawning survey. The terminal year sex ratio was greater than the 2.0 reference point indicating that the male population is not overfished and there was no declining trend in the sex ratio indicating that overfishing was not occurring.

12 APPENDIX A: BIOMEDICAL WORKGROUP REPORTS

12.1 Biomedical Best Management Practices

The scope of discussion for the best management practices (BMPs) was limited to the collection, bleeding, and release of crabs collected solely for biomedical purposes. However, the WG recognized that these same practices must also be used when collecting crabs that will ultimately go to the bait industry to ensure a quality product for the biomedical and bait industries. However, the focus of this discussion was on biomedical-only crabs.

Collection

- For targeted horseshoe crab trawl tows, reasonable tow times, recommended at 20-30 minutes bottom time (winches locked)
- Proper care and handling of horseshoe crabs while sorting and placing into bins
- Avoid exposure to direct sun, extreme temperatures as well as rapid temperature changes
- Night harvesting is recommended during periods of excessive heat
- During collection, sort out juveniles and do not bleed
- Sort out and return to the water individuals that do not appear to be healthy (damaged, slow movement, dull shell/old)
- When possible, release juveniles or unhealthy individuals immediately and do not transport to the facility
- Educate collectors in proper handling techniques
- Specify expectations of collectors in written contracts
- Periodically audit horseshoe crab collectors on implementation of BMPs for collecting

Transport to Facility

- Maintain temperature between approximately ambient water temperature at time of collection and 10ºF below ambient-water temperature
- Maintain good ventilation while stacked in bins
- Limit number of horseshoe crabs to a suitable number, dependent on container size and shape, and avoiding over-stacking to minimize damage to other horseshoe crabs
- Minimize travel time
- Keep bins and horseshoe crabs covered to protect against direct sunlight
- Secure containers in transport vehicle

Holding at Facility/Preparation for bleeding/Bleeding

- Limit holding time, under normal circumstances, at the facility to less than 24 hours
- No prolonged exposure to fresh water
- Follow written procedures for proper care and handling when sorting horseshoe crabs and moving them between bins and within the facility
- Inspect crabs for health and damage, selecting only undamaged and healthy crabs for bleeding
- Maintain clean, sanitary conditions during bleeding

- Maintain same level of care for rejected crabs that are not bled while they are being held until released back to sea
- Avoid bleeding crabs more than once per year
- If crabs are marked to avoid re-bleeding, ensure that the mark is residual and not harmful to the crab
- Bleed until rate slows down so that excessive bleeding is prevented
- Continue 30-year policy of not attempting to suction additional blood from the horseshoe crabs
- Perform internal audits to maintain quality control over written procedures

Post-Bleeding Holding

- Recognizing that the horseshoe crabs are now stressed from the bleeding process, maintain the same level of care as that used when transporting horseshoe crabs into the facility for bleeding
- Return to the water as soon as possible. If not being returned to the area of capture, ensure that conditions (salinity, water temperature, etc.) are similar to those found at the harvest site
- Minimize holding time post-bleeding
- While in holding, keep horseshoe crabs in the dark to minimize movement and injury
- Keep horseshoe crabs well-ventilated, moist, and allocate only a suitable number of crabs to holding containers
- Do not keep crabs out of the water for longer than 36 hours in total

Return to Sea

- Use same care in handling and transporting crabs being returned to the water
- Include return written instructions and requirements within contract with collectors, if applicable
- Periodically audit horseshoe crab collectors on implementation of BMPs for returning

Overarching practices for all steps

- Generate written procedures for all handlers of horseshoe crabs, covering all steps in the process from collection to release
- Keep horseshoe crabs cool, moist and covered, avoiding direct sunlight
- Establish a dialogue among collectors, the biomedical company, and the state regulatory agency to address concerns and challenges
- Have a written contract between collectors and the biomedical company, outlining practices and expectations
- Perform audits of the various steps and contractors/employees throughout the process
- Ensure proper monitoring and recording of mortality at each step in the chain of custody

Other opportunities-Dual use of bait horseshoe crabs

The WG agreed that dual use of bait horseshoe crabs should be encouraged where possible but not required due to differing state regulations and the challenges of transport, volume, and timing. Depending upon capture and facility location, travel time may exceed what is practicable to maintain the health of the horseshoe crabs during transport to a biomedical facility. Additionally, the bait industry tends to collect a large volume of crabs within a short period, such that a biomedical facility would not be able to keep up with that volume in that time frame. Company representatives felt that licensing issues would not be a major challenge to using more bait crabs in the biomedical process first; rather, it would be the logistics of coordinating harvesters and their volume of catch in order to increase the use of bait crabs.

Review of Bleeding Mortality reports

There was some discussion that given recent findings and the wide variation in testing conditions and mortality results in bleeding studies, a formal peer review of the published studies might be considered. Publication of such a report could reduce some of the conflicting views currently expressed by various interests. Such a report could also frame future research avenues.

Summary

This report establishes BMPs for the various steps throughout the biomedical process, from harvest to release. Many of these practices are already in use by the biomedical companies, in order to sustain the horseshoe crab population and ensure a steady and reliable supply of product to the pharmaceutical market. The WG recommends that biomedical facilities follow these practices and monitor their suppliers. The WG also recommends holding future meetings to discuss opportunities to further decrease mortality. Given the recent and expected future increased demand for LAL, such periodic meetings are essential for continued successful management of the horseshoe crab resource along the Atlantic coast.

12.2 Northeast Region Biomedical Literature Summary

There is only one biomedical facility in the northeast, Associates of Cape Cod (ACC) which is located in Falmouth, Massachusetts. The Massachusetts Division of Marine Fisheries gives ACC a letter of authorization (LOA) each year allowing them to receive horseshoe crabs for biomedical use. These letters follow the Best Management Practices (BMPs) outlined by the ASMFC Biomedical Working Group (http://www.asmfc.org/uploads/file/biomedAdHocWGReport_Oct2011.pdf), and also includes state-level permit requirements. Included in the LOA are specifications as to what temperature the crabs should be held (50-60° F during transport, ≤70° F in laboratory), a marking requirement to prevent re-bleeding the same crab within the same year, a requirement to keep crabs moist, a limit to how many crabs can be stacked on top of each other while held in barrels, a requirement to release biomedical crabs to the embayment they were collected from, and other requirements. Crabs are typically out of the water for less than 26 hours (personal communication B. Hoffmeister, ACC, March 2018). MA DMF regularly visits ACC to collect data and ensure the terms of the LOA are being followed. Three papers have been published on the impacts of bleeding horseshoe crabs for biomedical purposes in the northeast region; Kurz and

James-Pirri (2002), Leschen and Correia (2010), and Anderson et al. (2013). Both male and female crabs are bled by the biomedical industry, but all three papers from the northeast have focused solely on female crabs. The methods and results from these papers have varied (Table 1).

Kurz and James-Pirri (2002) attached an acoustic tag to ten bled and ten non-bled female crabs and released the crabs within half an hour of taking them out of the water. Two bled crabs and one non-bled crab were never detected again. It is unknown if these crabs left the survey area or died out of the water where they could not be detected. Making the assumption that the crabs had left the survey area, the reported mortality rate for bled crabs was 20% and 0% for non-bled crabs (Table 1). The two confirmed mortalities were found dead 28 and 68 days after being bled. There was no significant difference in the amount of movement between bled and un-bled crabs or in the spatial distribution of bled and un-bled crabs. Bled crabs appeared to exhibit more random directional movements compared to un-bled crabs, thus the authors suggested the bled crabs may have been disoriented after bleeding. Crabs in this study were subjected to conditions better than current BMPs. Time out of the water did not exceed half an hour and the crabs spent minimal time being transported to and from the collection site.

Table 1. Summary of three biomedical horseshoe crab bleeding mortality papers from the northeast region. All three studies focused only on female crabs. Control = non-bled crabs.

		Sample Size		Mortality Rate		
Study	Treatment	Control	Bled	Control	Bled	BMPs Followed
Kurz and James-Pirri 2002	1:Control	10		0%		Yes
	2: Bled		10		20%	Yes
Leschen and Corriea 2010	1: Control, 4hr exp.	98		3.1%		Yes
	2: Bled, 6 hr exp		89		22.5%	Yes
	3: Bled, 25 hr exp.		94		29.8%	Yes
Anderson et al. 2013	1: Outdoor ind. enclosures	7	7	Unreported	0%	No
	2: Indoor running wheel	7	7	Unreported	14%	No
	3: Indoor ind. enclosures	7	7	Unreported	14%	No
	4: Outdoor communal	7	7	Unreported	42%	No

Leschen and Correia (2010), in cooperation with ACC, also looked at post-bleeding mortality of female crabs. Three hundred and ten crabs were collected by ACC's supplier, transported to ACC by ACC's staff in an ACC truck, and bled by ACC staff. Crabs with injuries prior to bleeding were removed from the study and current BMP methods were followed. Crabs were then sent to a research laboratory and held in tanks. Mortality rates from this study were 3% for un-bled crabs (control, treatment one), 22.5% for crabs bled and placed in tanks the same day (treatment two), and 29.8% for crabs bled and held overnight before being placed in tanks the next morning (treatment three) (Table 1). Crabs from all three treatments were mixed together amongst six tanks. Within the bled treatments, 84.3% of the mortalities occurred by day six. An analysis of deviance revealed that treatment and tank were significant factors in explaining mortality. While bled crabs had a significantly higher mortality rate than un-bled crabs, the significant tank effect shows that something else also contributed to crab mortality rates.

Anderson et al. (2013) followed the "high stress" methods of Hurton and Berkson (2006) that the authors state "approximated the standard biomedical bleeding procedure". These methods drastically deviate from current BMPs. Fifty-six crabs were collected and split equally among four experiments which were sorted by crab size due to laboratory space restraints. The largest 14 crabs were placed into individual wire enclosures within an outdoor tank under natural light conditions (experiment 1). The smallest 14 crabs were placed on individual running wheels within partitioned indoor tanks (experiment 2). The remaining 28 crabs were split evenly among two experiments, one placed 14 crabs in a communal, indoor tank within individual enclosures (experiment 3), and the final 14 crabs were placed in a communal indoor tank and had 1-2 ml of blood drawn weekly to monitor hemocyanin levels (experiment 4). Half of the crabs in each experiment were bled, the rest were left as a control. Crabs that were bled were exposed to direct sunlight, temperatures reaching 37 °C, and held out of the water for 52 hours. Overall post-bleeding mortality rate was 18%. Mortality was highest in the experiment 4, where crabs were held communally at a very high density (27 crabs/m^2) and had hemolymph samples drawn multiple times post-bleeding (42% mortality) compared to experiments that partitioned crabs individually and handled them only once (0-14% mortality). The authors found that bleeding caused the crabs to be more sluggish and impacted their movement patterns when compared to crabs that were not bled and exposed to the "high stress" conditions.

Despite three peer-reviewed papers on the subject, given the wide range of mortality estimates produced there are still many questions as to how the bleeding process affects horseshoe crabs in the northeast region. The work reviewed above was conducted under a wide range of conditions and sample sizes, with varying study goals, making it difficult to compare results. Mortality rates from bled crabs ranged from 0% to 42% while reported mortality rates for un-bled crabs were less than 5%. There is evidence for negative effects of holding conditions (see also Coates et al. 2012), which likely compounded mortality estimates in some cases. There is obviously more work required to accurately estimate bleeding impacts to crabs (both lethal and sublethal). Given the wide range of mortality estimates published in the peer-reviewed literature for this region, any assignment of biomedical mortality rates for the assessment process must incorporate a sensitivity analysis. This would allow the assessment to produce model estimates of stock size over the range of potential biomedical impacts suggested by the best available science.

<u>Literature Cited</u>

Anderson, R. L., W. H. Watson III, and C. C. Chabot. 2013. Sublethal behavioral and physiological effects of the biomedical bleeding process on the American horseshoe crab, *Limulus Polyphemus*. *Biological Bulletin* 225: 137-151.

Coates, C. J., E. L. Bradford, C. A. Krome, and J. Nairn. 2012. Effect of temperature on biochemical and cellular properties of captive *Limulus Polyphemus*. *Aquaculture* 334-337:30-38.

Hurton, L., and J. Berskon. 2006. Potential causes of mortality for horseshoe crabs (*Limulus polyphemus*) during the biomedical bleeding process. *Fisheries Bulletin* 104:293-298.

Kurz, W., and M.J. James-Pirri. 2002. The impact of biomedical bleeding on horseshoe crab, *Limulus Polyphemus*, movement patterns on Cape Cod, Massachusetts. *Marine and Freshwater Behaviour and Physiology* 35(4): 261-268.

Leschen, A. S., and S. J. Correia. 2010. Mortality in female horseshoe crabs (*Limulus polyphemus*) from biomedical bleeding and handling: implications for fisheries management. *Marine and Freshwater Behaviour and Physiology* 43(2):135-147.

12.3 Delaware Bay Region Biomedical Literature Summary

The Delaware Bay region is unfortunately lacking in quantity as far as independent biomedical research projects are concerned. However, the quality of the few papers available is fairly high. The two projects available for review are Hurton's 2003 thesis for VA Polytechnical Institute and Walls' and Berkson's 2003 Fisheries Bulletin entry. It should be noted that Hurton's thesis results were used to publish 3 subsequent papers that were also reviewed.

The most important part of these papers to consider when deciding how to judge the accuracy of mortality rates is the methods section. Hurton's methods were well designed and documented which helps lend credibility to the results. Two groups were analyzed for Hurton's experiment. The first group (n= 200, 100M 100F) was designated as the "low stress." This cohort was treated following BMPs. The second group (n= 195, 110M 85F) was designated as "high stress." This cohort was treated with external pressures beyond bleeding, including temperature fluctuation, salinity fluctuation, and other variables that horseshoe crabs may experience during transport and holding. Both groups were subjected to the same bleeding treatments: a control group of 0% bled, a group of 10% total hemolymph extraction, a group of 20% total hemolymph extraction, a group of 30% total hemolymph extraction, and a group of 40% total hemolymph extraction. In the low stress group, total mortality was 0%. In the high stress group, average mortality was 7.2% for combined males (6.4%) and females (8.24%). The highest recorded value of all five high stress treatments occurred with the 40% bled female group at 29.4%. It should also be noted that this is the only mortality value in the whole data set that is over 15% value currently used as the standard biomedical mortality rate.

The Walls Berkson study had comparable results to Hurton's thesis. Overall mortality for bled crabs was 8% (16 crabs) while unbled crabs had a total mortality of .5% (1 crab). The issue with this study is the lack of description in the methods section. The paper only states that the bled cohort "underwent BioWhittaker's normal bleeding process." Due to how drastically the treatment of crabs can vary I think this would have been an important place to include exact treatments, especially because the mortality levels were so low. The whole 3-year study included 8 separate cohorts resulting in a total of 200 unbled crabs and 200 bled crabs being observed. It should also be noted that all crabs in this study were MALE.

Paper	Reported Mortality Rate	Sample Size	Adherence to BMPs
Hurton, Berkson, Smith 2005	0% in low stress group 7.2% in high stress group (bled) 2.6% in high stress (unbled) 29.4% F crabs bled at 40% volume	Low stress group N = 200, bled crabs= 160 High Stress group N=195 , (110M 85 F) bled crabs = 156	BMPs followed in low stress group, purposely not followed in high stress group
Walls, Berkson 2003	unbled HSC average .5% (0-3.3%) bled HSC average 8% (0-30%)	total unbled N = 200 total bled N = 200	crabs "underwent BioWhittaker's normal bleeding process"

<u>Literature Cited</u>

Hurton, L. and J. Berkson 2005. Potential causes of mortality for horseshoe crabs (*Limulus polyphemus*) during the biomedical bleeding process. Fishery Bulletin 104:293-298.

Hurton, L., J. Berkson, and S. Smith 2005. Estimation of total hemolymph volume in the horseshoe crab *Limulus polyphemus*. Marine and Freshwater Behaviour and Physiology 38(2):139-147.

Walls, E.A. and J. Berkson 2003. Effects of blood extraction on the horseshoe crab, *Limulus polyphemus*. Fish. Bull. 101:457-459.

12.4 Southeast Region Biomedical Literature Summary

A total of 5 studies have been conducted through the South Carolina Department of Natural Resources over a >20-year time-frame to assess the mortality associated with biomedical processing of American horseshoe crabs, *Limulus polyphemus*. Most of these studies were conducted in collaboration with the biomedical bleeding facility located in Charleston, SC (Endosafe, Inc.). For these studies, horseshoe crabs were harvested and handled in accordance with industry standards by Endosafe before SCDNR representatives randomly selected individuals for control groups, which were not bled, and treatment groups, which were bled. Following this process, horseshoe crabs were then followed for 7-14 days to assess mortality. One study, Linesch (2017), did not use crabs provided by Endosafe, but rather collected crabs themselves and independently simulated the biomedical bleeding process including holding of crabs in ponds prior to extraction of hemolymph, and then following crabs for 12 days. Estimates of total mortality from these studies range from 6.6% to 20.4%, with a mean mortality estimate of 12.3%. Additional results from the Linesch (2017) study, as well a study conducted in the northeast region (Owings 2017), show that biomedical processing can reduce the physiological fitness of horseshoe crabs that survive biomedical processing. While the mortality of biomedically-bled horseshoe crabs after 14 days has not been assessed in the southeast, the reduced physiological function associated with biomedical processing suggests that there is an increased risk to mortality that extends beyond this 14-day window of previously-conducted experiments. As such, there does not appear to be sufficient evidence to change the current 15% mortality rate for biomedically-processed horseshoe crabs in the Southeast region.

Table 1. Summary of biomedically-related mortality assessments conducted in South Carolina

Citation	# of Crabs	Mortality	Study Description
SCDNR (1999)	267	6.60%	Selected crabs from biomedical facility (133 un-bled, 134 bled). Tracked for 14 days
Thompson (1999)	40	15.00%	Selected crabs from biomedical facility (20 un-bled, 20 bled). Tracked for 7 days
Wenner & Thompson (2000)	150	8.30%	Selected crabs from biomedical facility (75 un-bled, 75 bled). Tracked for 14 days
DeLancey & Floyd (2012)	100	20.40%	Selected crabs from biomedical facility (50 un-bled, 50 bled). Tracked for 14 days
Linesh (2017)	96	11.00%	Hand-harvested crabs from beach (48 un-bled, 48 bled). Tracked for 12 days

Literature Cited

DeLancey L & Floyd B (2012). Tagging horseshoe crabs*, Limulus polyphemus*, in conjunction with commercial harvesters and the biomedical industry in South Carolina. Final report South Carolina Sea Grant Consortium. Project #: R/CF-14.

Linesch K (2017) Evaluating best management practices in the South Carolina horseshoe crab fishery: A field approach to determine physiological impacts of the biomedical bleeding process. Thesis, College of Charleston.

Owings M (2017) Effect of the biomedical bleeding process on the behavior and physiology of the American horseshoe crab, *Limulus polyphemus*. Thesis, University of New Hampshire.

SCDNR (1999). An evaluation of *Limulus* post-bleeding mortality experiment data.

Thompson (1999) Assessments of the population biology and critical habitat for the horseshoe crab, *Limulus polyphemus*, in South Carolina. Thesis, Medical University of South Carolina.

Wenner E. & Thompson M. (2000). Evaluation of harvesting impacts and population trends for *Limulus polyphemus* in South Carolina. Final report to NOAA, MARFIN Grant #NA87FFO431.

12.5 Biomedical Literature Review by Dr. James Cooper

The LAL Biomedical Industry Impacts Positively on Horseshoe Crab Sustainability

Presented to the Stock Assessment Subcommittee of ASMFC by James F Cooper, PharmD*

About the Author

James Cooper in 1970 pioneered development of the LAL test as a sensitive detector of endotoxin (pyrogen) for injectable drug products. His publications span the history of LAL technology and horseshoe crab (HSC) conservation. He founded Endosafe Inc. in 1987. He is a consultant on endotoxin issues and is a retired Professor of Pharmaceutical Sciences at the Medical University of South Carolina, Charleston. In 1997 he began ASMFC service as a member of the team, headed by Tom O'Connell, that drafted the Fisheries Management Plan for HSC. He has served on the HSC Advisory Panel since that time, including position of Chair for the past 12 years.

Introduction

This discussion briefly describes the life cycle of the Horseshoe crab (HSC) and critiques studies that attempt to understand the impact of biomedical bleeding processes upon donor crabs. Our understanding is incomplete, but we know a great deal about where and how HSC live. HSC are significant to the ecology of shallow-water marine life as prey, predators and hosts to a diverse array of epibionts on their shell, appendages and gills (Shuster and Sekiguchi 2003). These hitch-hikers affix to or infest HSC exterior surfaces and are significant factors in the aging and ultimate fate of their hosts. HSC require about nine-to-ten years and 16-18 molts to reach sexual maturity. In their early stages they are highly vulnerable to prey by birds, fish and other crustaceans. Juveniles and adults are prey for loggerhead turtles, sharks and other large sea creatures. Adults that are stranded on the beaches of Delaware Bay are susceptible to attack by laughing gulls. Humans negatively impact by loss of habitat (e.g., commercial and housing development) and exploitation of the resource. During spawning their eggs provide nutrition for a vast array of migratory shorebirds.

Large juveniles and adult HSC are opportunistic foragers in tidal flats and the ocean floor. In tidal flats, they prefer feeding on soft-shell clams and marine worms. A high concentration of large HSC predators, such as in Delaware Bay and the ACE Basin of South Carolina, has great impact on benthic invertebrates. Botton et al. (2003) observed that bivalves were the major diet of HSC in Delaware Bay tidal flats. Their examination of crabs dredged off the New Jersey coast found that their guts were stuffed with an average of 400 blue mussels.

Impact of the LAL Biomedical Industry on Horseshoe Crab Sustainability

The LAL biomedical industry impacts positively on HSC conservation because the importance of LAL makes them extremely valuable to mankind. Cooper and Levin (1971) developed a screening test for bacterial endotoxin in injectable drugs from LAL (*Limulus* amebocyte lysate) reagent. Subsequently, a robust LAL production industry (biomedical) flourished in the 1970s to meet the needs of the pharmaceutical and medical device industry. Five firms currently produce LAL. The LAL producers applied a return-to-sea policy from the outset. In 2011 they met with ASMFC to formalize Best Management Practices (BMPs). Mortality doesn't occur during the bleeding process of donor crabs, which is consistent with human blood donation. Investigators designed experiments to determine if there was significant post-bleeding mortality after release of donor crabs to the environment. Reported mortality rates varied greatly. (Table 1). Rudloe (1983) observed a 11% loss in a release-and-recapture study in a Gulf Coast bay. Thompson (1998) found 15% mortality in a small study where 40 bled and un-bled HSC were kept for a week in a shallow sea-water tank. Dave Yadon (1999) observed an 8.3% loss where 252 bled and un-bled HSC were retained in a shallow sea-water tank. Walls and Berkson (2003) reported a loss of 8% where 400 HSC were held in replicated flow-through tanks for 2 weeks. Hurton and Berkson (2006) reported no loss under low-stress conditions, but a 8.3% loss under high-stress conditions. The results of these reports prompted the ASMFC to assign 15% as the estimated post-release mortality from biomedical processing.

A robust report by Linesch (2017) is consistent with the above studies. Linesch held 100 bled and 100 un-bled donors in low-density seawater ponds at Waddell Mariculture Center in Bluffton SC for up to 8 weeks. Mortality was 11%. This study generally emulated practices of a South Carolina LAL-production facility. An exception was that Linesch only studied females. In contrast, the LAL facility currently observes a 2.6 male/female ratio so that only 30% of donors are females. She observed that a high carapace epibiont load impacted negatively on physiological health metrics.

Two studies reported mortality significantly greater than previous reports. A small study of 56 crabs reported an 18% loss (Anderson, *et al*., 2013). The excessive stress and containment in multiple small tanks rendered the experimental conditions as not representative of biomedical LAL practices and unaligned with BMPs. For example, specimen were subjected to long periods out of water and high temperatures, methods that are offensive and not justifiable. The report speculated that bleeding suppressed spawning activity, but other reports contradict this claim (Linesch 2017; Spawn 2018; Figure 1).

More puzzling was the study by Leschen and Correia (2010) that reported the effects of two LAL treatment methods on HSC held in salt-water tanks at the MBL (Marine Biological Laboratory) in Woods Hole, MA. Female horseshoe crab were separated into three treatment groups of 99, 89 and 93; treatments were intended to emulate the processing of HSC at a nearby LAL firm. Group 1 was the control group that was held out of water for 4 hours. Groups 2 and 3 were exposed to conditions mimicking an open boat deck, one-hour drive in a non air conditioned truck, being stored for 24 hours stacked in 30-gallon totes at room temperature, one-hour truck ride and a 15-minute boat ride. The HSC from Group 2 were held for six hours after the biomedical process and the HSC from Group 3 held overnight for 25 hours. Mortality of the un-bled control HSC was low (3%) and differed significantly from that of either bled group (22.5% and 29.8%, respectively).

The methods section specified that three groups of HSC were held in six flow-through seawater tanks that contained 5 cm of sediment. Tanks differed by volume and shared a common source and flow of seawater. A similar number of HSC from each treatment group and control were assigned to each tank. Although the mortality of HSC was similar for the two treatment groups, there was a significant difference in mortality with respect to the six tanks. Mortality did not align with treatment group. Since the author's data in Table 3 obscured the variation by tank, their results were reconfigured to reveal the unexplained variation in mortality by tank (Fig. 2), which the authors admit. The tank rates varied from 8.7% to 48%. There were apparently three populations in the study. The mortality rate for tanks 1 and 4, which contained 55 HSC, was 12.7%. The mortality rate for tanks 2, and 6, which contained 72 HSC, was 26%. The rate for tanks 3 and 5 was 45%; one control crab died in each of these tanks. Mortality was determined by multiplying the predicted mortality rate times the number of crabs per tank per treatment (Table 3 of Leschen and Correia 2010). This unexplained difference in mortality indicated that there was an apparent risk factor in at least two of the tanks, such as a chemical or microbial contaminant, or failure to maintain a condition, such as oxygen, that impacted negatively on female HSC that were stressed by bleeding. The reported 45% mortality rate for tanks 3 and 5 is significantly distinct from the other 4 tanks in the study as well as previously reported estimated mortality studies. In summary, this study encountered unforeseen experimental circumstances that apparently produced falsely-high, post-release mortality estimates. This flawed study should be excluded from reports that are used to define LAL-related mortality estimates.

For an estimated mortality to be applicable to biomedical procedures, it must be consistent with the Best Management Practices (BMPs) accepted by the ASMFC and LAL firms in 2011. These procedures generally describe the collection, inspection, handling, bleeding, training and return policies of biomedical firms. The value of excessive-stress studies that do not follow the BMPs are only indicative of the resilience of donor crabs in the presence of taxing conditions. The great limitation of most HSC mortality studies is that the donor crab is not returned to a preferred foraging site (see above), such as a tidal mud flat, but is retained in an artificial container in a high density. Also, control of ambient salinity, temperature, acidity and oxygen is challenging. HSC are 2-to-5 kg, large animals that generate considerable waste that must be managed. The ideal mortality experiment would require study of recently molted crabs that were returned to a natural environment, a costly and challenging experiment to manage. Technical advances reduce LAL needs. Charles River Labs attained FDA approval for a LAL-cartridge based system that reduces the need for LAL by 95%. Recombinant LAL products (rFC) are being evaluated for robustness, specificity and sensitivity. The FDA has zero tolerance for endotoxin contamination and will not approve these products until they are validated as equivalent and specific as LAL for endotoxin detection. Several years of product development and costly validation will be required before drug regulators and pharmaceutical industries will rely on a recombinant product.

Finally, the biomedical community has had a positive impact on HSC populations through 45 years of consistent conservation practices. The actual mortality from biomedical procedures is likely in single digits because the reported mortality studies present worst-case estimates. Biomedical efforts have produced either limits or bans for the HSC bait fishery in South Carolina and the Delaware Bay area. Public education is important; by placing a value on HSC for LAL, the public reveres HSC and watermen no longer destroy HSC collected as by-catch.

Conclusions

- Simulated post-bleeding mortality studies that are generally compatible with the biomedical BMPs indicate that the estimated biomedical mortality is less than 15%.
- Post-bleeding mortality studies that are generally incompatible with the biomedical BMPs are irrelevant to a mortality estimate and should not be used for that purpose.
- There is no credible evidence that biomedical use threatens the sustainability of the horseshoe crab or availability of eggs for migratory birds.
- The net effect of the biomedical industry for HSC sustainability is positive because of consistent and unique conservation efforts.

Literature Cited

Anderson RL, Watson WH, Chabot CC (2013) Sublethal behavioral and physiological effects of the biomedical bleeding process on the American horseshoe crab, *Limulus polyphemus*. *Biol Bull* 225:137–151.

Botton ML, Shuster CN Jr, Keinath JA (2003) Horseshoe crabs in a food web: Who eats whom. In: Shuster CN Jr, Barlow RB, Brockmann HJ (eds) *The American horseshoe crab*. Harvard University Press, Cambridge, pp 133-153.

Cooper, J. F., J. Levin and H.N. Wagner, Jr. 1971. Quantitative comparison of in vitro (limulus) and in vivo (rabbit) methods for detection of endotoxin. *J. Lab. Clin. Med*., 78: 138-148.

Hurton L., & Berkson J. (2006). Potential causes of mortality for horseshoe crabs (Limulus polyphemus) during the biomedical bleeding process. *Fishery Bulletin*, 104, 293-298.

Leschen AS, Correia SJ (2010) Mortality in female horseshoe crabs (Limulus polyphemus) from biomedical bleeding and handling: implications for fisheries management. *Mar Freshw Behav Physiol* 43:135–147.

Linesch K. (2017) Evaluating best management practices in the South Carolina horseshoe crab fishery: a field approach to determine physiological impacts of the biomedical bleeding process. MS Thesis in Environmental Studies, University of Charleston, Charleston, SC.

Shuster CN Jr, Sekiguchi K (2003) Growing up takes about ten years and eighteen stages. In: Shuster CN Jr, Barlow RB, Brockmann HJ (eds) *The American horseshoe crab*. Harvard University Press, Cambridge, pp 103–132.

Spawn B. (2018), Personal communication and photograph.

Thompson M (1998) Assessments of the population biology and critical habitat for the horseshoe crab, Limulus polyphemus, in the South Atlantic Bight. M. Sc. Thesis, College of Charleston, Charleston, SC. 50 pp.

Walls EA. & Berkson J. (2003). Effects of blood extraction on horseshoe crabs (Limulus polyphemus). *Fishery Bulletin*, 101, 457-459.

Yadon D. (1999). An evaluation of Limulus post-bleeding mortality experiment data: statistical analyses performed by South Carolina Department of Natural Resources (SCDNR) in Cooperation with Endosafe, Inc. An SCDNR Report, 4pp.

12.6 Biomedical Literature Review by Benjie Swan

Biomedical Use and Mortality Rates of Horseshoe Crabs, *Limulus polyphemus*

Benjie Swan
Limuli Laboratories
Cape May, New Jersey

Introduction

A horseshoe crab fishery has existed since the late 1800's with millions caught and reported, predominately in the Delaware Bay. The early harvests of horseshoe crabs became fertilizer for farm fields and feed for livestock until the 1900's. The large annual harvests of horseshoe crabs eventually dwindled and attention on the horseshoe crabs focused on its study with respect to human physiology and health which earned Dr. Hartline a Nobel Prize for his work. In the 1980's and 1990's, the horseshoe crab fishery grew as more horseshoe crabs were being harvested for eel and conch bait. At the same time, the link was discovered between horseshoe crabs and migratory shorebirds. The monumental importance of the horseshoe crab became apparent and the need for its management was recognized.

In response to the bait harvest of the horseshoe crabs, State regulations were introduced and eventually, a coast wide management plan was adopted in 1998 by the Atlantic States Fisheries Commission (ASMFC). Unlike other fishery plans, the Interstate Fishery Management Plan (FMP)for the Horseshoe Crab considered both the sustainability of the horseshoe crab population and the dietary demands of the migratory shorebirds. (The shorebirds feed on horseshoe crab eggs that are brought to the surface by large numbers of spawning horseshoe crabs.) Focusing primarily on the Delaware Bay region, seven addendums to the FMP followed, reducing the bait harvest of almost 3 million in 1998. Under the FMP, a current quota of 1,587,274 horseshoe crabs is allowed, however the 2016 actual harvest of 787,223 was much lower due to some states being more restrictive.

Another unique component of the horseshoe crab fishery is that horseshoe crabs are collected and used to manufacture, Limulus Amebocyte Lysate (LAL), a product critically connected to human health. This rather obscure product has tested human injectable drugs and medical devices from potentially life threatening bacteria for almost 50 years. LAL is produced from live horseshoe crabs, a marine species and horseshoe crabs, similar to human blood donors, are bled and then released alive in order to make the product.

Horseshoe crabs collected for manufacturing LAL are categorized as "biomedical" and governed separately from the bait fishery due to its critical use and the low mortality associated with the process. From the ASMFC Fishing Year Reports spanning the years 2004 to 2016, the average number of horseshoe crabs collected for biomedical use is 462,670, with 5,086 reported dead. It is presumed that some of the horseshoe crabs may die after bleeding and that average is 58,721 from the same time frame (Table 1).

Table 1. Biomedical horseshoe crab mortality numbers.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Reported Observed Mortality of Horseshoe Crabs for Biomedical Use	4,391	4,256	4,639	3,599	2,973	6,523	6,447	8,485	7,396	5,485	5,658	5,250	1,015
Estimated Post Bleeding Mortality of Bled Biomedical-Only Crab (15% est.mortality)	41,279	40,574	44,543	59,833	60,312	53,252	65,319	75,117	74,882	65,535	64,846	70,118	47,765
Number of Crabs Brought to Biomedical Facility (bait and biomedical crabs)	343,126	323,149	367,914	500,251	511,478	512,853	552,083	623,680	624,440	554,419	536,798	564,526	426,195*

As more attention is focused and more information is gathered on the horseshoe crab population and harvest numbers, more precise accounting is being called for, specifically for the Stock Assessment. Although the number of horseshoe crabs that die in order to manufacture LAL is a miniscule fraction of the coast wide population of horseshoe crabs, pressure has been placed to continually revisit the mortality rates. The number of horseshoe crabs that die due to biomedical processing is being analyzed as there is a large discrepancy between what the biomedical companies report as dead and the number of horseshoe crabs that are estimated to die because of the "bleeding" process. This paper examines the mortality studies associated with biomedical processing and assesses their applicability (Table 2).

History of LAL

The use of horseshoe crabs to manufacture LAL began with the discovery by Dr. Frederick Bang, a professor at Johns Hopkins University. He observed that the horseshoe crab's blood would clot when injected with live or dead gram negative bacteria (Bang 1956) and, working with Jack Levin, discovered the clotting phenomenon was localized in the amebocytes or white blood cells of the horseshoe crab (Levin and Bang 1964). James Cooper, a graduate student at Johns Hopkins and an employee of the United States Food and Drug Administration (US FDA) applied the horseshoe crab derived product to test radiopharmaceuticals for bacterial contamination. The in vitro (Limulus) test was more sensitive, easier to use and less costly than the in vivo (rabbit) test used at the time (Cooper et al. 1971 and 1972). In 1973, the US FDA declared that LAL was a biological product and was subject to licensing requirements as provided in Section 351 of the Public Health Service and in 1977, issued licensing for LAL production. Once the FDA Draft Guidelines for the LAL test was published in 1987, its use became more widespread and gradually replaced the Rabbit Pyrogen Test.

Table 2. Mortality studies summary.

Study	Year	Type of Study	Collection Time of Year	Total Time Held for Bleeding Process	Time Held After Study	Sample Size	Sample Size Female	Sample Size Male	Number Unbled	Dead Females	Dead Males	Mortality Rate of Unbled HSC	Number Bled	Dead Females	Dead Males	Mortality Rate of Bled HSC
Rudloe	**1983**	Mortality/Tagging	April 28 to May 30th	Time out of water 30 minutes	0	10,259	*	*	5,437	38 Not Sexed	*	*	4,822	47 Not Sexed	*	10% First Year/11% Second Year
Rudloe	**1983**	Behavior/Tank	*	*	30 days	80	40	40	40	2 Not sexed	*	5%	40	1 Not Sexed	*	2.5%
Thompson	**1998**	Mortality/Tank	May	BMP	7 days	40	20	20	20	0	0	0%	20	0	3	15%
Thompson	**1998**	Mortality/ Tagging	May/June	BMP	0	1,328	851	477	734	15	6	2.86%	594	0	0	0.00%
Endosafe	**1999**	Mortality/Pond	20-May	BMP	14 days	267	133	134	120 recaptured	1	1	1.67%	132 recaptured	4	7	8.33%
Kurz and Pirrri	**2002**	Behavior/ Transmitters	July 2 to 8	Time out of Water 30 minutes	0	20 Total	20	0	10	0	0	0%	10	2	0	20%
Walls and Berkson	**2003**	Mortality/Tank	Jul-Aug	BMP	2 weeks	400 Total	*	400	200	*	1	0.5% Average	200	*	16	8.00% Average
		Trial 1	8-Jul	*	Jul 08-22,1999	*	*	20	10	*	0	0.0%	10	*	0	0.0%
		Trial 2	22-Jul	*	Jul 22-Aug 05, 1999	*	*	20	10	*	0	0.0%	10	*	3	30.0%
		Trial 3	19-Jun	*	Jun 19-Jul 03, 2000	*	*	60	30	*	0	0.0%	30	*	0	0.0%
		Trial 4	7-Jul-2000	*	Jul 07-21, 2000	*	*	60	30	*	0	0.0%	30	*	0	0.0%
		Trial 5	1-Aug-2000	*	Aug 01-15, 2000	*	*	60	30	*	1	3.3%	30	*	6	20.0%
		Trial 6	6-Jun-2001	*	Jun 06-20, 2001	*	*	60	30	*	0	0.0%	30	*	0	0.0%
		Trial 7	20-Jun-2001	*	Jun 20-Jul 04, 2001	*	*	60	30	*	0	0.0%	30	*	2	6.7%
		Trial 8	15-Aug-2001	*	Aug 15-29, 2001	*	*	60	30	*	0	0.0%	30	*	5	16.7%

Table 2. *Continued*.

Study	Year	Type of Study	Collection Time of Year	Total Time Held for Bleeding	Time Held After for Study	Sample Size	Sample Size Female	Sample Size Male	Number Unbled	Dead Females	Dead Males	Mortality Rate of Unbled HSC	Number Bled	Dead Females	Dead Males	Mortality Rate of Bled HSC
Hurton and Berkson	**2005**	Mortality/ Tank	9-Jul-2003	15-20 hours	2 weeks	Low Stressed	100	100	40	0	0	0.0%	160	0	0	0% Average
		Trial 1	*	*	*	10% Blood Extraction	*	*	*	*	*	*	40	0	0	0.0%
		Trial 2	*	*	*	20% Blood Extraction	*	*	*	*	*	*	40	0	0	0.0%
		Trial 3	*	*	*	30% Blood Extraction	*	*	*	*	*	*	40	0	0	0.0%
		Trial 4	*	*	*	40% Blood Extraction	*	*	*	*	*	*	40	0	0	0.0%
		Mortality/ Tank	28-Aug-2003	47 hours	2 weeks	High Stressed	85	110	39	0	1	2.6%	156	7	6	8.33% Average
		Trial 1	*	*	*	10% Blood Extraction	*	*	*	*	*	*	39	1	0	2.6%
		Trial 2	*	*	*	20% Blood Extraction	*	*	*	*	*	*	39	0	2	5.1%
		Trial 3	*	*	*	30% Blood Extraction	*	*	*	*	*	*	39	1	3	10.3%
		Trial 4	*	*	*	40% Blood Extraction	*	*	*	*	*	*	39	5	1	15.4%
Leschen, Correia	**2010**	Mortality/ Tank	2-Jun	4 hours out of water	17 days	Group 1- Control (Unbled)	99	*	99	Not Reported	n/a	3% Average	*	*	*	*
		Trial 1	*	*	*	Tank 1	*	*	16	Not Reported	n/a	1.7%	*	*	*	*
		Trial 2	*	*	*	Tank 2	*	*	21	Not Reported	n/a	2.8%	*	*	*	*
		Trial 3	*	*	*	Tank 3	*	*	16	Not Reported	n/a	6.1%	*	*	*	*
		Trial 4	*	*	*	Tank 4	*	*	13	Not Reported	n/a	0.8%	*	*	*	*
		Trial 5	*	*	*	Tank 5	*	*	16	Not Reported	n/a	4.3%	*	*	*	*
		Trial 6	*	*	*	Tank 6	*	*	16	Not Reported	n/a	2.4%	*	*	*	*

Table 2. *Continued*.

Study	Year	Type of Study	Collection Time of Year	Total Time Held for Bleeding	Time Held After for Study	Sample Size	Sample Size Female	Sample Size Male	Number Unbled	Dead Females	Dead Males	Mortality Rate of Unbled HSC	Number Bled	Dead Females	Dead Males	Mortality Rate of Bled HSC
Leschen, Correia	**2010**	Mortality/ Tank	2-Jun	6 hours	17 days	Group 2	89	*	*	*	*	*	89	Not Reported	*	22.5% Average
Continued		Trial 1	*	*	*	Tank 1	*	*	*	*	*	*	15	Not Reported	*	15.2%
		Trial 2	*	*	*	Tank 2	*	*	*	*	*	*	19	Not Reported	*	22.5%
		Trial 3	*	*	*	Tank 3	*	*	*	*	*	*	13	Not Reported	*	40.0%
		Trial 4	*	*	*	Tank 4	*	*	*	*	*	*	14	Not Reported	*	7.2%
		Trial 5	*	*	*	Tank 5	*	*	*	*	*	*	14	Not Reported	*	31.4%
		Trial 6	*	*	*	Tank 6	*	*	*	*	*	*	14	Not Reported	*	20.3%
		Mortality/ Tank	2-Jun	25 hours	17 days	Group 3	93	*	*	*	*	*	93	Not Reported	*	29.8% Average
		Trial 1	*	*	*	Tank 1	*	*	*	*	*	*	17	Not Reported	*	20.3%
		Trial 2	*	*	*	Tank 2	*	*	*	*	*	*	21	Not Reported	*	29.3%
		Trial 3	*	*	*	Tank 3	*	*	*	*	*	*	14	Not Reported	*	48.7%
		Trial 4	*	*	*	Tank 4	*	*	*	*	*	*	9	Not Reported	*	9.9%
		Trial 5	*	*	*	Tank 5	*	*	*	*	*	*	15	Not Reported	*	39.5%
		Trial 6	*	*	*	Tank 6	*	*	*	*	*	*	18	Not Reported	*	26.5%
Anderson, Watson III, Chabot	**2013**	Mortality/ Tank	May 15-23	52 Hours	6 Weeks	56 Total	56	*	28	0	*	0% Average	28	5	*	17.9% Average
		Trial 1	June 06-08 Date of Bleeding	*	*	OU Tank	14	*	7	0	*	0%	7	0	*	0.0%
		Trial 2	June 01-03 Date of Bleeding	*	*	LRW Tank	14	*	7	0	*	0%	7	1	*	14.3%
		Trial 3	June 01-03 Date of Bleeding	*	*	LU Tank	14	*	7	0	*	0%	7	1	*	14.3%
		Trial 4	June 01-03 Date of Bleeding	*	*	LCT Tank	14	*	7	0	*	0%	7	3	*	42.9%

Manufacture of LAL

In August 1978, the Federal Register publication of proposed rules stated "There will be an adequate and available supply of source material, and to guarantee that the manufacture of LAL will not have an adverse impact on existing crab populations, the horseshoe crabs shall be returned alive to their natural environment after a single collection of blood" (Federal Register 1978). Another rule under general requirements regarding handling of the horseshoe crabs read "The horseshoe crabs (Limulus polyphemus) from which blood is collected for production of the lysate, shall be handled in a manner so as to minimize injury to each crab." (Federal Register 1980).

Prior to obtaining a license to sell LAL, companies enter a Biologic License agreement that adheres to the US FDA rules and requirements. Within that agreement, companies adhere to practices for the collection, handling, transport, bleeding and release of the horseshoe crabs that maximizes their well being and survival. In 2011, LAL companies in conjunction with ASMFC formalized these practices into Best Management Practices (BMPs). The 42 practices are documented in Table 3.

The manufacturing of LAL is entirely dependent on obtaining live and healthy horseshoe crabs. Depending on the location of the company along the eastern seaboard, the "bleeding season" varies in time of the year and duration. Horseshoe crabs are collected by hand when the horseshoe crabs are along the beaches, or by trawling when the crabs migrate to deep water. The horseshoe crabs are only accessible certain times of the year governed by weather and fishery regulations and cannot be stored or frozen for later use.

The health of the horseshoe crab from the collection to its release is of the utmost importance in order to obtain a quality product and a high survival rate of the bled horseshoe crabs. To avoid the hotter temperatures and sun of the day, the vast majority, if not all of the horseshoe crabs, are collected at night and transported in the early morning hours to the Laboratory for the "bleeding" process. The collected horseshoe crabs are carefully inspected for activity levels and injuries. The inspection is important for two reasons, injured or lethargic animals may introduce contamination into the sterile process and/or create a poor quality product and secondly, injured or slow moving horseshoe crabs may not survive the bleeding process. The rejected horseshoe crabs are not bled and returned to the water, to increase their odds of survival.

Only healthy crabs are bled; the blood flow is fast and steady initially and then slows to a drip. The blood is not extracted, but flows freely from the crab's open circulatory system. The actual "bleeding" of the crab takes minutes while the next steps of isolating and breaking open the white blood cells are labor intensive and require a full day. The bleeding process does not result in the death of the horseshoe crabs, and they are returned to the water adhering to the "Return to Sea" policy established from the onset of LAL manufacture.

Table 3. Best Management Practices (BMPs) for Biomedical Horseshoe Crabs.

Collection

- For targeted horseshoe crab trawl tows, reasonable tow times, recommended at 20-30 minutes bottom time (winches locked)
- Proper care and handling of horseshoe crabs while sorting and placing into bins
- Avoid exposure to direct sun, extreme temperatures as well as rapid temperature changes
- Night harvesting is recommended during periods of excessive heat
- During collection, sort out juveniles and do not bleed
- Sort out and return to the water individuals that do not appear to be healthy (damaged, slow movement, dull shell/old)
- When possible, release juveniles or unhealthy individuals immediately and do not transport to the facility
- Educate collectors in proper handling techniques
- Specify expectations of collectors in written contracts
- Periodically audit horseshoe crab collectors on implementation of BMPs for collecting

Transport to Facility

- Maintain temperature between approximately ambient water temperature at time of collection and 10ºF below ambient-water temperature
- Maintain good ventilation while stacked in bins
- Limit number of horseshoe crabs to a suitable number, dependent on container size and shape, and avoiding over-stacking to minimize damage to other horseshoe crabs
- Minimize travel time
- Keep bins and horseshoe crabs covered to protect against direct sunlight
- Secure containers in transport vehicle

Holding at Facility (Preparation for Bleeding/Bleeding)

- Limit holding time, under normal circumstances, at the facility to less than 24 hours
- No prolonged exposure to fresh water
- Follow written procedures for proper care and handling when sorting horseshoe crabs and moving them between bins and within the facility
- Inspect crabs for health and damage, selecting only undamaged and healthy crabs for bleeding
- Maintain clean, sanitary conditions during bleeding
- Maintain same level of care for rejected crabs that are not bled while being held until released back to sea

Holding at Facility (Preparation for Bleeding/Bleeding)(continued)

- Avoid bleeding crabs more than once per year
- If crabs are marked to avoid re-bleeding, ensure that the mark is residual and not harmful to the crab
- Bleed until rate slows down so that excessive bleeding is prevented
- Continue 30-year policy of not attempting to suction additional blood from the horseshoe crabs
- Perform internal audits to maintain quality control over written procedures

Table 3. *Continued*.

<u>Post-Bleeding Holding</u>

- Recognizing that the horseshoe crabs are now stressed from the bleeding process, maintain the same level of care as that used when transporting horseshoe crabs into the facility for bleeding
- Return to the water as soon as possible. If not being returned to the area of capture, ensure that conditions (salinity, water temperature, etc.) are similar to those found at the harvest site
- Minimize holding time post-bleeding
- While in holding, keep horseshoe crabs in the dark to minimize movement and injury
- Keep horseshoe crabs well-ventilated, moist, and allocate only a suitable number of crabs to holding containers
- Do not keep crabs out of the water for longer than 36 hours in total

<u>Return to Sea</u>

- Use same care in handling and transporting crabs being returned to the water
- Include return written instructions and requirements within contract with collectors, if applicable
- Periodically audit horseshoe crab collectors on implementation of BMPs for returning

<u>Overarching practices for all steps</u>

- Generate written procedures for all handlers of horseshoe crabs, covering all steps in the process from collection to release
- Keep horseshoe crabs cool, moist and covered, avoiding direct sunlight
- Establish a dialogue among collectors, the biomedical company, and the state regulatory agency to address concerns and challenges
- Have a written contract between collectors and the biomedical company, outlining practices and expectations
- Perform audits of the various steps and contractors/employees throughout the process
- Ensure proper monitoring and recording of mortality at each step in the chain of custody

Biomedical Numbers

The use of horseshoe crabs for the manufacture of LAL was fully established after the FDA issued Draft Guidelines in 1987. James J. Finn, a lysate manufacturer, located along the Delaware Bay shore, connected the biomedical use of the crab to fishery management and began reporting the number of horseshoe crabs used for LAL production. Finn's 1991 report on the first Delaware Bay spawning survey of horseshoe crabs estimated biomedical use to be about 130,000 in 1989, the onset of LAL manufacturing. About 280,000 crabs were bled in 1998 and 2000 based on a survey conducted by the ASMFC Horseshoe Crab Technical Committee in 2001.

These early estimates of biomedical use relied on yearly reports submitted by the biomedical companies to their respective State. In 2004, the ASMFC adopted Addendum III which required standardized reporting from the states with biomedical collection in order to obtain the number of biomedical horseshoe crabs collected coast wide. The number of horseshoe crabs collected averaged 462,670 during the years 2004 to 2016. However, even with standard reporting, it is difficult to compare yearly numbers as biomedical collection has changed in response to the FMP and its Addendums. For example, there was an increase in the biomedical numbers in 2006 possibly due to Addendum VI which encouraged the use of more males.

In addition to the submitted fishery information, companies are required to track their mortality numbers from collection to release at six steps.

Step 1. The horseshoe crabs are collected by hand or trawl.
Step 2. They are transported to the Laboratory.
Step 3. They are handled prior to bleeding.
Step 4. They are bled.
Step 5. They are handled and transported prior to release.
Step 6. They are released.

Mortality in the biomedical fishery is computed in two steps. First, mortality is determined from actual numbers of horseshoe crabs reported dead by the biomedical companies. The horseshoe crabs for biomedical use are donors, caught alive and released alive. Inherently, in any fisheries there is a mortality rate associated with the catch and release. This number is easily accountable and is part of the scrutiny of the horseshoe crabs used for bleeding. Both slow moving and dead horseshoe crabs are rejected as unresponsive and their numbers are about one percent of the total number of collected horseshoe crabs. The number of horseshoe crabs rejected for unresponsiveness are listed as mortal horseshoe crabs in the ASMFC tables. There is not an additional mortality associated with slow moving horseshoe crabs.

Besides demise, the crabs are carefully inspected for injuries, even the slightest injuries are noted and the horseshoe crabs are not bled. The horseshoe crabs rejected due to minor injuries will survive. Leschen and Correia (2010) worked with 310 collected horseshoe crabs for biomedical use and rejected 12 of the horseshoe crabs for bleeding. The biomedical company inspected the remaining 298 horseshoe crabs and after their scrutiny, rejected an additional 17 crabs for reasons unseen by the untrained eye. Although the horseshoe crabs were deemed not fit for bleeding, their injuries were so minor that Leschen and Corriea (2010) considered the rejected horseshoe crabs as adequate to use for the control group, an indication of their survival.

The second part for computation is a 15% mortality rate applied to all bled crabs assuming there would be some degree of post-bleeding mortality. Initially, the mortality rate of 10% reported by Rudloe in 1983 was used but after additional mortality studies were published, the post bled mortality rate was raised to 15%. However, the post-bleeding mortality that may occur is much harder, almost impossible to decipher.

<u>Mortality Studies</u>
Rudloe (1983)

The effect of bleeding on the horseshoe crab population was first studied by Ann Rudloe, 35 years ago, funded by the US FDA in response to the use of horseshoe crabs for LAL manufacturing. Her work is the most well known and cited for the mortality rate calculated for the horseshoe crabs.

The bulk portion of Rudloe's study focused on the release and recaptures of 10,062 bled and unbled animals within St. Joseph Bay along Florida's Gulf Coast. Both groups of animals were treated in the same manner and out of the water for about 30 minutes. Half of the animals were bled until the flow slowed to an intermittent drip similar to a "trained bleeder". The number of recaptures was 1,415 with 85 dead. Rudloe attributed a 10% greater mortality with bled crabs than unbled the first year and 11% the second year.

Another part of her study was a pen experiment that held the horseshoe crabs after bleeding to determine their survival. During the course of her study, Rudloe realized the difficulty in maintaining horseshoe crabs and designed a small scale tank study. Eighty adult horseshoe crabs were collected and half were bled. Both sets of crabs were placed in a pen and held for 30 days. Two unbled animals died (5%) and one bled female died (2.5%). The dead animals were noted as having "poor eye and shell condition" indicating they may have been older and in questionable health.

Rudloe also investigated the activity of the bled horseshoe crabs. Sixty horseshoe crabs, half bled and half unbled, were placed in a tank and their activity levels were gauged by chart deflections. Sixteen comparisons were performed between the control and the bled groups, in six cases there was no significant difference between the groups, in six cases the bled horseshoe crabs were more active and in four cases the control group was more active. Her tagging study also observed that the movements of unbled and bled horseshoe crabs were almost identical.

Thompson (1998)

The biomedical company in South Carolina, Endosafe, in conjunction with a graduate student from the College of Charleston, conducted a mortality rate study. Prompted by the acceptance of the FMP in 1998, both a tagging study and a preliminary tank study were performed to determine a mortality rate of horseshoe crabs bled by Endosafe.

Thompson tagged 734 unbled (non LAL) and 594 bled (LAL) horseshoe crabs in 1997. The 594 tagged LAL animals were selected from the horseshoe crabs transported, held and bled at the laboratory. The unbled animals were released along the spawning beaches where the study was being conducted and the bled animals were released at their usual release point in a more remote location. The mortality rate of the non LAL animals was 2.86%, 15 dead females and 6 dead males. The mortality rate for the bled animals was 0% with seven live recaptures reported. It should be noted the recapture rate for the LAL animals (1.18%) was much lower than the non-LAL crabs (12.94%) most likely due to their release in a remote area.

Thompson's preliminary tank study in 1996 used 40 horseshoe crabs specifically collected for biomedical use. The forty horseshoe crabs were collected, transported, and handled the same way except twenty crabs, ten males and ten females, were bled by Endosafe. After the bleeding process, both groups of horseshoe crabs were placed in a single tank that was drained daily to clean the water, and they were fed for seven days. Three of the 20 bled females died, resulting in a 15% mortality rate.

Endosafe, Inc. (1999)

Following Thompson's thesis work, Endosafe conducted another mortality study with the approval of South Carolina Department of Natural Resources (SCDNR) and the AMFC Technical Committee in May of 1999. Horseshoe crabs were randomly selected from horseshoe crabs collected for biomedical use and subjected to the same environmental conditions except half were bled and the other half unbled. The animals are marked with paint and a scratch mark and 133 unbled animals and 134 bled animals were released into a pond for a two week holding period. After the holding period, 120 horseshoe crabs from the control group and 132 bled crabs were accounted for. One male and one female died from the control group resulting in an overall mortality rate of 1.67%, and seven males and four females died from the bled group, 8.33% mortality. (It was noted that the bled animals were left out in the sun longer than the control group waiting for the marking paint to dry.)

Kurz and Pirri (2002)

Kurz and Pirri (2002) studied the movements of bled and unbled horseshoe crabs via transmitters upon release into Nauset Estuary, a small embayment in Massachusetts. Twenty female horseshoe crabs that were greater than 200 mm in size and free of epibionts were hand collected during the spawning season from mid May to early July. Ten of the crabs were bled until the blood flow slowed, losing 90 mL of blood. The crabs were not out of the water for longer than 30 minutes and released from July 2nd to July 8th.

Kurz and Pirri reported a more random movement pattern with the bled group than the unbled group but found no difference in their average rate of movement. There was also no significant difference in their spatial distribution with 17 of the 20 crabs, nine control crabs and eight bled crabs, located in the same spawning area.

During their study, Kurz and Pirri found two of the ten bled crabs were deceased after 28 days and 68 days. They reported a mortality rate of 20% and added that it may have been an artifact of low sample size designed for their behavioral study.

Walls and Berkson (2003)

Walls and Berkson (2003) researchers from Virginia Technological University worked directly with a LAL company, BioWhittaker/currently Lonza, to study the mortality rate of their bled horseshoe crabs. The crabs were trawl collected during July and August 1999, 2000 and 2001 in waters off Chincoteague, Virginia or Ocean City, Maryland. A small number of newly matured male horseshoe crabs were selected for study in order to limit any variation between the control and bled groups. The two groups were handled the same way and under the same conditions with the exception that half were bled according to the biomedical company's usual procedure. After the bleeding procedure, the horseshoe crabs were packed in coolers, transported to Hampton, Virginia where equal numbers of control and bled horseshoe crabs were placed in four replicated flow through holding tanks for a two week holding period. This process was repeated eight times over the course of the study.

The combined mortality rate for the eight two week period is 0.5% for the unbled animals (1 unbled crab died of 200) and 8% for the bled crabs (16 bled crabs died of 200). The mortality rates from the 8 periods were varied, ranging from 5 to 30% mortality for the bled individuals. The results from four of the periods resulted in 0% mortality while the other four periods resulted in 3 out of 10 crabs (30%) , 6 of 30 (20%), 2 of 30 (6.67%) and 5 of 30 crabs (16.67%) die.

Hurton and Berkson (2005)

Hurton and Berkson (2005) along with the biomedical company, Cambrex/ currently Lonza, expanded on their 2003 work and studied if mortality was directly related to the amount of blood taken from the horseshoe crabs and/or the stress level of the horseshoe crabs. The crabs were trawl collected from Ocean City, Maryland and transported to Virginia Tech, Blacksburg, Virginia.

During Experiment 1, a group of 100 males and 100 females were left out of the water for 15-20 hours at 21 degrees C and were considered "lower stressed" animals. They were bled with varying amounts of blood taken based on a predicted blood volume calculated using the crab's intraocular distance, The crabs were separated into five groups; a control group and four groups with 10%, 20%, 30%, 40% blood taken. The bled crabs were returned to the water tanks and monitored for 2 weeks. There were no deaths within any of the groups.

During Experiment 2, a "higher stressed" group of 110 males and 85 females were exposed to varying levels of blood loss. The stress included 47 hours out of the water and temperatures reaching 36 degrees C. Fourteen horseshoe crabs died; 1 unbled male died, 1 bled female died at 10%, 2 bled males died at 20%, 4 bled crabs at 30% and 6 bled crabs died at 40%. The overall resultant mortality was 8.3% compared to 2.6% for unbled animals. The study indicated with high stress more deaths may occur as blood loss is increased. Hurton and Berkson noted that the bleeding volume for a biomedical company would be in the range of 10% blood loss and the mortality rate of 10%.

Leschen and Correia (2010)

Leschen and Correia (2010) researched the mortality rates of bled animals in Massachusetts in response to stressful conditions and if their survival rate increased if they are returned to the water quicker. Leschen and Correia's study separated the horseshoe crabs into three treatment groups, Group 1 of 99 crabs, Group 2 of 89 horseshoe crabs and Group 3 of 93 crabs. Group 1 was the control group that was held out of water for 4 hours and Groups 2 and 3 were exposed to conditions mimicking an open boat deck, one hour drive in non air conditioned truck, bleeding until the blood clots (30% blood extraction), being stored for 24 hours stacked in 30 gallon Rubbermaid totes at room temperature, one hour truck drive and a 15 minute boat ride. The crabs from Group 2 were held for six hours after the biomedical process and the crabs from Group 3 held overnight, 25 hours. The three groups were distributed in six different tanks and monitored.

The mortality rates for the control group was 3.01% (reported) and for Group 2, 22.5% (reported) and Group 3 29.8% (reported). There was no significant differences in the number of crabs per tank, ranging from 6.1 to 7.2, dissolved oxygen levels, ranging from 8.6 to 9.1 or the water temperatures, ranging from 15.4 to 15.7. However, the mortality in Tank 3 was greater than the other Tanks for the three groups, followed by the mortality rates in Tank 5. Tank 4 had the lowest mean Dissolved Oxygen (DO) concentration and the lowest mortality while Tank 3 had the highest DO and highest mortality. It is appears although not significantly different, there was a tank effect.

Anderson, Watson III, Chabot (2013)

Anderson, Watson III and Chabot (2013) studied the impact bleeding has on the horseshoe crabs' locomotion and hemocyanin levels. They collected 56 female horseshoe crabs at spawning beaches at Adams Point, Great Bay, Durham, New Hampshire from 15th to 23rd of May 2012. Due to laboratory restraints, the horseshoe crabs were sorted according to size and distributed into four tanks. The tanks were identified as the Outdoor tank - OU with the largest size animals, the Laboratory Running Wheel tank - LRW with the smallest horseshoe crabs and the Laboratory Unrestrained tank - LU and the Laboratory Communal tank - LCT with the medium size animals.

For the bleeding process, the four groups of horseshoe crabs were exposed to a total of 52 hours of varying temperatures and conditions, meant to mimic biomedical practices. During the 52 hours, the LRW, LU and LCT groups were exposed to sunlight for four hours in a barrel and then kept in the barrel after it was covered for an additional four hours and maximum temperatures reaching 37 degrees C. The Outdoor group was not exposed to the direct sunlight and only subjected to maximum temperatures reaching 28 degrees C. The behavior study resulted in five bled horseshoe crabs dying, three on the second day from the LCT tank and two on the third day from the LRW and LU tanks. No bled crabs (0%) died in OU tank.

Anderson et al. found that the bled horseshoe crabs had decreased activity and expressions of tidal rhythms after two weeks of bleeding. The bled crabs also exhibited decreased linear and angular velocities in the first week after bleeding but resumed normal linear velocities after 3 weeks. The greatest effect of the bleeding process was the long term declines in the hemocyanin concentrations.

Assessing the Mortality Studies

The papers provide differing estimates for the mortality rates associated with unbled and bled horseshoe crabs. Some of the papers reported the average mortality rate from a number of experiments. There were 25 separate mortality rates for the control or unbled groups from the reviewed studies and their individual experiments. Assigning no relevance to the 25 estimates, the mortality rate for the unbled horseshoe crabs averaged 1.34% with 14 rates having zero deaths and the remaining rates ranging from 0.8% to 6.10%. If the average ten mortality rates are used, the average mortality rate was 1.56%, with four zero rates and the remaining rates ranging from 0.5% to 5%.

For bled animals, there were 39 individual rates and 13 estimates that were stated or averaged. The average of the 39 individual experimental rates was 14.25% with 10 rates that were zero and the rest ranging from 2.5% to 48.7%. If the 13 average estimates and stated were averaged, the resultant mortality rate is 11.80% with rates ranging from 2.5% to 29.80%. Nine of the 13 rates were below 15% mortality. The highest rates were from the studies conducted in Massachusetts meant to mimic the biomedical practices. The highest average rates reported were 17.9 % from Anderson et al. (2013), 20% from Kurz and Pirri (2002), and 22.5% and 29.8% from Leschen and Corriea (2010). The estimates illustrate the variability in the mortality rate of control and bled animals and its dependence on many factors.

The most well known and cited mortality rate of 10% is from Rudloe's tagging study. The greatest benefit of the study was the fact that the animals were released into their natural environment after bleeding. The practice most closely resembles the biomedical's "Return to Sea" policy. A policy established 40 years ago that greatly contributes to the survival rate of the bled individuals. Thompson's work also involved a tagging study and found a 0% mortality rate for the bled animals, however recaptures were minimal since the bled animals were released in a remote area. Seven live bled recoveries were found and no dead recoveries were found for the bled horseshoe crabs.

Although Kurz and Pirri's tracking study was similar to a tagging study, its design was set up to study behavior and had a very small sample size. They focused on the movements of twenty horseshoe crabs and found two bled horseshoe crabs dead and noted a mortality rate of 20% adding "However, the slightly higher mortality rate observed in this study may have been an artifact of low sample size."

Another variable to consider with the tagging studies is the natural mortality rate associated with spawning. If the tagging studies are conducted during the spawning season, the natural mortality rate is estimated to be 10% due to stranding (Botton and Loveland 1989). Stranding occurs when the horseshoe crab is overturned by the water and is exposed upside down to predation and the environment. Kurz and Pirri's study conducted during the spawning season found two dead crabs 28 days and 68 days after bleeding. Their death could have been attributed to the 10% spawning risk.

Most of the mortality studies are non tagging studies that held the horseshoe crab specimens in tanks for weeks prior to and after the bleeding process. The control group was kept the same amount of time for comparison, but the multiple stressors on the crabs would make the resultant mortality rate higher. Rudloe established the difficulty in keeping large numbers of horseshoe crabs in a confined area. More recently, Mattei (2011), while studying tag induced mortality penned 105 horseshoe crabs for 44 days and found a mortality rate of 4% for the untagged horseshoe crabs. Her work confirms the difficulty in maintaining horseshoe crabs.

The researchers attempted to combat the challenge of maintaining the horseshoe crabs by using small sample sizes, multiple study periods and/or many holding areas (tanks). Leschen and Correia used multiple tanks, distributing both the control crabs and the bled crabs between six tanks. Based on the mortalities, there was a difference between the Tanks with Tank 4 and Tank 5 having the greatest mortalities even for the control group. Although, they state there were no significant differences between the tanks, the resultant data strongly suggest the tanks did influence the mortality rate. Anderson et al.'s study also used multiple tanks to keep the horseshoe crabs. The tanks were quite different in size and volume affecting the environmental conditions the horseshoe crabs were exposed to. The difference in tank volumes is listed in the Chart below.

Tank	Number of Tanks	Size	Volume
Outdoor (OU)	7	183 cm x 92 cm x 50 cm	5.89 cubic meters
Laboratory Running Wheel (LRW)	4	80 cm x 65 cm x 32 cm	0.67 cubic meters

Laboratory Unrestrained (LU)	2	1.7 m x 0.9 m x 0.75 m	2.30 cubic meters
Laboratory Communal (LCT)	1	80 cm x 65 cm x 32 cm	0.17 cubic meters

The Outdoor Tank with the least mortalities had the greatest volume, whereas the Laboratory Communal Tank had the least volume and the greatest mortality. The two other Tanks had volumes between the Outdoor tank and the Laboratory Communal Tank and resulted in a mortality rate in the midrange of the other tanks.

In addition to using multiple tanks to maintain the horseshoe crabs in captivity, small sample sizes are necessary. Although, horseshoe crabs are the most studied invertebrate because of their hardiness, only a few can be maintained in tanks. However, small sample size diminishes the value of the studies. Anderson, Watson III and Chabot recorded a lesser blood volume taken from the horseshoe crabs in the laboratory tanks compared to the animals in the outdoor tank indicative of the health of the horseshoe crabs. This concurs that healthy animals must be used for bleeding, if not they do not bleed or survive well.

Ignoring flaws in the study designs, it is imperative to note that many of the studies did not adequately mimic biomedical practices. When comparing the BMPs to the studies' practices, many of the studies did not adhere to the same practices that the LAL manufacturers do. Holding time and temperatures as well as exposure to the elements deviate from the BMPs practices with most of the studies mimicking the worst case scenario for these factors. The two documented practices that are most essential for the survival of the bled horseshoe crabs would be to avoid direct exposure to the sun and to return the crabs to the water as soon as possible.

Leschen and Corriea's study demonstrated the importance of the "Return to Sea" policy and found a 7.5% greater survival rate when the bled horseshoe crabs were returned to the water 14 hours sooner. The rate for animals held 8 hours after bleeding (22.3%) was considerably less than the rate for animals held for 22 hours after bleeding (29.8%).

The studies were conducted during the warmer months of the horseshoe crab's spawning and/or bleeding season and are not reflective of the entire "bleeding" season. The "bleeding" season for some companies may not be conducted during the hottest months or only a portion of the season is conducted during those months. For example, in the Mid-Atlantic region the "bleeding" season starts after the horseshoe crabs' spawning season and may last until late October with July and August being the hottest months. All the studies were conducted during the hottest times of the season.

Some of the studies focused on the amount of blood taken and its effect on the survival of the horseshoe crab and also the time needed for the blood concentration to reach prebleeding levels. Rudloe (1983) rebled 26 horseshoe crabs that were recaptured 13 to 36 days after bleeding. The blood levels were only slightly below the initial blood volume, 49 mL compared to 63 mL for the males and 125 mL compared to 137 mL for the females. Twelve of the recaptured horseshoe crabs bled more the second time. Kurz and Pirri (2002) reported an average of 89.9 mL of blood were taken from ten females with an average prosoma width of 232 mm. Hurton, Berkson and Smith (2005) developed an equation relating the size of the horseshoe crab and the amount of blood taken but indicated that blood volume is affected by season, salinity, health and other environmental conditions.

Although blood volume is variable, Hurton and Berkson (2005) studied the effect the amount of blood extraction has on the survival of the horseshoe crabs. Mortality rates were zero if the horseshoe crab was unstressed even at the highest amount of blood loss, however, mortality rates increased as the amount of blood loss increased if in combination with extreme environmental conditions. They found the highest mortality rate of 15.4% for "stressed" animals when the greatest amount of blood is taken (40%). Hurton et al. noted that the blood loss during bleeding was generally less than the calculated 30% volume.

Leschen and Correia (2010) reported that the five mortalities resulting from their study seemed unrelated to the amount of blood loss. The mean percentage of blood taken from the deceased crabs was within the range of the overall amount of 19.8% for all the studied animals. They also reported that the change in activity levels were not related to amount of blood loss.

Anderson, Watson III and Chabot (2013) focused on blood volumes of the groups before and after bleeding. They reported the amount of blood loss ranged from 14% to 21% and did not differ between the live and dead horseshoe crabs. After six weeks, the laboratory animals did not regain their blood volumes, most likely due to poor holding conditions while the Outdoor group exposed to better holding conditions regained 60% of their original volume.

The studies indicate that blood volume is variable and dependent on many factors, however similar to mortality, under good conditions, blood levels return to normal. A biomedical practice is to bleed horseshoe crabs once in a season, enabling the horseshoe crab to regain their blood volume if necessary over a long period of time. In addition, since the horseshoe crabs with lower blood volumes were not deceased after the six weeks, their survival is most likely.

Summary

Overriding all the studies, is the fact that mortality of bled horseshoe crabs is low and survival is high. The tagging studies show minimal mortality and the laboratory studies in conjunction with the biomedical companies present rates similar to the tagging study mortalities. The studies meant to mimic biomedical practices or expose the horseshoe crabs to additional stressors reported much higher mortality rates, however the results are confounded by captivity and/or variable environmental conditions. The studies demonstrated the difficulty in maintaining horseshoe crabs and the effect environmental conditions have on the mortality rate. The mortality rates are variable across the studies, however the survival rate of the horseshoe crabs can be at their maximum if certain conditions are made.

The studies conducted by Leschen and Correia and Anderson, Watson III and Chabot subject the horseshoe crabs to the worst environmental conditions. Leschen and Correia (2010) exposed the bled horseshoe crabs to poor tank conditions evidenced by the high mortality rates for the control animals. Anderson, Watson III and Chabot intentionally placed the horseshoe crabs in barrels exposed to four hours of direct sunlight and then immediately covered the barrels, essentially "cooking" the horseshoe crabs for another four hours. Even under these extremely harsh conditions, the survival rates were between 60% and 70%.

The biggest obstacle to overcome in conducting mortality studies is how to monitor the horseshoe crabs after bleeding. Tagging studies adhere to the most important biomedical practice of releasing the bled horseshoe crabs into their natural environment. However, recapture of the tagged animals may be too minimal to estimate a mortality rate. Rudloe's study conducted in a small embayment had good recapture rates for both control and bled animals. Thompson's tag study had a minimal recovery rate of 1.2% for the bled animals, seven found alive and no crabs found dead.

The alternative to tagging studies is placing the horseshoe crabs in closed tanks and monitoring their survival. Horseshoe crabs need a large space and good water flow to maintain their health and survival. To achieve these needs, researchers used small sample sizes and, either used more tanks or conducted the study on different days. The use of more tanks introduced a new variable and influenced the mortality rates. Running the experiments during separate periods, introduces differences in the environmental conditions. The differences may be reflected in the variability of the results, ranging from 0% to 30% for one study.

Mortality rates for bled horseshoe crabs should be analyzed with caution understanding the complex nature of horseshoe crabs. The studies do demonstrate that adherence to the BMPs will ensure the horseshoe crab's survival after bleeding. Avoiding direct sunlight, extreme temperatures and excessive time out of the water are extremely important for the survival of the horseshoe crabs.

In conclusion, mortality rates are variable and ever changing dependent on many factors. There will never be one set mortality rate and if so, would the number be meaningful and add to our management of the horseshoe crab population. The number of horseshoe crabs estimated to die due to the bleeding process (average 58,721) is about 7% of the horseshoe crabs that die as bait for eel and conch (787,223 reported 2016 harvest) and a miniscule fraction, 0.2%, of the estimated number of horseshoe crabs in Delaware Bay alone (24,000,000).

<u>Literature Cited</u>

Anderson, R.L., W. Watson III and C. Chabot 2013. Sublethal behavioral and physiological effects of the biomedical bleeding process on the American Horseshoe Crab, *Limulus polyphemus*. Biol. Bull. 225: 137-151.

Atlantic States Fisheries Commission (ASMFC) 1998. Fishery Management Report No. 32 of the ASMFC, Interstate Fishery Management Plan for the Horseshoe Crab. 58 pp.

Atlantic States Fisheries Commission (ASMFC) 2004. Fishery Management Report No. 32c, Addendum III to the Interstate Fishery Management Plan for the Horseshoe Crab. 14pp.

Atlantic States Fisheries Commission (ASMFC) 2006. Fishery Management Report No. 32d, Addendum IV to the Interstate Fishery Management Plan for the Horseshoe Crab. 5 pp.

Atlantic States Fisheries Commission (ASMFC) 2009. 2009 Review of the fishery management plan in 2008 for the horseshoe crab (*Limulus polyphemus*). 14pp.

Atlantic States Fisheries Commission (ASMFC) 2013. 2013 Stock Assessment Update. 73pp.

Atlantic States Fisheries Commission (ASMFC) 2017. 2017 Review of the fishery management plan in 2016 for the horseshoe crab (*Limulus polyphemus*). 25pp.

Bang, F.B. 1956. A bacterial disease of *Limulus polyphemus*. Bull. Johns Hopkins Hosp., 98(3): 325-351.

Botton, M.L. and R.E. Loveland 1989. Reproductive risk: high mortality associated with spawning by horseshoe crabs (*Limulus polyphemus*) in Delaware Bay, USA. Marine Biology 101:143-151.

Cooper, J. F., J. Levin and H.N. Wagner, Jr. 1971. Quantitative comparison of in vitro (limulus) and in vivo (rabbit) methods for detection of endotoxin. J. Lab. Clin. Med., 78: 138-148.

Cooper, J.F., H.D. Hochstein, and E.B. Seligmann, Jr. 1972. The limulus test for endotoxin (pyrogen) in radiopharmaceuticals and biologicals. Bull. Parenteral Drug. Assoc., 34: 153-162.

Endosafe, 1999. An evaluation of Limulus post-bleeding mortality experiment data: statistical analyses performed by South Carolina Department of Natural Resources (SCDNR) in Cooperation with Endosafe, Inc. 1999. SCDNR (private printing), 4pp.

Federal Register, 1978. Proposed Rule. Vol. 43 No. 156, pages 35731-35734.

Federal Register, 1980. Rules and Regulations. Vol. 45 No. 97, pages 32296-32300.

Finn, J.J., C.N. Shuster, Jr., and B.L. Swan. 1991. *Limulus* spawning activity on Delaware Bay shores 1990. Finn-Tech Industries, Incorporated (private printing). 8pp.

Hurton, L. and J. Berkson 2005. Potential causes of mortality for horseshoe crabs (*Limulus polyphemus*) during the biomedical bleeding process. Fishery Bulletin 104:293-298.

Hurton, L., J. Berkson, and S. Smith 2005. Estimation of total hemolymph volume in the horseshoe crab *Limulus polyphemus*. Marine and Freshwater Behaviour and Physiology 38(2):139-147.

Kurz, W. and M.J. James-Pirri 2002. The impact of biomedical bleeding on horseshoe crab, *Limulus polyphemus*, movement patterns on Cape Cod, Massachusetts, Mar. Fresh. Behav. Physiol. Vol. 35, No. 4: 261-268.

Leschen, A.S. and S.J. Correia 2010. Mortality in female horseshoe crabs (*Limulus polyphemus*) from biomedical bleeding and handling: implications for fisheries management. Marine and Freshwater Behaviour and Physiology 43 (2):135-147.

Mattei, J.H., M.A. Beekey, H.R. Potter, C.S. Bond, A.R. Woronik, J.A. Roberts, and K.A. Smith 2011. Estimation of short-term tag-induced mortality in horseshoe crabs *Limulus polyphemus*. Transactions of the American Fisheries Society 140:954-958.

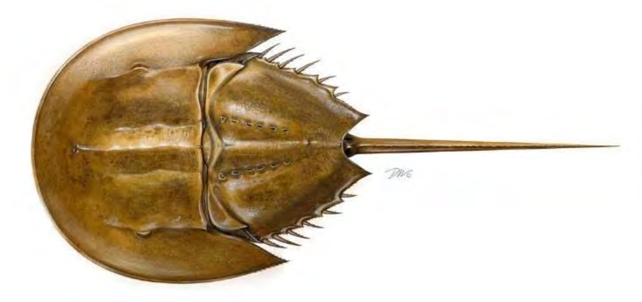
Rudloe, A. 1983. The effect of heavy bleeding on mortality of the Horseshoe Crab, *Limulus polyphemus*, in the natural environment. Journal of Invertebrate Pathology 42:167-176.

Thompson, M. 1998. Assessments of the population biology and critical habitat for the horseshoe crab, *Limulus polyphemus*, in the South Atlantic Bight. M. Sc. Thesis, College of Charleston, SC. 50pp.

Walls, E.A. and J. Berkson 2003. Effects of blood extraction on the horseshoe crab, *Limulus polyphemus*. Fish. Bull. 101:457-459.

Atlantic States Marine Fisheries Commission

Horseshoe Crab Benchmark Stock Assessment
Peer Review Report



March 2019

Sustainably Managing Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

Horseshoe Crab Benchmark Stock Assessment
Peer Review Report

Conducted on
March 26-28, 2019
Arlington, Virginia

Prepared by the
ASMFC Horseshoe Crab Stock Assessment Review Panel

Dr. Lawrence Jacobson (Chair), National Marine Fisheries Service (retired), Northeast Fisheries Science Center, Woods Hole, Massachusetts
Dr. Ruth Carmichael, University of South Alabama, Dauphin Island, Alabama
Dr. Matthew Cieri, Maine Department of Marine Resources, West Boothbay Harbor, Maine

A publication of the Atlantic States Marine Fisheries Commission pursuant to National Oceanic and Atmospheric Administration Award No. NA15NMF4740069

Acknowledgements

The reviewers thank the stock assessment team and Commission staff for their competent work and helpful attitude in preparing the report and facilitating the review.

Acronyms

ARIMA	Auto-Regressive Integrated Moving Average (stock assessment model)
ARM	Adaptive Resource Management
Bmsy	Biomass at maximum sustainable yield
CMSA	Catch Multiple Survey Analysis (stock assessment model)
CV	Coefficient of Variation
F	Annual fishing mortality rate
Fmsy	Fishing mortality rate at maximum sustainable yield
MSY	Maximum Sustainable Yield
Nmsy	Abundance at maximum sustainable yield
NEFOP	Northeast Fisheries Observer Program
TOR	Term of Reference

Executive Summary

The assessment splits the range of horseshoe crabs into four regions; Northeast (Maine, Massachusetts, Rhode Island), New York (Connecticut, New York), Delaware Bay (New Jersey, Delaware, Maryland, Virginia), and Southeast (North Carolina, South Carolina, Georgia, Florida).

The Panel recommends using horseshoe crab trend estimates for females and males combined from Autoregressive Integrated Moving Average (ARIMA) models fit to survey data for stock status determination, relative to abundance in 1998. Examination of results from multiple surveys within individual regions is necessary. Stock status was based on the proportion of surveys above or below their 1998 reference point when ASMFC management began. Stock status was considered poor if 33% of the surveys were below their reference point (red), good if 66% were above their reference point (green), and neutral (yellow) otherwise.

Stock status differs among regions based on the recommended 1998 reference point and ARIMA-based relative abundance estimates (see Figure 1 in Advisory Report). Based on this recommended approach, horseshoe crab relative abundance in the Northeast and Delaware Bay regions are in a neutral condition, New York is in a poor condition, and the Southeast is in a good condition. On a coastwide basis, horseshoe crab relative abundance is likely in a neutral condition.

ARIMA and Catch Multiple Survey Analysis (CMSA) model estimates were both available for female horseshoe crabs in the Delaware Bay region. The Panel recommends CMSA results when abundance and fishing mortality estimates are required, such as in the Adaptive Resource Management (ARM) model used by managers (Note the ARM model was described during review discussions but not reviewed by the Panel). CMSA results were not used for status determination because comparable reference points were not available. However, given the increasing survey trends, low landings, and CMSA results of low fishing mortality and relatively high abundance, overfishing and an overfished status are unlikely for female horseshoe crabs in the Delaware Bay region.

The magnitude of horseshoe crab discards in the targeted horseshoe crab fishery and other fisheries is potentially the most important uncertainty and highest priority research recommendation identified in the assessment to improve abundance estimates. Preliminary results show discard mortality may be comparable to or greater than combined mortality from other sources.

The stock assessment could not determine overfished stock status in terms of B_{MSY}, N_{MSY} or proxy reference points because biomass, abundance estimates and MSY reference points were not available. Trend-based relative abundance reference points were used instead, following common practice in many fisheries.

The stock assessment could not determine if overfishing is occurring in terms of F_{MSY} for horseshoe crabs as mortality estimates and suitable reference points were not available. It was not possible to determine if overfishing was occurring based on trends because discards are uncertain.

It is important to continue survey data collection for horseshoe crabs (particularly the Virginia Tech survey), promote consistent survey sampling among locations, and expand survey data collection to include size, sex, and information on female reproductive condition (primiparous vs. multiparous).

Terms of Reference

1. **Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:**
    a. **Presentation of data source variance (e.g., standard errors).**
    b. **Justification for inclusion or elimination of available data sources,**
    c. **Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, ageing accuracy, sample size),**
    d. **Calculation and/or standardization of abundance indices.**

The Review Panel examined a number of different fishery-dependent and fishery-independent data sources. Data used for ARIMA models and the Delaware Bay region were sufficient to support the analysis presented. The Panel noted the ARIMA approach was better than the Conn (2010) method in application to horseshoe crabs because of spatial variation in population dynamics within regions. Review efforts were therefore focused on the ARIMA approach.

Fishery-independent data included survey information and stock abundance from multiple different surveys (see Table 33 of Assessment Report), which are the primary data for ARIMA models. The assessment team presented the data clearly and handled the data appropriately. However, many surveys did not identify primiparous (first time female spawners) or multiparous individuals (repeat female spawners) nor record sex. This deficiency will hamper future assessment efforts, and a recommendation to add sex and maturity sampling was made by the Review Panel (see TOR 8).

Fishery-dependent data included bait landings, biomedical collection, and discards. Biological sampling for the bait fishery and biomedical collection seemed adequate given the limited use of commercial data in the assessment, although the assessment team did highlight several improvements from past stock assessments. Discards are a substantial uncertainty (see below). The development and use of bait bags may have reduced bait harvest numbers by 50-75% in the early years of management (when benchmark was set). The assessment team should provide a description of this change in the overview of the history of the stock (e.g., Fisher and Fisher 2006; Gerhart 2007).

The assessment team presented data and analysis on the proposed 15% biomedical mortality rate, which appears to be a robust estimate determined by a simple and fairhanded approach based on the best available data. The Review Panel agreed with the assessment team's approach, but noted some covariates such as season of harvest, size/condition of crabs, and location that are worth investigating. However, additional data and analyses are not likely to significantly alter assessment results due to the modest magnitude of biomedical mortality. As such, while an uncertainty, the biomedical mortality rate should receive less focus in future assessments.

By far the largest source of data uncertainty was regional and coastwide discards and the associated mortality of discarded horseshoe crabs. Losses due to discards may be similar or greater than losses from bait harvest and biomedical collection combined. The Review Panel highlights the importance of discard mortality for assessment and management of horseshoe crabs.

With respect to discards, the Review Panel recommends:

1) Expanding the analysis of discards to the entire stock unit, beyond the Delaware Bay region.
2) Further examination of discard mortality rates by gear, area, and season. This effort should include a literature review as well as field studies as time allows.
3) Stratification of observer data by season, area, and fleet is critical in discard estimation and it will be important to develop and test approaches for horseshoe crabs. It is important to exclude fleets incapable of harvesting horseshoe crabs (i.e., offshore fisheries, midwater or raised foot rope trawls). These tasks will require thorough examination of data from the Northeast Fisheries Observer Program (NEFOP) data and state at-sea observer programs.
4) Future assessment teams should include an analyst who has direct access to the NEFOP database and the experience necessary to conduct discard analyses. In addition, it would be useful to provide data training and access to ASMFC analytical staff.

2. Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:

  a. Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?
  b. If multiple models were considered, evaluate the analysts' explanation of any differences in results.
  c. Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock- recruitment relationship, choice of time-varying parameters, plus group treatment).

Models and modeling decisions for stock status determination were appropriate and acceptable. ARIMA models were the primary modeling technique used in this and the last two assessments to estimate relative stock abundance and define limit reference points based on trends for horseshoe crabs (Helper et al. 2002). The models were fit to selected survey data for males and females combined in each stock region and are intended to smooth the data, reduce noise, and estimate underlying trends in stock size. ARIMA models with three lags are well-suited for horseshoe crabs because: the statistical approach is objective, the model complexity is reasonable given the length and noise in the survey data, the method accommodates years with missing data, and results can be used to estimate stock status and reference points that are comparable. One attribute of the method is that it estimates multiple trends (one for each survey) instead of a single trend for each region. Conn (2010) models produce a single trend for each region and were evaluated for horseshoe crabs but rejected in favor of ARIMA models.

The assumption with Conn models of identical trends in each survey was sometimes violated, likely due to heterogeneous population dynamics within regions.

Estimates from a Catch Multiple Survey Analysis (CMSA) model are the best available estimates of abundance and fishing mortality for female horseshoe crabs in the Delaware Bay region. The CMSA estimates may be biased low, however, due to the assumption of 100% capture efficiency in the Virginia Tech trawl survey. Other uncertainties include missing years of Virginia Tech survey information (2012-2015), lack of a stock recruitment relationship, short time series of data, and discards. For these reasons, and as indicated in the assessment report, the Panel notes uncertainty in model results. The Panel further recommends caution in using this model to interpret stock status or develop management reference points at this time. However, the CMSA results are based on multiple survey time series, with data for some surveys available for all years. The model takes advantage of the ability to define new recruits in terms of primiparous individuals and the high probability that catchability is equivalent between primiparous and multiparous horseshoe crabs. Of note, the Virginia Tech survey is specifically designed for horseshoe crab collection and has a higher capture efficiency than other surveys (see research recommendations). The Panel agrees the CMSA model estimates are suitable for input to models such as the Adaptive Resource Management (ARM) model.

The Panel reviewed a theoretical simulation model used to estimate MSY-based reference points from a published density dependent relationship, including improved estimates of natural mortality. A similar method for making short-term stock abundance forecasts was also reviewed. Earlier versions of the reference point model were used in ARM management. The Panel agreed the new estimates of natural mortality and other changes were improvements that could be considered in the ARM framework. However, the reference points from the simulation approach should not be directly compared to abundance and fishing mortality estimates from the CMSA for status determination because calculations between the two models may not be comparable (see below). For the same reasons, the forecast model should not be used to make short-term stock size projections based on CMSA results. It is wiser to use the CMSA itself for short-term projections to ensure comparability and because variances for the predictions can be directly calculated. The theoretical population model and reference points may provide useful information in other circumstances.

There was considerable discussion about comparing stock estimates from one model to reference points calculated in another. The Reviewer's advice to avoid this practice is based on the possibility of errors in status determination that can be reduced or avoided using a single model to calculate stock size and reference points. As an example, if we ignore random estimation errors and say the stock size estimate from the first model is $B' = gB$ where B is the true biomass and g is a multiplicative bias due to model misspecification and data errors. The stock size and B_{MSY} reference point estimates from the second model are $B''=hB$ and $B_{MSY}''=hB_{MSY}$ where B_{MSY} is the reference point and h is the bias. The status determination ratio B'/B_{MSY}'' based on two models is in error by the factor g/h which might amount to substantial over- or underestimation. In contrast, using stock size and reference point from just the second model, for example, gives $B''/B_{MSY}'' = hB/hB_{MSY} = B/B_{MSY}$ which is likely more accurate because the bias h in the numerator and denominator cancels out.

3. **Evaluate the diagnostic analyses performed, including but not limited to:**
   a. **Sensitivity analyses to determine model stability and potential consequences of major model assumptions**
   b. **Retrospective analysis**

Residuals from ARIMA models used for status determination were normally distributed and had acceptable temporal patterns. Retrospective patterns generally are not a problem in ARIMA models. Historical analyses demonstrated that the ARIMA models were stable from one assessment to the next.

There was no evidence of retrospective patterns in CMSA results and the model fit to survey data was acceptable. Extensive sensitivity analysis demonstrated that the CMSA model was robust to assumptions about catchability, selectivity, natural mortality, and survey variance. The stability was due to assumptions that primiparous and multiparous females had the same catchability in the Virginia Tech survey and that the survey, which was designed for horseshoe crabs, captures nearly 100% of the horseshoe crabs in its path between the trawl sweeps. Sensitivity analysis showed the two assumptions were compatible because results were similar when one of the assumptions was eliminated.

4. **Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.**

The uncertainty in ARIMA model fits was displayed graphically in terms of confidence intervals. Uncertainty in status determination based on ARIMA model results considered the uncertainty in both the stock status measure and the reference point. The criterion used to identify stocks below their reference point was relatively stringent (50% probability of being less than the reference point with 80% confidence), but appropriate and consistent with Helser and Hayes (1995).

Variance and CVs for CMSA results were estimated using the delta method in AD-Model Builder for presentation in the final report. The assessment authors were asked to depict CMSA results using asymmetric confidence intervals and to provide CVs for estimates in tables. The variances for recruitment estimates in years with missing Virginia Tech survey data were large, as expected, but variances for total stock size were reasonable.

5. **If a minority report has been filed, review minority opinion and any associated analyses. If possible, make a recommendation on current or future use of the alternative assessment approach presented in minority report.**

No minority reports were submitted.

6. **Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.**

The Panel recommends using horseshoe crab trend estimates for females and males combined from ARIMA models fit to survey data for stock status determination, relative to abundance in 1998. Examination of results from multiple surveys within individual regions is necessary due to the lack of comprehensive, consistent survey methods through time. Stock status was based on the proportion of surveys above or below their 1998 reference point when ASMFC management began. Stock status was is considered poor if 33% of the surveys are below their reference point (red), good if 66% are above their reference point (green), and neutral (yellow) otherwise.

ARIMA and Catch Multiple Survey Analysis (CMSA) model estimates were both available for female horseshoe crabs in the Delaware Bay region. The Panel recommends CMSA results when abundance and fishing mortality estimates are required, such as in the Adaptive Resource Management (ARM) model used by managers. CMSA results were not used for status determination because comparable reference points were not available. However, given the increasing survey trends, low landings, and CMSA results (low fishing mortality and relatively high abundance), overfishing and an overfished status are unlikely for female horseshoe crabs in Delaware Bay.

Exploitation estimates were available for females in the Delaware Bay region only. Simple catch/survey, catch/ARIMA and catch/swept area abundance exploitation rates were not calculated because of difficulties in estimating catch including discards.

7. **Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods and measures.**

For the coastwide and regional assessments using ARIMA models, the Review Panel endorses the use of reference points for each stock region based on relative abundance in 1998, when ASMFC management commenced. A second alternative of using quartiles was examined but was not favored given the short timeframe of the indices.

Further, the Panel recommends using horseshoe crab trend estimates for females and males combined from ARIMA models fit to survey data for stock status determination relative to abundance in 1998. Examination of results from multiple surveys within individual regions is necessary. Stock status is based on the proportion of surveys above or below their 1998 reference point when ASMFC management began. Stock status is poor if 33% of the surveys are below their reference point (red), good if 66% are above their reference point (green), and neutral (yellow) otherwise. The color code system is useful in tables that summarize stock status results.

To help managers determine if changes in harvest practices or other population pressures have affected horseshoe crabs in recent years, the Review Panel requested a table comparing regional status results in the current and previous stock assessment.

For the Delaware Bay region, the Panel reviewed a reference point approach based on a theoretical population model, which was used to estimate N_{MSY} and F_{MSY}. The modeling indicated F_{MSY} for Delaware Bay is below 0.1 and population growth occurs slowly, over decades. While informative, the reference points from the theoretical approach should not be directly compared to abundance and fishing mortality estimates from the CMSA for status determination because calculations in the two models may not be comparable. Alternative, history-based reference points could be explored, but given the short time series, the Review Panel and assessment team expressed concern about the historical approach. Ultimately, the Review Panel did not make any recommendations on Delaware Bay region-specific reference points.

8. **Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment and provide recommendations to improve the reliability of future assessments.**

Research Recommendations

The Review Panel commends the assessment team for development of a thorough set of research recommendations under the categories of future research, data collection, and assessment methodology. In contrast to the recommendation of the SAS, however, the Review Panel recommends that a benchmark stock assessment be considered in five years. The potential for improved discards estimation and associated model updates to significantly affect horseshoe crab stock assessment was the primary reason for this recommendation. Also the Review Panel supports the assessment team's plan to remain proactive about maintaining surveys and research programs particularly focused on three main areas: 1) refining estimates of bycatch and discard mortality through literature review and experimentation, 2) better defining the constraints of existing trawl surveys, and improving the efficiency and consistency of surveys among locations and through time, particularly to include data on both primiparous and multiparous females whenever possible, and 3) improving the assessment methodology to support future model applications.

The Panel also noted there is a meaningful need for data on the juvenile and subadult components of this stock that are not well captured in either trawl or spawning surveys. While trawl surveys are likely to continue to serve as the primary basis of tracking abundance through time, it is important to continue to support research to better define these poorly understood stock components such as natural mortality and recruitment.

The Review Panel cautions the assessment team to avoid broad-brushing when discussing survey results. Remember that surveys are necessarily an index of change based on specific locations and segments of each population.

Climate change is already likely affecting horseshoe crab populations, habitat, and food resources in undefined ways. While not as much of a priority for study as discard estimates, the Review Panel appreciated the assessment team's inclusion of research recommendations on this topic and thinks the concept must be a consideration in all ongoing and future research. Of particular importance are the effects of temperature and sea level rise on the extent of available spawning and foraging habitat.

To improve data analyses and subsequent assessment, the Review Panel noted some constraints that could be improved for future assessments:

1) In some cases, additional data needed to address questions were available, but not readily accessible to the ASMFC assessment team. The Review Panel recommends ensuring that existing resources such as fisheries observer (discard) and NEFOP data be made directly available to the assessment team.
2) The inability to publicly show regional biomedical collection and mortality data and derivative stock assessment results presents a material constraint to fully explaining the stock assessment results. The assessment team could consider alternative approaches to share mortality data such as by reporting biomedical and bycatch estimated mortality together. Efforts should be made to improve data access and use however possible.
3) Given the evidence of links (as yet poorly defined) between the Atlantic coast and Gulf coast horseshoe crab populations, which will likely increase if the effects of climate change prompt large-scale alteration of habitat or animal movement, and the likelihood of future harvest pressure in the Gulf, the Review Panel encourages the assessment team to enhance communication with Gulf States Marine Fisheries Commission and encourage data collection in anticipation of future need.

The Review Panel prioritized the following research recommendations from the assessment report:

Data Collection

- Better characterize discards, landings, and discard mortality by gear. This effort could be accomplished through a combination of literature research for other commercial species such as blue crabs and other invertebrates and experimentation.
- Continue biosampling for sex and weight, particularly by primiparous and multiparous, and expand where possible, using standardized protocols across regions and surveys.
- Continue to fund and operate the full Virginia Tech Trawl Survey annually.
- Conduct a gear efficiency study of the Virginia Tech Trawl Survey given the importance of using swept-area estimates of abundance in modeling the Delaware population.
- Determine the sampling constraints of all surveys used in horseshoe crab stock assessment, particularly better defining the area and type of habitat represented by

each survey and the portion of the population sampled (by size, sex, maturity status to the extent possible). This could be done at the cost of staff time only.

- Define the features among existing trawl surveys and compare them to the demographics of the sampled populations to determine which survey approaches (timing, gear type or size, etc.) are effective to encourage consistent and most effective sampling methodology among locations. This could be done at the cost of staff time only.
- Expand coastwide tagging studies to better define movement (extent of range), population mixing among regions (including greater tag and recapture effort in the Gulf of Mexico), mortality and maximum age. Mortality estimates from tagging are particularly important when other estimates are not available, and they should be emphasized in future assessments. These data will support use of the MARK and JSC models outside of Delaware Bay and inform applicability of management zones.

Assessment Data and Methodology:
The configuration of the Northeast region, which includes the Rhode Island and Massachusetts surveys, should be reconsidered in the next assessment. Declining trends in the Rhode Island survey are like trends in the New York region to the south and markedly different from the increasing trend in the more northern Massachusetts survey. In addition, the small Rhode Island survey has a disproportionate effect on status determination for the much larger Northeast region.

Some potential improvements to the CMSA model should also be considered. Survey data are weighted in aggregate based on standardized variances from preliminary Conn models and then individually based on estimated annual CVs. Sensitivity analyses showed that model results were robust to configuration of weights. However, it is not clear whether uncertainties were double counted or that the product of the two types of inverse variance weights (one standardized the other not) is appropriate. The assessment team should consider whether these conventions and assumptions affect the delta method variances for abundance and fishing mortality estimated in the model.

Survey data for primiparous horseshoe crabs in the Virginia Tech trawl survey are important in CMSA for estimating recruit abundance. The Virginia Tech survey is the only survey that distinguishes between primiparous and multiparous horseshoe crabs. The survey was not conducted during 2012-2015. Therefore, the variance of model recruitment estimates is very large for these years. Alternate approaches to estimating recruitment and more realistically appraising its variance should be considered. For example, a spawners-recruit formulation or a random walk model that assumes similar recruitment in adjacent years might be appropriate. It might be advantageous to individually weight recruitment deviations to control problematic estimates. Fortunately, as demonstrated by sensitivity runs, the uncertainty of recruitment estimates in years with missing survey data had very little effect on total stock abundance estimates because the recruitment estimates in adjacent years tend to be negatively correlated such that an underestimate in year *t* results in an overestimate in year *t+1* that cancels the potential error in total abundance. The changes suggested could increase the realism of the estimated recruit time series but would probably have little effect on the overall abundance estimates.

If use of the CMSA model continues or is expanded, then it should be modified to include short-term projection capabilities so that projections and historical model estimates are guaranteed to be comparable. It is easy to calculate the variance of projected estimates, including uncertainty in recruitment, terminal stock size, catchability, etc. Also, it would be good to compute any new reference points directly in the CMSA to ensure comparability of reference points and stock status measures.

CMSA models for male horseshoe crabs in Delaware Bay and other areas should be developed. The best approach may be to use a two-sex version of the model so that combined male and female abundance can be compared to catch and surveys with no sex data.

The CMSA for horseshoe crabs took advantage of aspects of female horseshoe crab biology (terminal molt at maturity) and the Virginia Tech survey carried out in Delaware Bay which distinguishes between primiparous (newly mature = recruits in CMSA) and multiparous crabs (post-recruits in CMSA). Unfortunately, primiparous and multiparous crabs are not distinguished in other surveys and the methods used for Delaware Bay are not applicable elsewhere. Other approaches to tracking abundance of new recruits (e.g. cohort slicing) could be tested so that the model can be applied to other areas and sexes.

If the CMSA model is too difficult to apply in other areas, then a two sex and length-based (or possibly age based counting age from recruitment to the fishery) approach should be considered. Alternately, and considering data and staff limitations, it may be best to continue using the robust and simple ARIMA model approach.

9. **Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.**

The Review Panel recommends that a benchmark stock assessment be considered in five years given the potential for improved discard estimates and associated model updates to significantly improve the horseshoe crab stock assessment.

Special Comments

To facilitate communication, the Review Panel recommends using consistent and accurate terminology such as N_{MSY} rather than B_{MSY} when referring to counts as opposed to biomass data. Similarly, the Panel suggests, to the extent possible, displaying comparable data on the same axis range (or scale) to facilitate data interpretation.

References Cited

Conn, P.B. 2010. Hierarchical analysis of multiple noisy abundance indices. Can. J. Fish. Aquat. Sci. 67: 108–120.

Fisher, R.A. and Fisher, D.L. 2006. The use of bait bags to reduce the need for horseshoe crab as bait in the Virginia whelk fishery. Virginia Institute of Marine Science, VIMS Marine Resource Report No. 2006-10, VSG-06-12.

Gerhart, S.D., 2007. A review of the biology and management of horseshoe crabs, with emphasis on Florida populations. Florida Fish and Wildlife Conservation Commission, FWRI Technical Report TR-12.

Helser, T. E. and D. B. Hayes. 1995. Providing quantitative management advice from stock abundance indices based on research surveys. Fishery Bulletin 93: 290 – 298.

Advisory Report

A. Status of the stock: Current and projected

Based on the recommended modeling approach (see below), horseshoe crab in the Northeast and Delaware Bay regions are in a neutral condition, New York is in a poor condition, and the Southeast is in a good condition (Table 1). On a coastwide basis, horseshoe crab relative abundance is likely in a neutral condition.

Fishing pressure was estimated for female horseshoe crabs in the Delaware Bay region but not for males or horseshoe crabs in other regions because discard mortality in the horseshoe crab and other fisheries is unknown and may be substantial.

B. Stock Identification and Distribution

The Atlantic States Marine Fisheries Commission (ASMFC) manages the horseshoe crab stock from Maine to eastern Florida (Figure 1). Genetics, isotope analyses, and tagging data suggest the horseshoe crab population is comprised of multiple units, some distributed across multiple states and others embayment-specific that are linked to varying degrees. Due to varying levels of data at these levels, the assessment splits the range of horseshoe crabs into four regions; Northeast (Maine, Massachusetts, Rhode Island), New York (Connecticut, New York), Delaware Bay (New Jersey, Delaware, Maryland, Virginia), and Southeast (North Carolina, South Carolina, Georgia, Florida). This was a pragmatic decision that balances data availability and biological realism.

C. Landings

Since the mid- to late-1900s, horseshoe crabs have been harvested commercially primarily for use as bait and for use in the biomedical industry (Figure 2). Bait harvest is used primarily in the conch and American eel pot fisheries. The biomedical industry uses crabs to manufacture Limulus Amebocyte Lysate (LAL) which is used to test pharmaceuticals for the presence of gram-negative bacteria.

Early harvest records should be viewed with caution due to potential under-reporting. Between the mid-1800s and mid-1900s harvest ranged from approximately 1 to 5 million crabs annually, then dropped to between 250,000 and 500,000 crabs annually in the 1950s. About 420,000 crabs were harvested annually during the early 1960s.

Commercial landings declined after 1998 when ASMFC management began and then fluctuated around an average of 753,000 crabs from 2004-2017. The 2017 harvest level was the largest harvest since 2003 but still over 500,000 crabs less than the coastwide quota of 1.587 million crabs.

Biomedical losses are modest (<13% of bait landings assuming 15% bleeding mortality) but are not shown due to confidentiality concerns.

D. Data and Assessment

Relative abundance trends were estimated by fitting ARIMA models to survey data for horseshoe crabs taken during multiple research surveys in each of the four regions. Relative abundance in 2017 was compared to relative abundance during 1998 when ASMFC management began where the estimates for 1998 and 2017 were both from ARIMA models.

Additional information about abundance and exploitation are available for female horseshoe crabs in the Delaware Bay area from a CMSA model. The results were not used for status determination but are recommended for use where biomass and fishing mortality estimates are required for management.

E. Biological Reference Points

The recommended biological reference point for horseshoe crabs is the relative abundance of male and female horseshoe crabs during 1998 from ARIMA models. Stock status is based on the proportion of surveys in a region or coast wide that are above or below their 1998 reference point. Stock status is poor if 33% of the surveys are below their reference point (colored red in tables), good if 66% are above their reference point (green), and neutral (yellow) otherwise (Table 1).

F. Fishing Mortality

CMSA results indicate low fishing mortality for female horseshoe crabs in Delaware Bay in recent years (Figure 3). It was not possible to develop trend based or other measures of fishing pressure on males in Delaware Bay or for other areas due to uncertainty about discards.

G. Recruitment

CMSA model estimates for female horseshoe crabs indicate roughly average recruitment during 2017-2018 but the estimates are uncertain due to missing Virginia Tech survey data for 2013-2016 (Figure 4). No other direct information about recruitment is available.

H. Spawning Stock Abundance

Based on CMSA estimates, female spawning biomass in Delaware Bay is relatively high (Figure 5). No other direct estimates of spawning stock abundance are available.

I. Bycatch

The assessment provided the first estimates of discard mortality in the horseshoe crab and other fisheries. Preliminary results are uncertain but suggest that discard mortality may be comparable to or greater than mortality from other sources (bait landings plus biomedical collection). The magnitude of horseshoe crab discards in the horseshoe crab and other fisheries is the most important uncertainty and research recommendation identified in the assessment.

J. Other Comments

It is important to continue survey data collection for horseshoe crabs (particularly the Virginia Tech survey), determine how current survey methods differ (and implications for assessment across sites), define which methods are most effective to promote consistent survey sampling among locations, and to expand survey data collection to include size, sex, and female reproductive condition (primiparous vs. multiparous) information.

K. Tables

Table 1. Stock status determination for the coastwide and regional stocks based on the 1998 index-based reference points from ARIMA models.

Region	2009 Benchmark	2013 Update	2019 Benchmark	2019 Stock Status
Northeast	2 out of 3	5 out of 6	1 out of 2	Neutral
New York	1 out of 5	3 out of 5	4 out of 4	Poor
Delaware Bay	5 out of 11	4 out of 11	2 out of 5	Neutral
Southeast	0 out of 5	0 out of 2	0 out of 2	Good
Coastwide	7 out of 24	12 out of 24	7 out of 13	Neutral

L. Figures

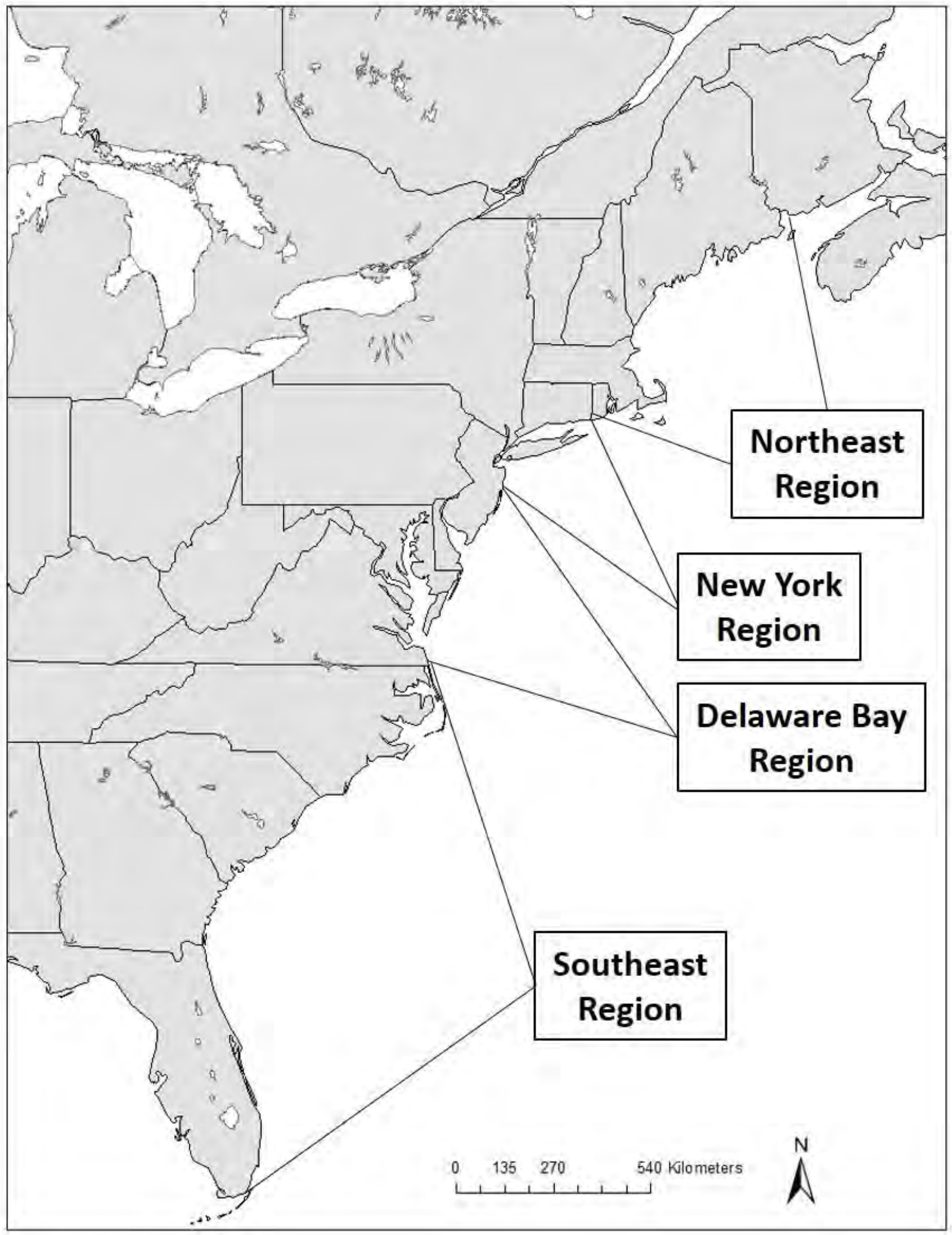


Figure 1. Map of the Atlantic coast showing the regions for horseshoe crab assessment.

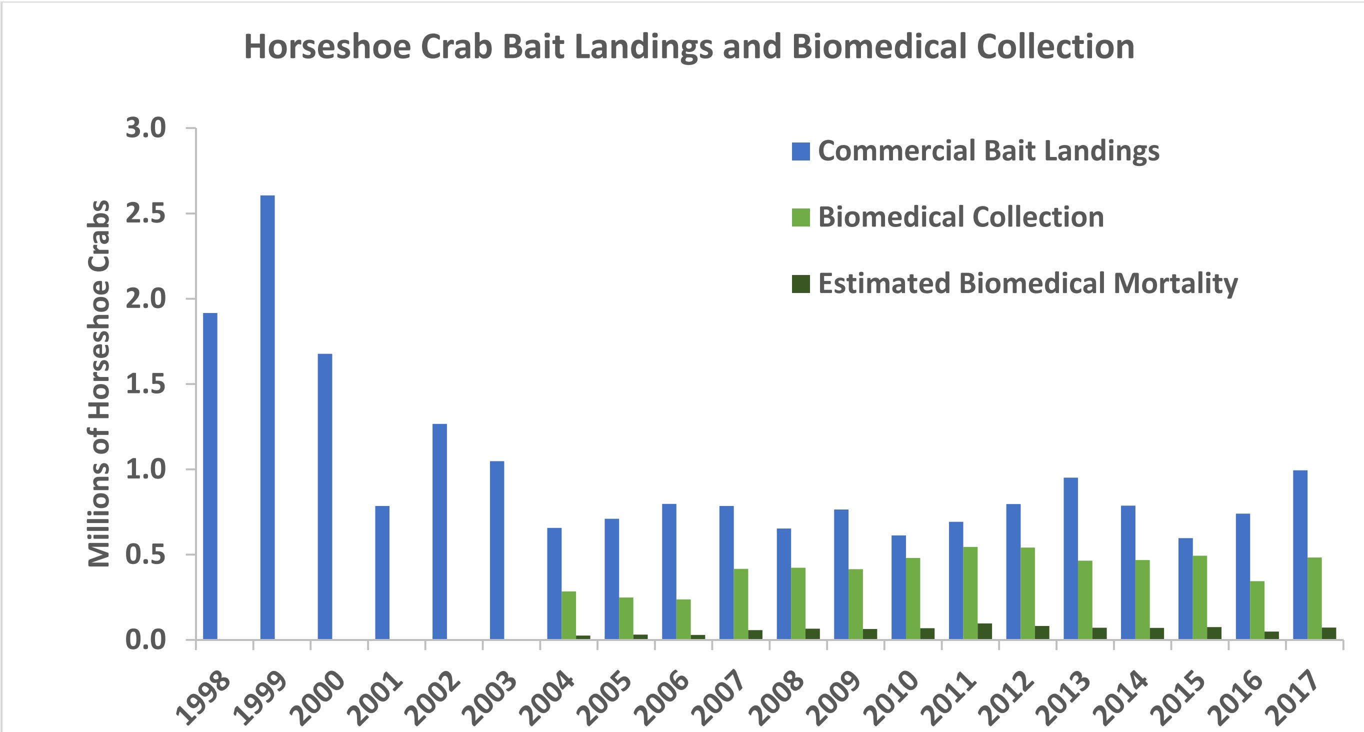


Figure 2. Coastwide horseshoe crab bait landings, biomedical collection, and estimated mortality attributed to the biomedical industry. Biomedical collection data has been annually reported to ASMFC since 2004 and includes all crabs brought to bleeding facilities except those harvested as bait and counted against state quotas. A 15% rate is applied to the number of horseshoe crabs bled and released alive to estimate mortality from the industry.

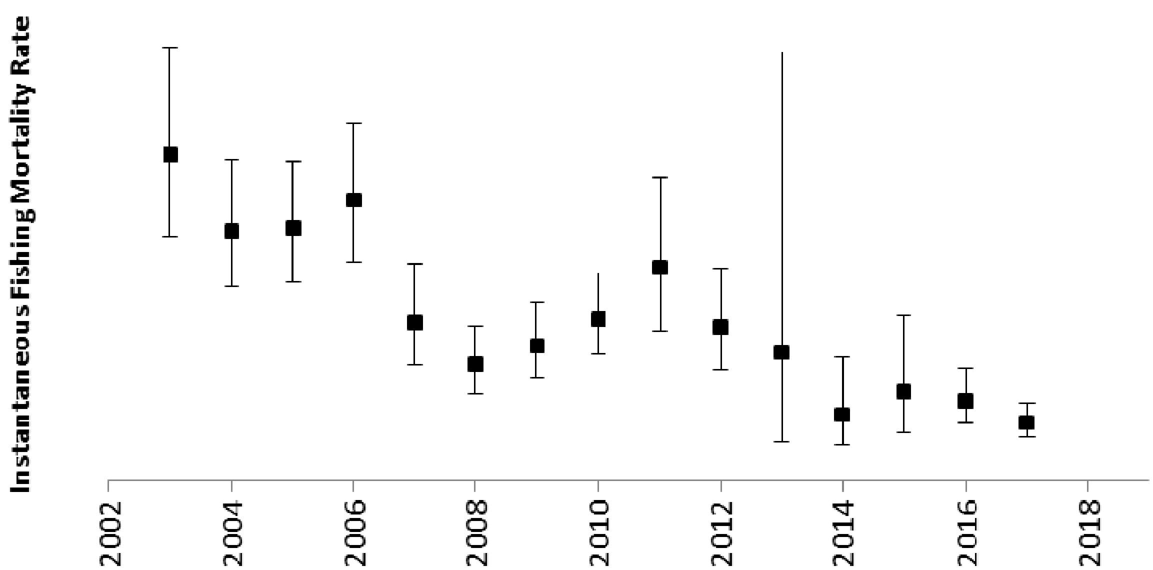


Figure 3. CMSA model estimated instantaneous fishing mortality rate F with lower and upper 95% confidence limits. Y-axis values have been removed due to CONFIDENTIAL data.

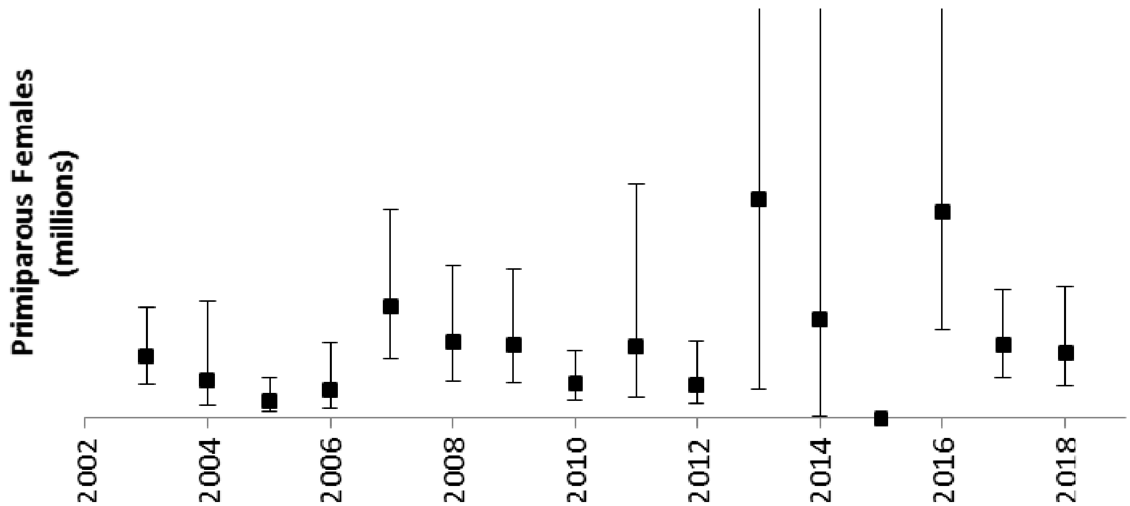


Figure 4. CMSA model estimated primiparous female abundance with lower and upper 95% confidence limits. Upper confidence limits for 2013, 2014, and 2016 extend beyond y-axis with values of CONFIDENTIAL. Y-axis values have been removed due to CONFIDENTIAL data.

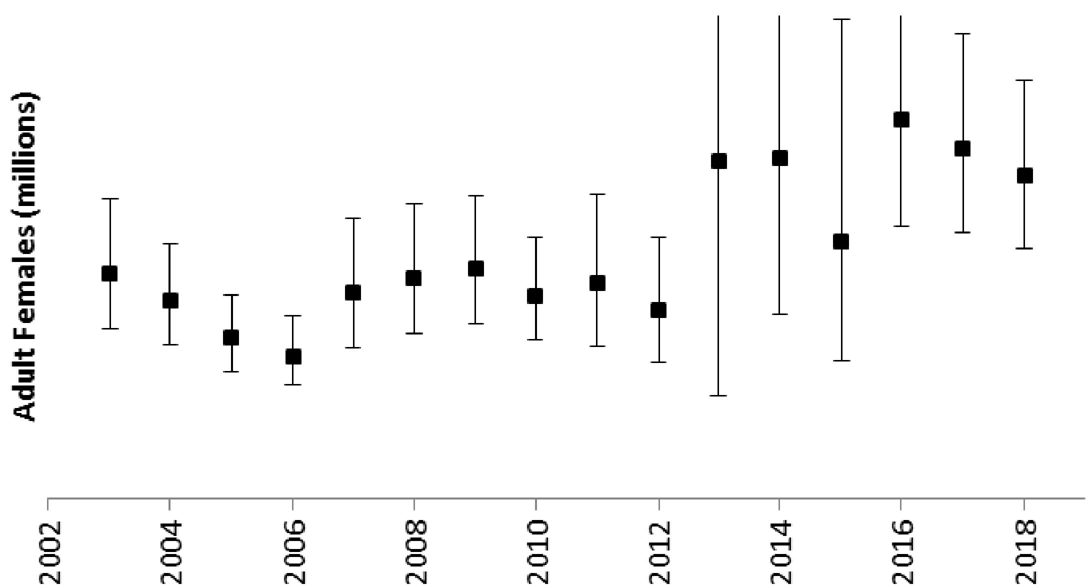


Figure 5. CMSA model estimated adult (primiparous + multiparous) female abundance with lower and upper 95% confidence limits. Upper confidence limits for 2013, 2014, and 2016 extend beyond the y-axis with values of CONFIDENTIAL. Y-axis values have been removed due to CONFIDENTIAL data.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

April 11, 2019

To: Horseshoe Crab Management Board

From: Tina Berger, Director of Communications

RE: Advisory Panel Nomination

Please find attached a new nomination to the Horseshoe Crab Advisory Panel – Nora Blair, a biomedical representative from South Carolina. Nora replaces Dr. James Cooper, who has served on the Advisory Panel since 1997. Please review this nomination for action at the next Board meeting.

If you have any questions, please feel free to contact me at (703) 842-0749 or tberger@asmfc.org.

Enc.

cc: Mike Schmidtke

M19-27

Horseshoe Crab Advisory Panel

Bolded names await Board approval

Massachusetts

Jay A. Harrington (comm/handpicker/raker)
#6 Sherman Road
P.O. Box 321
South Orleans, MA 02662
Phone: 508.255.0582
indeepH2O@gmail.com
Appt. Confirmed 4/7/98
Appt. Reconfirmed 10/02; 10/06; 5/10; 8/18

Brett Hoffmeister (biomedical)
Associates of Cape Cod
331 Barlows Landing Row
Pocasset, MA 02559
Phone (day): 508.444.1426
BHoffmeister@acciusa.com
Appt Confirmed 2/3/16
Appt. Reconfirmed 8/18

Rhode Island

Vacancy (comm/otter trawl)

New York

John L. Turner (conservation)
10 Clark Bouelvard
Massapequa, NY 11762
Phone (day): 631.451.6455
Phone (eve): 516.797.9786
redknot@optonline.net
Appt. Confirmed 2/10/05
Appt Reconfirmed 5/10

Peter Wenczel (pot/conch)
675 West Shore Drive
Southold, NY 11971
Phone: 631.765.5669
pwenczel@optonline.net
Appt. Confirmed 4/7/98
Appt. Reconfirmed 10/02
Appt. Reconfirmed 10/06
Appt Reconfirmed 5/10
Participation: Inactive; attended last meeting in 2010

New Jersey

Benjie Swan (biomedical)
Limuli Laboratories
Dias Creek, 5 Bay Avenue
Cape May Courthouse, NJ 08210-2556
Phone: 609.465.6552
Swan24@verizon.net
Appt. Confirmed 8/5/10

Delaware

Lawrence Voss (comm./pot)
3215 Big Oak Road
Smyrna, DE 19977
Phone: (302)359-0951
shrlyvss@aol.com
Appt. Confirmed 10/24/18

2 vacancies - dealer/processor & conservation/environmental

Maryland

George Topping (comm/trawl)
32182 Bowhill Road
Salisbury, MD 21804
Phone: 443.497.2141
george@zztopping.com
Appt. Confirmed 5/16

Jeffrey Eutsler (comm/trawl)
11933 Gray's Corner Road
Berlin, MD 21811
Phone: 443.497.3078
jeffeutsler@me.com
Appt. Confirmed 2/4/98
Appt. Reconfirmed 10/02
Appt. Reconfirmed 10/06
Appt Reconfirmed 5/10

William R. Legg (comm/pot/eel)
110 Rebel Road
Grasonville, MD 21638
Phone: 410.820.5841
Appt. Confirmed 4/7/98
Appt. Reconfirmed 10/02
Appt. Reconfirmed 10/06
Appt Reconfirmed 5/10

Participation: Inactive; attended last meeting in 1998

Chair – Allen L. Burgenson (biomedical)
8875 Hawbottom Road
Middletown, MD 21769
Phone: 301.378.1263
allen.burgenson@lonza.com
Appt. Confirmed 8/21/08

Virginia
Richard B. Robins, Jr. (processor/dealer)
3969 Shady Oaks Drive
Virginia Beach, VA 23455
Phone (day): 757.244.8400
Phone (eve): 757.363.9506
richardbrobins@gmail.com
Appt. Confirmed: 2/9/00
Appt. Reconfirmed 1/2/06
Appt Reconfirmed 5/10

1 vacancy - comm/pot/conch

South Carolina
Nora Blair (biomedical)
Charles River Laboratories Microbial Solutions
1852 Cheshire Drive
Charleston, SC 29412
843.276.7819
Nora.Blair@crl.com

Cindy Sires (comm/pot/trawl)
7609 White Point Road
Yonges Island, SC 29449
Phone: 843.607.3287
troubleyi@aol.com
Appt. Confirmed 8/5/10
Participation: Inactive; never attended meeting since appt in 2010

Nontraditional Stakeholders
Jeff Shenot
7900 McClure Road
Upper Marlboro, MD 20772
Phone: 301.580.4524
JUGBAY@msn.com
Appt. Confirmed 8/2018
Walker Golder
7741 market Street, Unit D
Wilmington, NC 28411-9444
Phone (day): 910.686.7527
Phone (eve): 910.619.6244
wgolder@audubon.org
Appt. Confirmed 8/2018

ATLANTIC STATES MARINE FISHERIES COMMISSION

Advisory Panel Nomination Form

This form is designed to help nominate Advisors to the Commission's Species Advisory Panels. The information on the returned form will be provided to the Commission's relevant species management board or section. Please answer the questions in the categories (All Nominees, Commercial Fisherman, Charter/Headboat Captain, Recreational Fisherman, Dealer/Processor, or Other Interested Parties) that pertain to the nominee's experience. If the nominee fits into more than one category, answer the questions for all categories that fit the situation. **Also, please fill in the sections which pertain to All Nominees (pages 1 and 2). In addition, nominee signatures are required to verify the provided information (page 4), and Commissioner signatures are requested to verify Commissioner consensus (page 4). Please print and use a black pen.**

Form submitted by Robert H. Boyles State: SC
(your name)

Name of Nominee: Nora Blair

Address: 1852 Cheshire Dr.

City, State, Zip: Charleston, SC 29412

Please provide the appropriate numbers where the nominee can be reached:

Phone (day): (843) 276-7819 Phone (evening): (401) 258-0270

FAX: ________ Email: Nora.Blair@crl.com

FOR ALL NOMINEES:

1. Please list, in order of preference, the Advisory Panel for which you are nominating the above person.

   1. Horseshoe Crab Advisory Panel
   2. ________
   3. ________
   4. ________

2. Has the nominee been found in violation of criminal or civil federal fishery law or regulation or convicted of any felony or crime over the last three years?

   ☐yes ☒no

3. Is the nominee a member of any fishermen's organizations or clubs?

   ☐yes ☒no

If "yes," please list them below by name.

______________________________ ______________________________

______________________________ ______________________________

______________________________ ______________________________

4. What kinds (species) of fish and/or shellfish has the nominee fished for during the past year?

______________________________ ______________________________

______________________________ ______________________________

______________________________ ______________________________

5. What kinds (species) of fish and/or shellfish has the nominee fished for in the past?

______________________________ ______________________________

______________________________ ______________________________

______________________________ ______________________________

FOR COMMERCIAL FISHERMEN:

1. How many years has the nominee been the commercial fishing business?

2. Is the nominee employed only in commercial fishing? ☐yes ☐no

3. What is the predominant gear type used by the nominee? ______________________

FOR CHARTER/HEADBOAT CAPTAINS:

1. How long has the nominee been employed in the charter/headboat business? _____

2. Is the nominee employed only in the charter/headboat industry? ☐yes ☐no

   If "no," please list other type(s) of business(es) and/or occupation(s): ______________________

3. How many years has the nominee lived in the home port community? _____ years

   If less than five years, please indicate the nominee's previous home port community.

   ____

FOR RECREATIONAL FISHERMEN:

1. How long has the nominee engaged in recreational fishing? _____ years

2. Is the nominee working, or has the nominee ever worked in any area related to the fishing industry? ☐yes ☐no

   If "yes," please explain.

   ____

FOR SEAFOOD PROCESSORS & DEALERS:

1. How long has the nominee been employed in the business of seafood processing/dealing? _____ years

2. Is the nominee employed only in the business of seafood processing/dealing?

   ☐yes ☐no
   If "no," please list other type(s) of business(es) and/or occupation(s):

   ____

3. How many years has the nominee lived in the home port community? _____ years

   If less than five years, please indicate the nominee's previous home port community.

   ____

FOR OTHER INTERESTED PARTIES:

1. How long has the nominee been interested in fishing and/or fisheries management? 15 years

2. Is the nominee employed in the fishing business or the field of fisheries management?
   ☐yes ☒no

   If "no," please list other type(s) of business(es) and/or occupation(s):

   Quality Operations Manager, Microbial Solutions, Charles River Laboratories

FOR ALL NOMINEES:

In the space provided below, please provide the Commission with any additional information which you feel would assist us in making choosing new Advisors. You may use as many pages as needed.

The nominee is currently employed by Charles River Labs (CRL) Microbial Solutions and assigned duties include oversight of a lab which performs testing on LAL (Limulus amebocyte lysate) based products, which are derived from the blood cells of the horseshoe crab (HSC). In various roles, the nominee has been working with Charles River and performing tasks related to LAL since 2015, including participation in a season of LAL production during bleeding of HSC specimen. Training includes qualification for proper handling of horseshoe crabs by CRL's official management procedures. The nominee has worked with and received instruction regarding responsibilities of AP members from the current SC Advisor, Dr. James Cooper. In 2010 the nominee earned a M.S. in Marine Biology from the College of Charleston. Her Master's thesis focused on bottlenose dolphin interactions with the blue crab fishery in Charleston, SC. This work involved a great deal of research into fisheries practice and management, as well as extensive study of stock assessments, and communication with the fisheries stakeholders. This combination of fisheries management and LAL knowledge make Nora Blair the ideal candidate for the HSC Advisory Panel.

Nominee Signature: NBlair Date: 07 Mar 2019

Name: Nora Blair
(please print)

COMMISSIONERS SIGN-OFF (not required for non-traditional stakeholders)

State Director

State Legislator

Governor's Appointee

Atlantic States Marine Fisheries Commission

ISFMP Policy Board

May 2, 2019
8:00 a.m.-9:45 a.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1.	Welcome/Call to Order *(J. Gilmore)*	8:00 a.m.
2.	Board Consent *(J. Gilmore)* • Approval of Agenda • Approval of Proceedings from February 2019	8:00 a.m.
3.	Public Comment	8:05 a.m.
4.	Update from Executive Committee (*J. Gilmore*)	8:15 a.m.
5.	Update from the Risk Policy Work Group (*J. McNamee*)	8:30 a.m.
6.	Committee Reports • Law Enforcement (*M. Robson*) • Artificial Reefs (*L. Havel*)	8:45 a.m.
7.	Review Noncompliance Findings, If Necessary **Action**	9:05 a.m.
8.	Other Business	9:15 a.m.
9.	Adjourn	9:45 a.m.

The meeting will be held at the Westin Crystal City, 1800 S. Eads Street, Arlington, Virginia; 703.486.1111

MEETING OVERVIEW

ISFMP Policy Board Meeting
Thursday May 2, 2019
8:00 -9:45 a.m.
Arlington, Virginia

Chair: Jim Gilmore (NY) Assumed Chairmanship: 10/17	Vice Chair: Pat Keliher (ME)	Previous Board Meeting: February 7, 2019
Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (19 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 7, 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Update from Executive Committee (8:15-8:30 a.m.)
Background • The Executive Committee will meet on May 1, 2019
Presentations • J. Gilmore will provide an update of the two meetings
Board action for consideration at this meeting • none

5. Update on the Risk and Uncertainty Policy (8:30-8:45 a.m.)
Background • In 2016, the Risk and Uncertainty Policy Workgroup presented a draft Commission Risk and Uncertainty Policy and were advised by the Board to continue development. • In 2018, the Risk and Uncertainty Policy Workgroup held a Workshop to walk through the Policy using striped bass as an example. • At the 2018 Annual Meeting, the Board advised the Workgroup to continue development of the Risk and Uncertainty Policy and to bring the Policy to some of the Commission technical committees for review.
Presentations • J. McNamee will present the progress to-date the workgroup has made.

Board action for consideration at this meeting
• None

6. Standing Committee Reports (8:45-9:05.m.)
Background
• The Artificial Reef Committee met on February 25-27 • The Law Enforcement Committee (LEC) will meet on April 30 and May 1.
Presentations
• L. Havel will present an overview of the Artificial Reef Committee activities • M. Robson will present and overview of the LEC activities
Board action for consideration at this meeting
• None

7. Review Non-Compliance Findings, if Necessary Action

8. Other Business

9. Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

ISFMP POLICY BOARD

The Westin Crystal City
Arlington, Virginia
February 7, 2019

These minutes are draft and subject to approval by the ISFMP Policy Board
The Board will review the minutes during its next meeting

TABLE OF CONTENTS

TABLE OF MOTIONS

1. **Approval of Agenda by Consent** (Page 1).

2. **Approval of Proceedings of October 2018** by Consent (Page 1).

3. **Move to approve the new recommendations to the Appeals Guidance Document as modified today** (Page 6). Motion by Doug Grout; second by David Borden. Motion carried (Page 7).

4. **Move to approve the 2019 specifications for Atlantic herring as presented today** (Page 15). Motion by Robert Boyles; second by Doug Grout. Motion carried (Roll Call: In Favor – NH, MA, RI, CT, NY, NJ, PA, DE, MD, PRFC, VA, NC, SC, GA, NOAA Fisheries; Abstentions – FL; Absentees – ME, DC, USFWS (Page 16).

5. **On behalf of the American Lobster Board, move the Policy Board send a letter to NOAA Fisheries for consideration by the Atlantic Large Whale Take Reduction Team to develop and support a suite of options for electronic vessel monitoring for federally permitted vessels.** (Page 16). Motion by Dan McKiernan. Motion carried (Page 16).

6. **Motion to Adjourn** by consent (Page 17).

ATTENDANCE

Board Members

Doug Grout, NH (AA)
Dan McKiernan, MA, proxy for D. Pierce (AA)
Eric Reid, RI, proxy for Sen. Sosnowski (LA)
Jason McNamee, RI (AA)
David Borden, RI (GA)
Justin Davis, CT (AA)
Maureen Davidson, NY, proxy for J. Gilmore (AA)
Heather Corbett, NJ, proxy for L. Herrighty (AA)
Russ Allen, NJ, proxy for T. Fote (GA)
Adam Nowalsky, NJ, proxy for Sen. Andrzejczak (LA)
Andy Shiels, PA, proxy for T. Schaeffer (AA)
Loren Lustig, PA (GA)
Roy Miller, DE (GA)
John Clark, DE, proxy for D. Saveikis (AA)
David Blazer, MD (AA)
Russell Dize, MD (GA)
Pat Geer, VA, proxy for S. Bowman (AA)
Steve Murphey, NC (AA)
Robert Boyles, SC (AA)
Spud Woodward, GA (AA)
Doug Haymans, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Derek Orner, NMFS

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Staff

Bob Beal
Jessica Kuesel
Toni Kerns

Guests

The Interstate Fisheries Management Program Policy Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Thursday, February 7, 2019, and was called to order at 10:55 o'clock a.m. by Executive Director Robert E. Beal.

CALL TO ORDER

CHAIRMAN ROBERT E. BEAL: Good morning. We'll go ahead and start the ISFMP Policy Board meeting. I'm Bob Beal, Executive Director of ASMFC. Jim Gilmore, the Chairman had to leave for a family situation; and Pat Keliher left to try to get ahead of some weather that's heading into the state of Maine. The Commission Charter provides that I can Chair the meeting in their absence. That's what we'll be doing for the Policy Board here.

APPROVAL OF AGENDA

We have a fairly lengthy agenda; but I think we can move through some of these pretty efficiently. There are two additions that we would like to add to the agenda; one is the Atlantic herring specifications, and then the second is a letter from the Lobster Board. Are there any other additions to the agenda for the Policy Board this morning?

Seeing none; we'll go with that agenda. Are there any other changes or things to the agenda? Is everybody comfortable with it? All right we'll go with that agenda.

APPROVAL OF PROCEEDINGS

CHAIRMAN BEAL: The next item is approval of proceedings from October, 2018 at the annual meeting. Are there any edits or changes that folks need to make to those minutes from the annual meeting Policy Board? Seeing none; those minutes will stand approved.

PUBLIC COMMENT

CHAIRMAN BEAL: The next we have is Public Comment. Are there any individuals that want to make public comment on anything that is not on the agenda? I don't have anyone signed up. Not seeing any hands in the back of the room we'll keep moving forward with the agenda. The next item is an Update from the Executive Committee.

UPDATE FROM THE EXECUTIVE COMMITTEE

CHAIRMAN BEAL: Before Jim Gilmore left, he was kind enough to write up a summary of what happened at the Executive Committee; so I'll move through that pretty quickly. The Executive Committee met yesterday morning from about eight to ten in the morning; tackled a number of issues. The first one was Plus-up funding.

At the annual meeting the Executive Committee reviewed or was informed that the Commission had about $400,000.00 of Plus-up money; and the question was how do they want to use it? At the time they agreed to fund five high priority projects. That used about half the funds that were available. Those projects were; striped bass tagging, hook and line survey, coordination for the offshore lobster enforcement vessel, lobster maturity work, offshore spawning for the herring fishery, and data collection in that fishery as well as the menhaden aerial and hydro acoustic survey design. All those projects are moving forward. We talked about a couple of them at different times during this week. I could answer questions on any of those; if you would like to hear more. The Executive Committee then talked about what do we do with the remaining funds? They looked at a couple other options such as an additional stock assessment person or supporting some additional stock assessment work for summer flounder.

But, given that Congress hasn't yet finalized the FY2019 budget, the Executive Committee said let's just hold tight and not allocate any of those funds. They don't have to be spent very quickly. We've got until actually 2022 to spend that additional Plus-up money. We have some flexibility; and the Executive Committee said let's wait until we're fully informed on what the budget looks like before we make any other changes.

ACCSP Recreational Data Collection was the next topic that the Executive Committee tackled. Mike Cahall from ACCSP came in and gave an update on where things stand; on APAIS and some other things. Overall the APAIS Program is collecting data a lot more efficiently and effectively than they have in the past or since, spending about the same amount of money, but we're achieving about 30 percent increase in successful interviews at the dock. That's good news.

Based on that success the question was; do the states want to take on the for-hire telephone survey, which is a survey that it sounds like, which is calling the for-hire vessels and asking them about their fishing trips. ACCSP and APAIS folks have developed a computer-aided survey tool that helps with that data collection; and there was an agreement within the Executive Committee to move forward on that to start working with NOAA on transitioning the for-hire telephone survey to the states.

However, the states would have the option of doing it themselves or using ASMFC as essentially a contractor to do that work for them. This may evolve over a number of years; but we're working toward that direction of the states and ACCSP and ASMFC collecting additional recreational data, since the idea is that the states are closer to the individual fishermen, and they can build a rapport with the fishermen and collect better data. That will be moving forward.

MRIP outreach, there is some concern raised by the Marine Recreational Information Program staff that the outreach efforts by the states and on their websites are kind of scattered and all over the place and inconsistent; and some is old, some is nonexistent. There is an agreement to work with the Atlantic Coastal Outreach Committee; and have them work with the MRIP staff to develop some standard MRIP outreach materials that can be used by the states on their websites, or the states can link their websites back to the standard information, either at ASMFC website or the MRIP website. That will be going forward as well.

The next item was aquaculture activities. Last year the Commission through federal funding funded seven different aquaculture projects. Those are all moving forward pretty well; one is actually completed, the other six are ongoing and making great progress. The Commission Monday of this week advertised a request for proposals for development of an oyster research consortium on the East Coast. It's a lot of money, it is $880,000.00 or so, so there may be more than one that can be funded. The idea is that the consortium will help out individual growers; and tackle projects that individual growers can't really tackle themselves. The idea is that things like genetic work and hatcheries and other things that are beyond the scope of an individual oyster grower, this consortium will be able to help out and tackle some of these big picture items that can benefit all the growers up and down the coast.

That is out on the streets right now. March 15 is the deadline for the pre-proposals, so if folks have any interest in applying, please do. We would love to have a great pile of qualified proposals that we can select from. That is moving forward. You also see another proposal from us for aquaculture pilot programs; not limited to oysters, it could be essentially anything except oysters, right Pat? Oysters are not included in that one since we have this other consortium.

In the past it has funded clams and some small scale, I think finfish, seaweed projects, all sorts of things can be funded by this. You will see that proposal; it's going to be about $550,000.00 or so that can be applied by individuals or states, or anyone that's interested in tackling some of these projects. Aquaculture activities are busy.

The current administration is putting a lot of money into aquaculture and growing that. States are doing different things; and having different levels of success, and controversy in growing aquaculture. It's a complicated issue; but it's one that there is a lot of money to promote that right now.

The next topic that the Executive Committee tackled was use and structure of Management Board Working Groups. As you all know there have been a series of working groups that have been formed over the past number of years that tackled everything from eel allocation, black sea bass allocation, lobster offshore enforcement, lobster-whale interactions, all these different things, recreational issues for some of the jointly managed Mid-Atlantic species.

Those are really effective groups; but there was not a lot of structure on those. They are kind of catch-as-catch-can ad hoc things that are run differently, staff kind of Chair some of them, Commissioners Chair some of them. The question was do we want to add some more structure to that system. Transparency is always a question with that type of group as well.

The Executive Committee sort of settled on we don't want to put too much structure on them; because they are all unique in themselves. But we do want clear charge to the group, clear tasking, and try to define an end point. This group should get together and do this finite project; make recommendations to the management board that they work for, and then that is the end of their existence.

It was very clear, or needs to be made clear that these groups are not decisional; they just provide recommendations to the management boards for action. I think we wanted to also increase the public involvement; and make them a little bit more accessible, so the public knows what's going on. It's a tough balance of how big those groups get; how big the audience gets, you know what they want to do and how quickly they can operate, trying to strike the right balance there.

The Executive Committee also approved some modifications to the Awards Committee standard operating procedures, and Dennis Miller, not Dennis Miller. Dennis Abbott and Roy Miller that's a combination that's perfect, who are the Chairs of the Legislators and Governor's Appointee Commissioners, developed a primer for sort of indoctrinating and orienting new Legislative and Governor's Appointee Commissioners. That document was reviewed at the Executive Committee; which is a lot of the State Directors it was also reviewed during the LGA lunch, which is the LGA.

I think everyone around the table has had a shot at it; and at least got a chance to look at it. If you have feedback send it to either me or Dennis or Roy; and we can weave those in for the next go around. Those are the highlights of the Executive Committee meeting that took place yesterday morning.

I would be happy to answer any questions; and again, all Commissioners are welcome to attend those meetings if you would like. That's that summary; any questions?

CONSIDER REVISIONS TO THE APPEALS GUIDANCE DOCUMENT

CHAIRMAN BEAL: All right seeing none; the next item is Review and Consider Revisions to the Appeals Guidance Document. Toni is going to introduce those changes.

MS. TONI KERNS: The Executive Committee is making a series of recommendations to change the Appeals Guidance Document. These recommendations are to provide additional clarity to states that are making appeals when drafting and bringing those appeals forward to the full Commission; not to make any changes to the guidance itself, but just to give more information.

I'm going to go through some of the clarity that the Executive Committee is recommending to the Policy Board. For the first one, where the group is recommending that we state where the current goals and objectives are in the different FMPs; it's letting folks know that goals and objectives can be found in either the goals and objectives sections of amendments, and when then looking at addendums you can see some of those in either the statement of the problem or its in the statement of the problem of the addenda.

Then looking at Number 2, Failure to Follow Process, it's just identifying where the Commission has those processes listed; so things like the Charter, the Rules and Regulations, and other guiding documents of the Commission like the Conservation Equivalency Guidance Document. Number 3 is adding examples to what insufficient, inaccurate, incorrect application of technical information can be.

There are a series of additions here; I'm not going to read them all for everybody. But for example, if any data used as the basis for a decision undergoes a modification which impacts the results after a decision had been rendered; you could bring that forward for an appeal. Then in addition we did add that any appeal based on Criteria 3, could be verified independently by a technical body that would be appointed by the Chair as needed.

It's not necessarily something that has to happen every time a state used Criteria 3; but if the Chair felt that additional verification would be needed then they could appoint a technical body as needed. It doesn't necessarily have to be the Technical Committee for that species. It could be a subset or different individuals. We pulled out Number 4, historical landings period not adequately addressed; not because it's not viable for an appeal, but the group felt that that issue was addressed under Issue 3, Insufficient, inaccurate, or incorrect application of the data. It's just considered a part of that criterion. Then lastly, management actions resulting in unforeseen circumstances or impacts that were not considered by the Board as the Management Document was developed.

It's just specifying that it's things that were not considered during the development of the document, which wasn't specified before. Those are all the clarifications that were added to this document. If this Policy Board is okay with those clarifications then we would need to approve the changes; we'll make them and then post them.

CHAIRMAN BEAL: Great thanks, Toni. As a bit of background, this document was developed at least a decade ago. It kind of sat on a shelf and thankfully got a little bit dusty, and we didn't have to use it, and we didn't have many appeals. But in the recent future we've had a flurry of appeals; and it's been used a little bit more often.

Through those recent appeals we recognized, and the Executive Committee recognized there are areas that it could be improved. That's kind of why it was opened up and looked at as do we need to update this to reflect how it's actually functioning? With that are there any questions for Toni, or thoughts on approving these changes? Yes, Justin.

DR. JUSTIN DAVIS: I'm just wondering if the list of examples underneath Number 3 is meant to be an exhaustive list, or is sort of these are potential examples but there could be other types?

MS. KEARNS: These are potentially examples; and there could be other types.

CHAIRMAN BEAL: Justin, do you think we need to clarify that; that it's including but not limited to kind of language?

DR. DAVIS: Yes I guess. I mean I would leave that up to your discretion. If you think the intent is clear with the existing language that's fine. I don't know want to sit here and wordsmith the document.

MS. KERNS: We can add but not limited to after the word include.

CHAIRMAN BEAL: We will do that to make that a little more clear; any other thoughts, Adam?

MR. ADAM NOWALSKY: I think this historical landings item is a difficult one to address. I understand the sense that Number 3 includes a reference to historical landings. But I think the reference to it is very different in principle; found to be incorrect as a technical error is very different in my opinion than not adequately addressed.

My read on this is that this document as modified would significantly diminish the importance of historical landings in the decision making process; because it would take away that element as an appeal criteria. I would be very interested in hearing more about the rationale in making this decision; or discussion here today before we approve this about the sense of how much importance do we put on historical landings in our decision making, and do we really want to take that away as an appeal, because I feel that that is essentially what these changes do.

CHAIRMAN BEAL: Adam, I think part of the conversation that we had. I don't remember if it was the Executive Committee or the Working Group that was working on this. But the idea is that historic information is sort of part of the broader suite of technical information. I'm not saying you're right or wrong.

That was part of the conversation that took place, and let's put all the sort of how is technical information and data considered put that all in one criterion. That's part of the thought process. I'm not saying it is right or wrong, just sort of as background. Jason may have some comments as well.

MR. JASON McNAMEE: Adam, I think you are 100 percent correct. That was exactly the intent was to take it out of the realm that it was in; move it into a more technical realm of there was a mistake or something of that nature. I think the reason we were comfortable doing that was because we felt the notion of not adequately addressed was captured in one of the other appeals criteria; in a more general way.

We didn't think it was necessary to call it out. I can't remember exactly which one it is; but it is one of the first two appeal criteria, where it has to do with there wasn't an adequate process, or the process wasn't documented correctly. We felt that it was the notion of; you know you didn't look at enough combinations of historical periods or something like that was already captured. Knowing that historical landings are important in a lot of the things that we do, we wanted to still have it in there, but to bring it more into a technical there was an error realm.

CHAIRMAN BEAL: Toni, you have a comment?

MS. KERNS: Adam, specifically I remember in the Working Group call we talked about it being insufficient use of historical allocation data. Folks felt like that was saying the same thing as historical landings periods were not adequately addressed.

CHAIRMAN BEAL: Adam, does that help with your concern, make your concern worse? Where do you stand?

MR. NOWALSKY: I think I would be interested in hearing any other conversation around here today; or a specific reference made to which document, whether it's the Charter, or whether it's some other guiding document. I'm thinking probably each FMP with goals and objectives in the individual FMPs may treat historical landings differently. Again as I prefaced this with, I think this is difficult. I would be interested in hearing more conversation to determine what my comfort level is with taking this out at this point.

CHAIRMAN BEAL: That's fair; other thoughts and comments about use and appeal-ability, if that's a word, of historic data. Yes, John.

MR. JOHN CLARK: Having appealed in the past that was one of the reasons I was interested in updating these; because they are very ambiguous. I felt that that was, I agreed with Jay that that is a pretty ambiguous category right there that could be captured more strongly in the third criterion, as Jay pointed out, in terms of strictly a technical standpoint. Then as part of the process in Number 2 there, but I think they're all, it's kind of tough to get too specific and yet some of these I think were so ambiguous that it was hard to see how an appeal could actually be considered on some of that.

CHAIRMAN BEAL: Adam, there also was a bit of a conversation about, maybe it was already said, but allocations in the future will be based on historic landings and possibly on a lot of other things. Having it as a standalone criteria for an appeal, I think some folks felt it should be blended with a lot of the other technical information.

Historic data usually, or I think every time would be an allocation question really. Are we sort of getting to the point where we're weaving together a lot of things to allocate? I'm not saying it is right or wrong again, just that was part of the conversation as well. Other thoughts on how this new wording affects the use and the ability to appeal on historic data? Eric Reid.

MR. ERIC REID: I would share Adam's concerns but the explanation I have today kind of makes me comfortable with the direction you're taking. That will be my position.

CHAIRMAN BEAL: Maureen.

MS. MAUREEN DAVIDSON: Right now at this time I am a little uncomfortable with the change; given the current state of New York filing a suit discussing historic landings; and how they apply to our allocation for summer flounder. I understand the desire to make it a more technical type of reference; just now at this time I'm a little uncomfortable at changing it.

CHAIRMAN BEAL: Yes, you guys are in unique spot right now; so got it. Doug.

MR. DOUGLAS E. GROUT: Are you ready for a motion?

CHAIRMAN BEAL: Yes I think so. If people are getting close to their comfort level with this conversation; I think a motion would be fine.

MR. GROUT: I would move to approve the new recommendations for the appeals process as improved today.

CHAIRMAN BEAL: Thank you is there a second, David Borden. Additional comments, Doug do you have anything else you want to say in support?

MR. GROUT: No, other than to thank the working group that worked on this for their excellent and insightful modifications to this. I think it is an improvement over something that was kind of vague; and at the time it may have been intended to be vague. But now I think it is better that we have a little more clarity on this.

CHAIRMAN BEAL: David. It should be noted this is a working group and you were not part of it; that's unique. That's good.

MR. DAVID V. BORDEN: I would note, Mr. Chairman, you took the words right out of my mouth.

CHAIRMAN BEAL: Adam.

MR. NOWALSKY: While I expect I could get a second to a motion to deal with Number 4; not having heard much support for the concept of keeping 4 in around the table. I think I would just leave it go at that; and in the future should the question of historical landings come up, reference the discussion we've had here around the table that the discussion did not suggest that we're removing that as a grounds for an appeal, but just that it would fall into one of the other categories and it would be incumbent upon the appellant to find the correct reference to it for that particular issue.

CHAIRMAN BEAL: I think that's a fair point. Any other thoughts before we vote? **All right let's try this. Are there any objections to the motion that's up on the board? One, New York is voting in opposition; any other, seeing no other votes in opposition any abstentions or null votes? Seeing none; the motion carries.** All right we're scheduled for a lunch break; but I don't think we're necessarily there yet, so we'll keep moving.

DISCUSS THE BENCHMARK STOCK ASSESSMENT TIMELINE

CHAIRMAN BEAL: Discuss the Benchmark Stock Assessment Timeline; Toni and Katie are ready to roll.

MS. KERNS: As I noted earlier today or earlier in the week, the delay in the shad stock assessment would come back at Policy Board. For those of you that were not at the Shad and River Herring Board meeting, Jeff went over the progress that they've been making to date. There have been some delays in deliverables of data; and that is due to several factors, including the unavailability of the data as well as staff who are working on that information having the priority time to bring that data forward to the Assessment Team.

It's the recommendation of the Committee as well as the Board agreed to delay that assessment until August of 2020; which is the same delivery time as the lobster stock assessment. Jeff Kipp is the ASMFC staff person on both of those assessments; I will lead it over to my team member, Katie here to go through the implications of that.

DR. KATIE DREW: There is not a tremendous amount of overlap between the Lobster Stock Assessment Subcommittee and the Shad and River Herring Stock Assessment Subcommittee; with really the exception of ASMFC staff on this issue. However, it does fall to ASMFC staff usually to put a tremendous amount of work into developing the assessment report. We expect both of these assessment reports to be large and complex; especially on the shad side.

Right now we do have the workload planned out that both of those can be accomplished in the time that is allotted to them. However, if we continue to have issues with deadlines being met, with products being brought forward on a timely manner, I guess the prioritization process of the Stock Assessment Team at this point is to prioritize lobster as a higher priority than shad and river herring, so that staff time will be allocated to lobster over shad should this occur. The consequences of that are if the Shad Stock Assessment Subcommittee members can't step up to prepare the document in a timely fashion; it's going to be shad that gets bumped back, not lobster. We wanted to bring this decision to you guys to make sure everybody is on board with that; otherwise we're going to have to re-discuss how to prioritize these assessments as well as staff time and Technical Committee time on these issues.

CHAIRMAN BEAL: All right, any comments on the change and the notion that should lobster and shad assessments kind of start to overlap and conflict with each other, given the staffing workload. We may have to slow down the shad assessment over slowing down the lobster assessment. Is everybody okay with that?

You know there is a potential that if state scientists are able to step up and provide a lot more support to the shad assessment, they can both move forward in parallel. But it would take some assistance from the state scientists to be able to do that; and the shad assessment has suffered a couple of setbacks over time.

Some of those are due, and again not being critical, but some of those are due to the workload issues associated with the state scientists and their ability to provide data and fulfill their roles on that committee. It's just not critical but a workload for sure. David.

MR. DAVID BLAZER: I guess I just have one question. Did the Shad Management Board make any comment related to this news?

MS. KERNS: To the assessment being delayed, no.

CHAIRMAN BEAL: That's an easy answer. There didn't seem to be any heartburn at the Board level. Are there any other comments on the timeline for the assessments? Yes, John.

MR. CLARK: Just a question. Katie, yesterday of course we saw the striped bass stock assessment, and we assume that will be up in May. The SSB now is a heck of a lot higher than it will likely be. Is the ERP kind of the Ecological Reference Points for menhaden, do they take into account things like where we're setting the SSB for striped bass?

DR. KATIE DREW: Yes. The models will be using, our plan is to use information on the predator species that includes the newest MRIP information; so that scale factor will go in, and we will be looking at the current existing targets and thresholds for striped bass and the other predator species when we're trying to establish how these things all balance out. We are putting a lot of effort into incorporating that updated information for striped bass; and the other predator species.

CHAIRMAN BEAL: Great. Are there any other questions or comments on the benchmark assessment timeline? Seeing none; thank you, Katie again for your presentation.

ATLANTIC COASTAL FISH HABITAT PARTNERSHIP REPORT

CHAIRMAN BEAL: Now, Dr. Lisa Havel is here to update us on the Atlantic Coastal Fish Habitat Partnership.

DR. LISA HAVEL: Thank you Mr. Executive Director. Our Steering Committee met November 15 through 16 in Newburyport, Massachusetts. They approved the recommendations for the FY19 National Fish Habitat Action Plan funding. Massachusetts Division of Marine Fisheries presented on the conservation moorings that they've been working on in the state. We received updates on the ACFHP website, Southeast Mapping Project, Business Plan, and National Fish Habitat Partnership. There was also a presentation from Ipswich Shellfish Group on commercial clamming.

Our Southeast Mapping Project is wrapping up; hopefully this is the last time I say that to you all. This work is a spatial prioritization for fish habitat conservation areas from North Carolina through Florida; and it's to help ACFHP and partners identify where best to invest efforts in future project funds.

We conducted four separate analyses; a diadromous assessment from North Carolina down to Cape Canaveral, two estuarine assessments, one from North Carolina to Cape Canaveral and one from Cape Canaveral down through the Florida Keys, and then a coastal coral assessment from Cape Canaveral through the Florida Keys.

Here are the results of the diadromous assessment. It included variables such as impervious surface, point source pollution, non-point source pollution, riparian buffers, fragmentation, diadromous presence, and sturgeon critical habitat designations. Red areas are potentially better suited for protection; whereas yellow and orange areas might be better suited for restoration, based on the variables that we used in this analysis.

These are the results of our northern estuarine assessment; and variables included sea grass, oyster reef, and tidal vegetation coverage, proximity to protected habitats, and proximity to development, water quality, hardened shoreline, and habitat fragmentation. Here are the southern estuarine results; and they included the same variables as the northern.

Then the coastal assessment was a little different. We decided as a group that all coral habitats off of Florida was in need of conservation; regardless of the quality, due to their slow growth and then the immediate threats that they're facing right now, which includes bleaching, pollution, burial, and the disease that's been going on since 2014.

We thought it would be best to just point out where all of the coral and hardbottom is off of South Florida; and use this more as an outreach tool, as opposed to identifying areas for restoration. This was a pilot project to start a conversation in identifying places for protection or restoration. It does not contain all metrics; for example it doesn't include any fish presence data besides in our diadromous assessment, and it doesn't include any information on fishing grounds.

We urge caution if you're going to apply this for protection. For example, in the estuarine assessments a lot of the deep water in the estuary came out high as areas for protection; but those might be great trawling grounds, and we're not saying you need to shut down trawling in those areas. That is just the way that the results came out.

Then you could use that to decide whether or not the results actually make sense in that particular area. The final report is coming soon; and we'll be starting our Northeast Assessment once that wraps up as well. The maps are available on line on databasin.com. On this tool you can zoom in. You can toggle the different analyses on and off, change the transparency and compare the results with secured protected lands and other layers as well. Moving on, in December we launched our new website.

Up here is the home page. The website has, I'm just going to run you through it really quickly. The about us section includes information on our priority habitats, mission and vision, the ACFHP Region, our team, our guidance documents, and the National Fish Habitat Partnership. We have different sections for our five different priority habitats; submerged aquatic vegetation, tidal vegetation, shellfish beds, coral and live hardbottom and riverine bottom.

These contain background information; why they are important fish habitat, the primary threats facing each habitat, and then the work that ACFHP has done in order to conserve those habitats. Our work identifies our on-the-ground projects, science and data projects, and outreach and communication projects, as well as some projects from our partners, including ASMFC.

This is our on-the-ground page. There is a map that includes all of our funded and endorsed projects. You can click on the icon and it takes you to a separate page; where it has press releases on the projects, different photos from the projects, a little background information, the partners involved, et cetera.

Our getting involved section has information on our meetings; how to donate to ACFHP, how to sign up for our newsletter, funding opportunities, project endorsement, the Melissa Laser Fish Habitat Conservation Award, and how to become an ACFHP member. One of the things that we're most excited about on the new website is our species habitat matrix database.

I screen shot all of this; because I know how slow the internet can be here. The database populates in real time. You can use any combination of categories; and you can sort them by the arrows. It is easy to add or remove variables. You can download the entire dataset; or just share results as a CSV.

We think this might be a good tool for identifying fish habitats of concern for Commission managed species. We also endorsed a dragline ditch restoration project in Northern Florida. This is being led by the Florida Fish and Wildlife Conservation Commission, St. John's Regional Watershed Management District, and U.S. Fish and Wildlife Service.

They're working to restore spoil piles built for mosquito control in the mid-1900s to an elevation suitable for salt marsh re-colonization. In total they've restored approximately 625 acres around Florida; which has yielded 250 new acres of wetlands. They calculate that around 50 pounds of fish are benefited per acre per year; which produces about 31,250 pounds of fish through this project. There are hundreds of acres of spoil piles that remain.

Here's a diagram of what they're doing. They're taking elevations that were high over to the gray areas and smoothing them out; to create new wetlands so that the tidal vegetation can move in. Currently these spoil piles consist of remnant wetlands, deep channels and upland plants, including invasive species like Brazilian peppers. These areas are often designated as impaired for certain water quality parameters like nitrogen, phosphorous, dissolved oxygen, et cetera, and by redistributing the sediments, again it allows the re-colonization. It traps sediments, so allows for more growth, traps nutrients, produces oxygen, and allows for more fish habitat. Here is a photo of what the areas look like before the work is done; and then after smoothing them out, and then an aerial shot.

Here is from July of 2009, and one of the areas that has been restored, and then June, 2015. A lot of that Brazilian pepper has been removed; and then you can get the tidal vegetation moving in. As usual, ACFHP would like to thank the ASMFC for all of your continued operational support.

I wanted to do a quick shout out that the ASMFC Habitat Committee is going to be putting together an aquaculture survey in the near future; to refocus and repurpose the aquaculture document that we've been working on the past couple of years. I'll be happy to share that with you all if you're interested in providing input on what you would like to see in an aquaculture document; and I'll take any questions that you might have.

CHAIRMAN BEAL: Any questions, comments, thoughts? You know one thing real quick. The new ACFHP website has a lot of great information on it; you know access to all the projects they funded that are completed and underway, and the database that Lisa mentioned and some other things.

As you have time, spend some time on there. It's pretty impressive what they've been able to do; and the website is great and highlights all their accomplishments. Thank you, Lisa, for that. Thanks for all the hard work. Are there any questions or comments? Doug, do you have your hand up. Okay, I thought I saw it. Steve.

MR. STEVE MURPHEY: Yes Lisa, I'm intrigued by the project down in Florida. I mean we also have lots of old mosquito ditch ditches. I'm curious as to how that was permitted. That would seem like the big hurdle to do; because of dredge and fill issues. Do you have any information; or could you point me to the people in charge of that?

DR. HAVEL: Yes, they actually have a website on the projects; and I'm happy to share that with you, and then also put you in contact with Jeff Beal, who is the Project Manager for it.

MR. MURPHEY: All right, thank you.

CHAIRMAN BEAL: Great, anything else on the habitat activities? Roy, do you have your hand up or are you just resting your arm? You're resting that's good, do that; yes, David Blazer.

MR. BLAZER: Just one real quick question. Will the Aquaculture Workgroup that we've put together recently, can they help with the survey, or can they get a look at the survey before it goes out? Is there some cooperation between those two projects?

CHAIRMAN BEAL: Toni is looking like she really wants to answer this one. I'm going to take that.

MS. KERNS: They can. But I think the Habitat Committee would really like to put together a document that will help inform you all as mangers on what types of information you're looking for out of an aquaculture document; relative to habitat to the Committee. We can share it with both groups; but we still want your input as well, just to reiterate that for Lisa, because that document started to go in a lot of different directions, so we're really trying to bring it back into focus.

DR. HAVEL: Yes that document ballooned out into including everything but the kitchen sink; so we're trying to refocus. We could really use your feedback on what you would find most valuable in an impacts to fish habitat document; so we could definitely use help on developing the survey. But we would like you all to fill it out if you're interested in providing the input.

CHAIRMAN BEAL: Great thank you. As soon as Lisa walks about ten feet away, any other questions? We can get her to walk back and forth as many times as possible. Anything else, seeing none. I think Lisa the other thing that really strikes me on that Florida project is you can equate acres of restoration to pounds of fish.

That's something we can all relate to is we did this work, we got this out of it. I think that's a great way to characterize it any way we can. With that seeing nothing else; I think you're safe to go now, Lisa. Thanks again.

DISCUSS THE MODERNIZING RECREATIONAL FISHERIES MANAGEMENT ACT OF 2017

CHAIRMAN BEAL: The next agenda item is the Modern Fish Act. I'll give a quick overview of that; and I don't claim to be an expert on this.

But there is Kelly maybe in the back of the room can help us out. You know the full title is the Modernizing Recreational Fisheries Management Act of 2017. It was approved on December 31 of 2018. It wasn't approved very long ago. Most of the time since that document has been approved; the Federal Government has been shut down.

What we're lacking completely or for the most part, is the federal interpretation of what this law means, how it's going to be implemented at the federal level through the Council systems and everywhere else. Kelly may be able to shed some light on that toward the end of this; but I know they have not had a lot of time to chew on this.

Quickly the background is this was the champions and the sponsors were Wicker from Mississippi, Nelson from Florida, and Graves from Louisiana; so obviously a Gulf centric group of sponsors that were working on this law. It started out as a comprehensive amendment to the Magnuson Stevens Management Act.

It was diluted over time; and negotiated down to some of the less controversial issues. It struck a balance between different user groups. A lot of the controversial issues were sort of taken out and converted into study areas, rather than mandatory or legal law changes to the Magnuson Act. There is a lot of follow up work that will be done on this act.

The big thing that probably will trickle down and affect the ASMFC more than anything else; well there are two parts. First is the Modern Fish Act allows alternate recreational fishery management measures; including extraction rates, fishing mortality rates and targets, and a harvest control rule. Other ways of managing recreational fisheries other than the RHL, recreational harvest limit that we all know and love due to a lot of the jointly managed species with the Mid-Atlantic Council and other Councils. Not critical of the Councils; just the rules that they are bound by. It appears there is going to be some more flexibility in recreational management through the federal process under this new law.

Again, I think that is one area that needs a lot of interpretation from the federal government; as to what exactly that means and how it's going to be implemented. There is also a provision that allows the implementation of the 2017 National Academy of Sciences Review of Marine Recreational Information Program; so there is a series of recommendations, series of changes that came out of that 2017 study from the National Academy of Sciences that can be implemented or will be implemented under this new law.

There is a state federal partnership to improve angler registries. The idea there is like it sounds; just get a better picture of what the recreational fishing universe is. All the states have licensees. Some have registry systems. There are federal licenses. Is there a better way to coordinate that? You get a better, more dynamic picture of what and who is out recreational fishing.

The series of reports, recommendations and studies that are included include explorations of the federal mixed use fishery, allocations in the South Atlantic and Gulf. Red snapper was a driving force for this; which isn't a surprise to a lot of folks probably. There is some reallocation and consideration of the current allocations down there.

There is a study of the Limited Access Privilege Programs and mixed-use fisheries; some of the ITQ systems and other things that are used in mixed-use fisheries, incorporation of state and nongovernmental data, analysis in stock assessments and surveys. The question is; what data beyond MRIP and some of the other areas can be used, citizen science, self-reporting, all these other things.

How can they be used? How can they be incorporated in the management and the science? That's a pretty big question; a very open-ended question. It's going to take some work. Then the last bullet is the MRIPs compatibility with the annual catch limit. MRIP, as everyone knows is done on these two month waves. There is about a six week lag.

But some of the recreational fisheries at the federal level are managed through annual catch limits. How is that system working out where you've got two month waves with a bit of a lag, and you've got annual catch limits that we're trying to maintain through some of the recreational management programs? How do those two differing systems mesh together?

That's a quick summary of what's in the Modern Fish Act. There will be, my understanding in talking to some of the MRIP staff is that there will be a lot of involvement with the FINs, the Fishery Information Networks; which is ACCSP on the East Coast, Gulf FIN, PacFIN, RecFIN on the West Coast.

Those groups are going to be relied on a lot to conduct some of these studies; and incorporate some of this information into the changes that this law will implement, and some of the studies that it requires. Again, a brief summary, there are other folks around the table that have studied this; and they know more of the details than I do. But thanks to Deke; for putting together a summary for me. Kelly, I don't know if you have anything to add from the Federal level, other than it's still new to you as well.

MS. KELLY DENIT: Thanks Bob, yes I think the only thing I would add is with respect to the extraction rates and the other components that were incorporated in 1520; is that from our preliminary review that is putting into statute flexibilities that we believed already existed and were being used. The Modernized Fish Act explicitly still requires annual catch limits and preventing overfishing; and so that is important to understand.

CHAIRMAN BEAL: Any questions or other thoughts on this? John.

MR. CLARK: Just some of the summaries I've seen of the Bill state that there is going to be much more emphasis on anglers self-reporting their catch; and that it almost seemed like in the summaries I've seen that there is a mandate for, in this case ACCSP to use that data. I was just wondering if any thought has been given to how that is going to work. I asked yesterday to Mike Cahall. It sounded like they're already planning to develop some interface for anglers to use.

CHAIRMAN BEAL: Yes, we're definitely developing, or they are developing systems to collect our data and warehouse that data; or at least that data is going to come in. It's going to start coming in through a number of self-reporting Apps and other things, and ACCSP will be able to house that data.

The question is; how do you use that data? That's a pretty complicated statistical question, I think. There are avidity questions; you know the more avid anglers may do the self-reporting, so they may not represent the general fishing public, and all these other things that we've heard over and over about self-reported data.

There is also a lot of the self-reporting programs that have been implemented; in Year 1 and 2 there is a pulse of activity, then it kind of tapers off. The novelty of that self-reporting App on their phone kind of wears off; and they've moved on to something else. The system in general, the assessment side of things and the statistics folks, are going to have to figure out how that data compares with MRIP.

I don't think MRIP as we know it is going to necessarily go away by any means; so how do you balance out self-reported data with statistically sampled survey data that is not a census by any means, the MRIP Program, but it is pretty solid data, even though there are some problems with it. The short answer is I don't think we know yet, John, how the self-reported data is going to link into the survey data.

MR. CLARK: I guess just the follow up, Bob, would be in summaries I've seen is that true though? Is it a mandate in this Bill that that data has got to be used, or has to be used in fisheries management?

CHAIRMAN BEAL: Kelly, do you want to comment on that?

MS. DENIT: Sure, thanks Bob. I didn't reread the statute, John. I don't recall there being a mandate to use that. I believe that we are mandated to explore opportunities; and I recall at least in one version that there was something to require the use of self-reported data, in the sense of moving to electronic technologies for MRIP data collection. But I can't remember if that was in the final version; so let me double check, and we'll get back to Toni and Bob to confirm that. But as far as I remember there is no mandate.

CHAIRMAN BEAL: The South Atlantic Council is working on their Citizen Science Data Program; they've got that kind of moving along pretty well. There is a lot of different sort of initiatives that are moving citizen science, citizen self-reported data forward. We're going to have to figure out how to use all that information once we get it. Are there any other questions or comments on the Modern Fish Act? Yes, Adam.

MR. NOWALSKY: My understanding is that this was not a complete reauthorization of the Act; that the previous reauthorization had had the authorization of appropriations expire about five years ago. Did 1520 reauthorize any appropriations, or are we still dependent on Congress's discretion to continue that funding?

CHAIRMAN BEAL: I don't think there was any reauthorization. Kelly, have you seen it differently?

MS. DENIT: I don't remember. I'll double check.

CHAIRMAN BEAL: But I don't think there was anything about appropriations in here, Deke. Deke is shaking his head no; and he's looked at this pretty well. Yes, I think it is Congress's discretion; if it makes you feel comfortable or not is up to you. Are there any other thoughts on the Modern Fish Act?

We'll continue to report out on this, John, to help answer your questions. There is going to be a lot of interpretation and sort of decisions made through the FIN programs and some others on how to roll this out in the MRIP Program, and we'll be able to give you some more updates, once we have more feedback from the Federal Government. Yes, John.

MR. CLARK: The other part was the FIN; as you mentioned there. I mean from my understanding all the states have implemented FIN number issuance and collection. I'm just curious as to what's going to change with that.

CHAIRMAN BEAL: Yes I don't know; and you and I are using two different terms, FIN. You're the Fisher Identification Number and I'm the Fishery Information Network kind of person; the same acronym, two different things. But the one I was using is implementing a number of these changes through ACCSP; but what you said is true.

I don't know if any changes to your version of FIN are going to change at all; but time will tell. Anything else, all right seeing none.

ATLANTIC HERRING SPECIFICATIONS FOR 2019

CHAIRMAN BEAL: The next agenda item is Reviewing Noncompliance, thankfully we don't have any of those, so that brings us to the Atlantic Herring Specifications. If you were at the Atlantic Herring Board, which was the first meeting this week, you would know that the Federal Government had not published the final specifications for the Atlantic herring fishery as of Monday of this week. They were published about three hours ago; and we have that sort of hot-off-the-presses update on that. The Atlantic Herring Board deferred to this Board final approval of herring specifications for ASMFC and the states. That is why this issue has been brought to the Policy Board and wasn't handled at an individual species board. With that I will ask Megan to update us on where we are and what the hot-off-the-press information is.

MS. MEGAN WARE: Just a reminder of how we got to where we are today. We had our 2018 stock assessment that showed concerning signs for the Atlantic herring resource. There was concern that poor recruitment would likely result in a substantial decline in herring biomass. As a result, in August of 2018 we had an in-season adjustment to reduce the risk of overfishing. Our 2018 specifications were reduced in-season.

The Council was scheduled to develop 2019 through 2021 specifications in a new package; but due to timing, 2019 has been separated out from 2020 and 2021. As Bob mentioned, the 2019 specifications were filed this morning. This is where we were at the second half of 2018; so these were the in-season numbers that were adjusted.

The middle column there is the New England Council recommended 2019 specifications; and a key component of that was to use the ABC Control Rule that was approved by the Council in Amendment 8. You can see that those numbers are different than what came out in the 2019 Proposed Rulemaking; and so the difference here is that that Proposed Rule still used the Interim Control Rule, where there is a 50 percent probability of preventing overfishing.

Then finally, these are the final 2019 specifications; so you can see that it is the Council's recommendation that has been implemented or will be implemented for 2019. The sub-ACL allocation percentages are still the same as those used in the 2016 to 2018 specification package, so those percentages have not changed. But obviously we have a lower ABC than what was in the Proposed Rulemaking.

CHAIRMAN BEAL: Any questions for Megan on the new information that came out this morning on herring specifications? All right seeing none; that's good. We do need a motion to approve the specifications for this year. This is a final motion, so it will be a roll call vote. I know the southern states are not quite as informed as the rest of the other folks. But there will be a roll call vote; so you can vote your conscience. With that I think, Robert.

MR. ROBERT H. BOYLES, JR.: I take that as a challenge, Mr. Chairman. I would make a motion that we approve the specifications as presented.

CHAIRMAN BEAL: All right, we have a second from Doug Grout. Are there any other comments on the motion? Any other comments or questions on this, I think it's pretty straightforward. Robert feels it's a good set of specifications, so we're in good shape. Yes, Doug.

MR. GROUT: I appreciate the cooperation between the north and the south on this.

CHAIRMAN BEAL: It's the opposite of global warming; the herring are heading down there maybe. Since this is a roll call vote I'll ask Toni to do a roll call and we'll go from there.

MS. KERNS: Maine is absent. New Hampshire.

MR. GROUT: Yes.

MS. KERNS: Mass.

MR. DANIEL McKIERNAN: Yes.

MS. KERNS: Rhode Island.

MR. REID: Yes.

MS. KERNS: Connecticut.

DR. DAVIS: Yes.

MS. KERNS: New York.

MS. DAVIDSON: Yes.

MS. KERNS: New Jersey.

MS. HEATHER CORBETT: Yes.

MS. KERNS: Pennsylvania.

MR. ANDREW SHIELS: Yes.

MS. KERNS: Delaware.

MR. CLARK: Yes.

MS. KERNS: Maryland.

MR. BLAZER: Yes.

MS. KERNS: District of Colombia is absent; Potomac River Fisheries Commission.

MR. MARTY GARY: Yes.

MS. KERNS: Virginia.

MR. PAT GEER: Yes.

MS. KERNS: North Carolina.

MR. MURPHEY: Yes.

MS. KERNS: South Carolina.

MR. BOYLES: Yes.

MS. KERNS: Georgia.

MR. SPUD WOODWARD: Yes.

MS. KERNS: Florida.

FLORIDA: Abstain.

MS. KERNS: U.S. Fish and Wildlife Service is absent, sorry; NOAA Fisheries.

MS. DENIT: Yes.

CHAIRMAN BEAL: **The motion carries 15 yes, with one abstention.** The motion carries; how is that for coastal cooperation, perfect? Is there anything else on the herring specification?

AMERICAN LOBSTER MANAGEMENT BOARD LETTER OF RECOMMENDATION

CHAIRMAN BEAL: Seeing none; the final item is a recommendation from a letter that came forward from the American Lobster Management Board earlier this week. Toni is going to handle the lobster letter issue.

MS. KERNS: At the Lobster Board meeting the management board discussed making a recommendation to NOAA Fisheries to have vessel monitoring systems on all Federal vessels. This recommendation had come from two different working groups; one from the Whale-Lobster Working Group that is addressing changes in lobster management in light of changes coming from NOAA Fisheries, due to conservation of North Atlantic large right whales.

In addition there was a working group that was looking at enforcement in offshore waters; and that enforcement group had also made a recommendation for vessel monitoring in the offshore fishery. The Board had come up with a motion that Dan has said he would read into the record for the Policy Board; to send a letter to NOAA Fisheries via the Take Reduction Team.

The rationale for sending the letter to NOAA Fisheries to the Take Reduction Team is that the Take Reduction Team would be an efficient process to have these measures implemented; if they are so deemed important to get information on the offshore fishery, as well as conservation of right whales.

MR. McKIERNAN: My motion: on behalf of the American Lobster Board, move the Policy Board send a letter to NOAA Fisheries for consideration by the Atlantic Large Whale Take Reduction Team, to develop and support a suite of options for electronic vessel monitoring for federally permitted vessels.

CHAIRMAN BEAL: **Since this is on behalf of the Lobster Board it does not need a second. Is there any objection to sending this letter to the Take Reduction Team through NOAA Fisheries? All right seeing none; we will craft that letter and work with the leadership of the Lobster Board to get that signed and sent off pretty quickly, so the Take Reduction Team can consider it as quickly as possible.**

OTHER BUSINESS

CHAIRMAN BEAL: Is there anything else to come before the Policy Board today? Toni.

MS. KERNS: On the subject of whales and maybe data, sort of. Each of the states should have received an e-mail from a contract group that is working with NOAA in collecting data regarding the Take Reduction Team. I believe his first name is Bob, Bob Black. I don't know who the e-mail goes to in each of our individual states. But they are looking for data on your fisheries; all fisheries not just lobster fisheries, in order to develop a model that looks at what gear is out, and then the potential for that gear to interact with right whales.

It will be used for evaluating interactions with right whales. I just would like to stress or reiterate the importance of the states reviewing that information; knowing that that data will be used for something that's very important, making sure that IEC has the correct data for your state, and that your state agrees with the model that they use to inform the TRT, the Take Reduction Team for right whales. It is very important information, so please make sure that that data is being reviewed by your state.

CHAIRMAN BEAL: Great, thanks Toni. That data is going to be critically important. It goes all the way to Florida; so no one escapes this whale issue, I don't think. John, do you have a question?

ADJOURNMENT

Are there any other questions, comments, issues to come before the Policy Board today? Seeing none; I think we'll go ahead and adjourn the Policy Board.

(Whereupon the meeting adjourned at 11:59 o'clock a.m. on February 7, 2019)

Atlantic States Marine Fisheries Commission

South Atlantic State/Federal Fisheries Management Board

May 2, 2019
10:15 a.m. – 12:15 p.m.
Arlington, Virginia

Draft Agenda

The times listed are approximate; the order in which these items will be taken is subject to change; other items may be added as necessary.

1. Welcome/Call to Order (*P. Geer*)	10:15 a.m.
2. Board Consent • Approval of Agenda • Approval of Proceedings from February 2019	10:15 a.m.
3. Public Comment	10:20 a.m.
4. Review and Consider Draft Amendment 1 to the Cobia Fishery Management Plan for Public Comment (*M. Schmidtke*) **Action**	10:30 a.m.
5. Review State-Gathered Public Input and Consider Potential Management Action for Atlantic Croaker and Spot (*P. Geer*) **Possible Action**	11:30 a.m.
6. Other Business/Adjourn	12:15 p.m.

The meeting will be held at the Westin Crystal City, 1800 S Eads Street, Arlington, VA 22202; 703.486.1111

MEETING OVERVIEW

South Atlantic State/Federal Fisheries Management Board

Chair: Pat Geer (VA) Assumed Chairmanship: 02/18	Technical Committee (TC) Chairs: Black Drum: Harry Rickabaugh (MD) Cobia: Vacant Atlantic Croaker: Chris McDonough (SC) Red Drum: Vacant	Law Enforcement Committee Representative: Capt. Bob Lynn (GA)
Vice Chair: Robert H. Boyles, Jr.	Advisory Panel Chair: Tom Powers (VA)	Previous Board Meeting: February 6, 2019
Voting Members: NJ, DE, MD, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS, SAFMC (12 votes)		

2. Board Consent

- Approval of Agenda
- Approval of Proceedings from February 6, 2019

3. Public Comment – At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

4. Draft Amendment 1 to the Cobia Fishery Management Plan (10:30 a.m. – 11:30 p.m.) Action
Background • In May 2018, the Board initiated Draft Amendment 1 to the Cobia Fishery Management Plan (FMP) to reflect removal of Atlantic cobia from the South Atlantic and Gulf of Mexico Fishery Management Councils' Coastal Migratory Pelagic Resources FMP and establish recommendations for measures in federal waters. • In October 2018, the Board reviewed public comment on a Public Information Document (PID) and gave direction to the Cobia Plan Development Team (PDT) on options to be included in Draft Amendment 1. • The PDT has developed Draft Amendment 1, which includes several management options for Board Review for Public Comment (**Briefing Materials**).
Presentations • Draft Amendment 1 to the Interstate Fishery Management Plan for Atlantic Migratory Group Cobia by M. Schmidtke

Board actions for consideration at this meeting

- Review and consider approval for Draft Amendment 1 to the Cobia FMP to be released for Public Comment.

5. Review State-Gathered Public Input and Consider Potential Management Action for Atlantic Croaker and Spot (11:30 a.m. – 12:15 p.m.) Possible Action

Background

- In 2017, the Board tasked the Atlantic Croaker Technical Committee (TC) and Spot Plan Review Team (PRT) with exploring potential updates to the Traffic Light Analyses (TLA) used to annually evaluate performance of these fisheries, due to conflicting harvest and abundance signals in the current TLAs.
- In February 2018, the Atlantic Croaker TC and Spot PRT provided recommended updates to the TLAs (**Briefing Materials**). Incorporation of all recommended updates would result in management action being triggered for both species.
- In May 2018, the Board populated and tasked the Atlantic Croaker and Spot Plan Development Team (PDT) with exploring potential management responses to the triggers resulting from incorporation of the TLA updates.
- In August 2018, the Atlantic Croaker and Spot PDT provided recommendations that season or trip limits be established for each species (**Briefing Materials**). The Board desired additional public input on measures that would be feasible.
- Several states have gathered public input or conducted in-house analyses to consider potential management responses that could follow incorporation of the TLA updates (**Briefing and Supplemental Materials**).

Presentations

- Summary of Atlantic Croaker and Spot TLA Adjustments and State-Gathered Public Input by M. Schmidtke

Board actions for consideration at this meeting

- Consider potential management action regarding Atlantic croaker and spot TLAs.

6. Other Business/Adjourn

DRAFT PROCEEDINGS OF THE

ATLANTIC STATES MARINE FISHERIES COMMISSION

SOUTH ATLANTIC STATE/FEDERAL FISHERIES MANAGEMENT BOARD

The Westin Crystal City
Arlington, Virginia
February 6, 2019

TABLE OF CONTENTS

INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).

2. **Approval of Proceedings of October 2018** by Consent (Page 1).

3. **Move to approve the 2018 Spot FMP Review, State Compliance Reports and de minimis status for New Jersey and Georgia** (Page 10). Motion by Lynn Fegley; second by Malcolm Rhodes. Motion carried (Page 10).

4. **Motion to adjourn** by Consent (Page 10).

ATTENDANCE

BOARD MEMBERS

Emerson Hasbrouck, NY (GA)
Adam Nowalsky, NJ, proxy for Asm. Andrzejczak (LA)
Heather Corbett, NJ, proxy for L. Herrighty (AA)
Russ Allen, NJ, proxy for T. Fote (GA)
John Clark, DE, proxy for David Saveikas (AA)
Roy Miller, DE (GA)
Craig Pugh, DE, proxy for Rep. Carson (LA)
Russell Dize, MD (GA)
David Blazer, MD (AA)
Lynn Fegley, MD, Administrative proxy
Pat Geer, VA, proxy for S. Bowman (AA), Chair
Bryan Plumlee, VA (GA)
Steve Murphey, NC (AA)
Chris Batsavage, NC, Administrative proxy
Mike Blanton, NC, proxy for Sen. Steinberg (LA)
Malcolm Rhodes, SC (GA)
Spud Woodward, GA (AA)
Doug Haymans, GA (GA)
Jim Estes, FL, proxy for J. McCawley (AA)
Marty Gary, PRFC
John Carmichael, SAFMC

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Staff

Toni Kerns
Robert Beal
Mike Schmidtke
Caitlin Starks
Jessica Kuesel

Guests

Joe Cimino, NJ DEP
Justin Davis, CT (AA)
Jeff Deem, VMRC
Phil Edwards, RI DEM
Zach Greenberg, PEW Trusts
Bill Hyatt, CT (GA)
Raymond Kane, MA (GA)
Arnold Leo, E. Hampton, NY
Chip Lynch, NOAA
Nichola Meserve, MA DMF
Mike Millard, USFWS
Rob O'Reilly, VMRC
Derek Orner, NOAA
Cheri Patterson, NH F&G
Ken Sprankle, USFWS
Mike Thalhauser, MCCF
Jack Travelstead, CCA

These minutes are draft and subject to approval by the South Atlantic State/Federal Fisheries Management Board.
The Board will review the minutes during its next meeting.

The South Atlantic State/Federal Fisheries Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Wednesday, February 6, 2019, and was called to order at 11:15 o'clock a.m. by Chairman Pat Geer.

CALL TO ORDER

CHAIRMAN PAT GEER: Welcome to the South Atlantic State/Federal Fisheries Management Board. My name is Pat Geer; I'm from Virginia, I'm the Chairman. I welcome you all here today. The first order of business today is approval of the agenda. Are there any changes to the agenda; any modifications? Hearing none; the agenda is approved by consent.

APPROVAL OF PROCEEDINGS

CHAIRMAN GEER: Moving on to the proceedings from the October annual meeting, are there any changes or additions to them? Hearing none; it's approved by consent. We don't have anybody signed up for public comment. Is there anybody in the audience that wants to comment on anything that is not on the agenda today?

DRAFT AMENDMENT 1 FOR THE COBIA FISHERIES MANAGEMENT PLAN

CHAIRMAN GEER: Hearing none; we'll move on. The next item on the agenda is the Draft Amendment 1 for the Cobia Fisheries Management Plan. Mike is going to give us a progress update**;** as well as talk about giving us some guidance on the Plan Development, as far as it's concerned with some of the options we have, so Mike you have the floor.

PROGRESS UPDATE

DR. MIKE SCHMIDTKE: Today I'll be talking about kind of the progress made on Draft Amendment 1; as well as some additional guidance that is necessary for the Plan Development Team to proceed forward in the development of that draft. Before I get into the draft amendment, I do want update the Board on the SEDAR 58 assessment process for Atlantic cobia. The data workshop was previously scheduled to take place in Charleston in mid-January.

However, due to the federal government shutdown that workshop was postponed. The most recent information I have is that the SEDAR Steering Committee will have a conference call to reschedule the dates for that workshop; as well as any other assessments that were affected by it. Once I get information from that call I'll distribute it to the Board. Currently I don't have the reschedule dates for that workshop. I guess before I get into the amendment, are there any questions concerning the assessment and the progress there?

MR. JOHN CARMICHAEL: Yes, John Carmichael. It will actually be a planning group not the Steering Committee that does that. But the Science Center did initial planning last week; and the reports we're getting back from the coordinators who have been working with the projects leads is it sounds like they can pick that up pretty quick. We're not expecting an excessive delay; and hoping that we can have the workshop sometime in maybe late March or April. I hope there won't be too much of a delay.

DR. SCHMIDTKE: Thank you, John. Now getting into the Draft Amendment, first I'll go through a brief review of the process to this point. Draft Amendment 1 to the Interstate Management Plan was initiated in May of last year. This amendment is necessary to replace the current language that is dependent on the Council's Coastal Migratory Pelagics FMP; as well as reflect the removal of Atlantic cobia from that FMP via Amendment 31.

Additionally, the Board expressed a desire to consider management strategies other than those that are currently in place through the Complementary Plan. A Public Information Document was published last year; and distributed to gather input on options for the draft Amendment. Public comments were received through hearings and e-mails; and they were summarized for the Board last October, when the Board gave some initial guidance for the Cobia Plan Development Team.

The draft Amendment was tasked to be designed to address two main issues; recommended management for federal waters and establishment of a harvest specification process. This is a reminder of the current timeline for the amendment. Fortunately, this amendment has not really been impacted by the federal shutdown; so the PDT has been able to move on discussions for developing the document.

We are still planning to have the draft amendment available for Board consideration for public comment in May; with a potential final approval during this year's August meeting. The PDT has held two conference calls earlier this month; to begin developing preliminary options for several measures addressed by the draft amendment.

However, the group decided that additional guidance on accountability options was necessary to move forward; as current accountability measures have some dependency on how the landings are evaluated against targets or quotas. Decisions concerning accountability could impact options for other measures as well.

Accountability is being considered in this draft amendment; because it is included in status quo measures. During previous discussions some states had expressed concern about inequitable access. That is what led to Commission involvement in this stock in the first place; and additionally because some questions have been asked concerning the health of the stock, due to recent ACL overages in both sectors.

The Commission's guiding documents do not require accountability measures in a plan; however, removal of accountability measures would divert from the status quo for this particular FMP. If this is desired for either sector that would have to be considered along with status quo; as one of multiple options for this draft amendment.

Here I'll summarize the status quo accountability measures. On the recreational side accountability is applied at the state level for non de minimis states. If a state's average harvest over a three year period exceeds its annual harvest target that state must reduce its season or vessel limit; such that the target may be achieved in the next three year period. For the commercial fishery accountability is applied through a coastwide closure. NOAA Fisheries monitors commercial harvest and projects when the commercial ACL will be met. When the ACL is projected to be met, both federal and state waters are closed to commercial fishing for the remainder of the year.

An additional accountability measure in effect from the coastal migratory pelagics FMP is that payback would be applied annually; based on ACL overages, if the total ACL (meaning the combined ACL of recreational and commercial sectors), if that is exceeded while the stock is under an overfished status.

We've had some overages in recent years; but there has been no payback, because the stock is not currently overfished, according to the last assessment. Payback would be applied according to those sector-specific overages. Unless both of the conditions are met of an overage and an overfished status, payback is not applied and the ACL resets each year.

This measure is not in the interstate FMP, and could not be carried over as a status quo measure. However, because it is conditional on overfished status, if the Board does desire this type of measure as an option; that could be considered outside of the status quo measures that get carried forward in place that are under a regular not overfished status.

Status quo could be maintained for the recreational fishery by simply adapting some terminology. We would not have an ACL any longer; we would define independently the RHL and redefine a few other terms as well. Some preliminary options explore the RHL specification process; and the landings evaluation process, and look at these for time periods other than three years.

But these could be addressed separately without impacting the management response to an overage. That response is a state level reduction to the state harvest target. However, carrying forward status quo could be a bit more difficult to implement for the commercial fishery. Under and adapted status quo scenario, states would be responsible for the monitoring and closure for landings in their state.

They would have to keep track of when the annual quota is met; and issue the closure within the states. Given the difficulties with keeping the landings under the ACL under federal monitoring and closure, a key question is do states believe they would have ability to monitor their landings and enforce a timely closure if the coastwide quota were met?

Another note for consideration is that most Commission FMPs, which are not required to use payback methods, typically have payback procedures in place for commercial fisheries but not for recreational. In summary, some aspects of status quo accountability could be adapted and carried forward, without needing to develop alternative accountability options.

However, there are some caveats to doing that; particularly for the commercial fishery. The first question that the PDT would need addressed to move forward is; does the Board want to include accountability options other than the status quo in this draft amendment? At this point if it pleases the Chair, I would ask for Board feedback on this question. There are a couple follow up questions; depending on the response that the Board gives at this time.

PROVIDE GUIDANCE TO PLAN DEVELOPMENT TEAM TO DEVELOP MANAGEMENT OPTIONS

CHAIRMAN GEER: I want to open the floor for discussion on this. Are there any comments? I see Malcolm and I see Joe.

DR. MALCOLM RHODES: If we could monitor the status quo it could work. I know in our state we would have an issue with the federal water closures; and I think Georgia the same way, because that is where our fisheries take place for the most part. Any state waters we close for the breeding stock; and Robert's talked about that at length.

I don't know if our state could. I don't know that's just an issue that we would have to work out; if we stuck with the status quo along that line. I don't have a specific recommendation; but it's something that we just need to consider as we go forward.

CHAIRMAN GEER: Joe.

MR. JOE CIMINO: Thanks, Mike for laying all this out for us. You know I think it was a big step forward when we got to this idea of this three year period for the recreational fishery. I would really like to see that play out. I think something needs to be done with the commercial fishery. I just wonder who that kind of falls to for tracking overall as a coast.

I believe there were times where even ASMFC staff was involved with tracking dogfish when Council and Commission had different, and I wouldn't want to see it go that way. I had some concerns about this commercial fishery. I think that a lot of fish still go unreported; so it's a fishery that's already exceeding its ACL, and yet I still think there are fish that are ending up in restaurants that aren't even on that quota. I think it's a difficult one to track in real time for any state. Then well, I'll leave it at that.

CHAIRMAN GEER: All of it, Malcolm; anyone else? Lynn.

MS. LYNN FEGLEY: I just wanted to make sure that I understand. If we go forward with the inclusion of accountability measures, if there are options in there that would require states to track their state-specific landings, you know for those of us who's harvest is very low, we're de minimis in these.

I'm just wondering if there is going to be some specific language in the plan that would specify how de minimis states would need to deal with those accountability measures. Would we be equally responsible? I'm just wondering. We probably need to think through how that works a little bit.

DR. SCHMIDTKE: With the way that the Plan is now, there is a coastwide quota. It's not divvied up by states at all. De minimis or non, it doesn't really matter when it comes to the commercial fishery. All of that goes into evaluating the landings against that coastwide quota. Unless there are adjustments made to that; then the de minimis states, which are essentially de minimis for the recreational fishery, would also have to be incorporated in that monitoring effort.

CHAIRMAN GEER: Follow up, Lynn?

MS. FEGLEY: Yes, thank you for that. Just to be clear, you know the way that we went forward in a complementary way with the Federal Plan, I think worked really well for us. But if we're going to deviate from the status quo, I just want to make sure we think it through.

CHAIRMAN GEER: Next I have Chris.

MR. CHRIS BATSAVAGE: Thinking about how to monitor the commercial fishery. It's really two states landing the majority of the commercial cobia. In terms of how to handle the de minimis states, I think with the recreational fishery when we allocate it to the states, it was 99 percent of that RHL and then 1 percent covered the de minimis states.

I don't know if that's something that we could do for the commercial fishery if we go to either of the states, Virginia, North Carolina in this case, monitoring the quota or another entity that it's at like a 99 percent or even less of that level to account for overages, but also account for the de minimis states so they're not having to try to track down just very sporadic commercial landings that may or may not occur in their states.

CHAIRMAN GEER: Anyone else? We have to make a decision whether or not, first of all if we want accountability measures, and if we do, if we want to stay with our status quo or do we have any other ideas? What's the pleasure of the Board? Joe.

MR. CIMINO: I support Chris's notion; and maybe if we could actually task the TC to look at the coastwide landings for the past few years, and get an idea if it would be a 1 percent set-aside, or what an appropriate number would be. Then kind of move forward with that for the commercial. Again, I'm going with support for status quo for the recreational.

CHAIRMAN GEER: Chris is correct; I mean it's basically Virginia and North Carolina that make up the large bulk of the commercial landings. We both have quota systems in effect that can track the landings; whether or not we're getting it all. But we do have a tracking system. We could put something into play where we start to look at it when it reaches some certain percentage; and deal with the season that way.

DR. SCHMIDTKE: I think we can just incorporate that into the PDT process. We don't have to have a separate TC task for it; just have that as part of the option development for the PDT.

CHAIRMAN GEER: I'm not hearing any objections to not having accountability measures. I have a few people in support of them. Hearing none; we're all in consensus that we want the accountability measures to move forward? That's with status quo. If you want any others added, any other thoughts. I'm not hearing much, tough crowd. Roy.

MR. ROY W. MILLER: Mr. Chairman, in your statement, are we assuming status quo is the preferred option?

CHAIRMAN GEER: If we have no other options. It's a plan right now; so if there is anything else, any thoughts or ideas anybody has, bring them forth now. Spud.

MR. A. G. SPUD WOODWARD: I think it will help the PDT if we can at least address this payback issue now as a group. Do we want paybacks to even be considered a component of the accountability measures or not? I for one think in the recreational sector no, just my opinion.

CHAIRMAN GEER: Anyone else on that? Mike has something.

DR. SCHMIDTKE: Spud, just to be clear; that would include under an overfished status, still no payback at all for the recreational, correct? Okay.

CHAIRMAN GEER: What does everyone think about that? Lynn.

MS. FEGLEY: Okay, so if we're in an overfished status we would have a payback for the commercial sector but not the recreational sector; is that correct? Is that how that works?

CHAIRMAN GEER: I believe that's what Spud was proposing. Is that what you were proposing, Spud?

MR. WOODWARD: Well I'm not necessarily proposing a payback for the commercial sector; just making sure that I don't want us to get into a situation where we do it in the recreational sector. I think if we were to go with something like status quo. In essence if you have to truncate your season or make other adjustments the year after you sort of reached the threshold; that is a de facto payback, if you get really down to it, just without enumerating the fish, per say.

But, the commercial fishery is so small and is unlikely to grow under the restrictions that are there already. I don't know that we need to bog down too much in that. I mean if you've got the only two states are the principal players in it can control the harvest through the quota monitoring system and in-season closures. I mean, what's the likelihood of us getting into a situation where a payback is really necessary?

CHAIRMAN GEER: Well, we've gone over every year since there has been an ACL.

MR. WOODWARD: By what percentage, what margin?

CHAIRMAN GEER: It varies. As you said, relative to the recreational fishery it's tiny. I mean landings have been I think there was 67,000 pounds last year. It is going over by 20 percent. But it's still a very small portion of the overall harvest. Lynn has her hand half up.

MS. FEGLEY: Thank you, Mr. Chair for your patience. I guess my thought is just in terms of equity. Something just niggles at me that we would put an option in for payback for one sector but not the other. With the commercial fishery maybe being so small; maybe the commercial fishery winds up in the same place that the recreational fishery does, where if the commercial fishery is exceeding its ACL, if it exceeds then the states need to adjust somehow their commercial fisheries. I know we're all on a standard regulation right now; and the feds have been monitoring it and closing the season when NOAA has calculated that the quota is caught. But maybe we just need to keep the recreational and the commercial on an even plane. If the commercial sector is exceeding, then the states need to figure out how to adjust their landings accordingly.

CHAIRMAN GEER: Joe.

MR. CIMINO: I support that. I have a question maybe for Mike or staff. Do we know in this plan, can you request de minimis for just a sector? Because I think if other states could request it just for commercial, it might give us more options on how to manage the commercial fishery.

DR. SCHMIDTKE: Joe, are you asking could we change the de minimis; I guess the way the de minimis is defined? Because right now it is defined that it only really effectively applies for the recreational sector; but incorporating the commercial sector into de minimis qualification and status. That is something that could be incorporated into the amendment, yes.

CHAIRMAN GEER: Toni.

MS. TONI KERNS: I just have a question for the states; because I thought we said on the PDT call that the states don't timely monitor the quota enough for in-season closures. For the states that have commercial fisheries is there timely enough monitoring with this pulse fishery that it is; to actually have a closure when we reach or get close to the commercial quota?

Like could we set up for triggers in order to reduce catch some; if you don't want to do full closures, so that harvest then starts to drop off, so you don't have such large percent overages? Some measure; because right now I don't think we're timely monitoring in order to have an accountability measure.

CHAIRMAN GEER: Virginia tracks the landings.

MS. KERNS: Timely? How often do you get your landings for this; monthly, weekly?

CHAIRMAN GEER: No, it's at least weekly if not daily. North Carolina, they have a call-in system as well, right?

MR. BATSAVAGE: Yes thanks. We have a quota monitoring system for some of our other commercial fisheries. We would have to go and talk to staff; as far as how we would handle cobia, being a much smaller quota. But we do have a mechanism in place to track landings on a more frequent basis than the typical get the trip tickets a month later, and then see where you are.

But yes, I think it's something that we could potentially do; we just need to work out the details with our staff, to figure out the best way. I think in terms of just the commercial landings information; having the PDT look at when those landings occur during the month, and seasonal landings and what not. That would help us too; as far as trying to get a sense of the frequency. You know if it's all happening in a couple months; or if it's spread out over the year, or somewhere in between. I think that would help us; as far as whether we need to do daily reporting, weekly reporting, things like that.

CHAIRMAN GEER: Mike's writing down a lot of things here. One of the things was separating out de minimis for recreational and commercial; considering not having payback for recreational fisheries or commercial. Is there anything else or any comments on those issues that we just discussed? Not hearing any. Is there anything else you want the PDT to look at or the TC; as far as information you want going into the Plan as a possible option? Boy, I'm not hearing anything. Mike is doing a wonderful job, isn't he? Mike.

DR. SCHMIDTKE: Just to make sure we're clear going forward. All the feedback that has been given today could be accomplished essentially with status quo accountability measures. Again like I said, the payback provision is from the coastal migratory pelagics FMP; that is not part of the interstate FMP.

We would just not add it. That would be fine to have status quo going forward; which would mean that there would not be accountability options in the draft amendment. That would just be a carryover from the previous management plan. We would be able to look at some details like the timing of the period and things like that outside of those measures. But I just wanted to make sure that the Board was clear that that is what we would have going forward.

CHAIRMAN GEER: I see a few heads shaking yes. Anything else, Mike do you have what you need at this time? Okay. Thanks for that discussion. Several of us sit on the PDT as well; so we'll be having some more conference calls about this as we continue to develop the amendment. Do you have a question, Toni?

MS. KERNS: Is it the intention of the Board for the commercial fishery to close in-season when the quota is caught? Is that what the Board is looking for; to clarify?

CHAIRMAN GEER: Chris is nodding his head and so am I.

MS. KERNS: Okay.

CHAIRMAN GEER: Yes. Is there anything else? All right moving on, oh I've got another question. Joe.

MR. CIMINO: Is that a state-by-state closure? If North Carolina and Virginia are going over, would they expect all states to be able to respond quickly enough to?

MS. KERNS: I think it depends on how you set up the quota in the document. If you're going to have a state-by-state commercial quota, then it would be each individual state would close when you set that up. But if you don't have state-by-state quotas, which I don't believe we do right now. Then it would just be when the commercial quota is caught in total; and everybody would close.

CHAIRMAN GEER: But if we had that 1 percent or 2 percent set-aside; we may be able to address it through that.

MS. KERNS: The de minimis states would also have to, everybody would have to close once the commercial quota is caught, usually.

CHAIRMAN GEER: Right. Okay.
MS. KERNS: I mean you can write it any way you want that's true. You can change it, but typically that's what happens.

CHAIRMAN GEER: I have Lynn and then Joe.

MR. CIMINO: I think I would like to consider maybe through the Plan, something where there was like a 1 percent set-aside for de minimis. You know we had a public hearing in New Jersey, and one individual showed, he was a commercial fishermen, large-mesh gillnets. He doesn't target cobia; but his one concern is the closures impact his fishery.

I know North Carolina has this issue with king mackerel. I know I've said it before, but I'm always in favor or turning dead discards into something more reasonable. I know for at least my state, if de minimis was running on a 1 percent set-aside; I would be able to turn those discards into non-targeted harvest.

CHAIRMAN GEER: Lynn.

MS. FEGLEY: I think I am right on the same wavelength with Joe. In our state, because we have so few of these fish, we cannot monitor state-by-state quota. We are not equipped to do that for this fish. Some sort of set-aside I think, would work well for the commercial fishery. If push came to shove, I don't think it would be ideal, because I'm assuming the majority of the commercial landings are coming out of North Carolina and Virginia.

You know they would be our bell weather. If they are in the position to track their quota then close, then you know we could follow suit. We're set up right now to follow Virginia's regulations recreationally to keep us consistent. We could walk down that same road commercially as well; although you know as Joe said, I think if there is a way to treat these little states a little differently that would be ideal.

CHAIRMAN GEER: Roy.

MR. MILLER: I would support that thought process as well; because there is a cost associated with implementing regulations. If a commercial closure is required, and you have a state that landings are so incidental or occasional that you don't even have landings greater than zero in most years. The administrative cost of closing that fishery just doesn't seem worth it. I like the idea of a 1 percent set-aside, thanks.

CHAIRMAN GEER: That is a good idea. Malcolm.

DR. RHODES: Just to be clear about this. If there were a federal closure or a commercial closure in the federal waters, would the wording apply just to commercial, or recreational only? Speaking for my own state, cobia is game fish, so we have no commercial fishery period. But as stated earlier, our fishery is 90 percent prosecuted in federal waters.

If the federal waters were closed, by mandate our recreational season is closed. That is what happened for several years. Is there a way to disconnect commercial and recreational in the Plan that's coming up? Would federal water closure be federal water closure period; or would it just be federal for commercial harvest?

DR. SCHMIDTKE: One of the parts of this draft amendment is addressing the recommended federal regulations relative to the state. There are options in place, like one of them being if you're fishing by your state of landing, even though you're in federal waters you adhere to the regulations of the state of landings. I believe that NOAA Fisheries has indicated that they would essentially reflect those regulations in enforcement. There wouldn't necessarily be a federal closure; unless it was mirroring a state closure.

CHAIRMAN GEER: Toni.

MS. KERNS: To clarify. The closure would be for commercial fishing, Malcolm, for all states to close their commercial fishery. If you don't have a commercial fishery then you wouldn't have to worry about it. If we made that recommendation to want to extend it out to federal waters, it would be just a closure of commercial fishing in federal waters.

DR. RHODES: Understood; but I just wanted to be clear, the way our laws are mandated that if the federal waters are closed then the fishery is closed to everybody. I don't know, maybe we just need to make sure about the wording of it either in this, and we can talk about it later, or within our state. Is that how you understand it, John?

MR. CARMICHAEL: I think that's how it's worded now. What I was trying to think about is if all the states closed there is nowhere to land. Then with the federal waters being opened or closed it would kind of be moot. But then I think there are also situations where once all the states that have, in cases where you've divided them up, once all the states that have a piece have all closed, then I think in some cases the feds close. But my recollection a lot of times that comes down to what the Commission does; in terms of asking the feds to take action. I think you have the ability to do it either way you wish to do it.

CHAIRMAN GEER: Malcolm, are you okay with that?

DR. RHODES: Yes I'm clear with this; and we'll be able to discuss it some, and then we'll have the document in May. I just want to make sure we don't get inadvertently closed out of the fishery; because of the way our laws are written, with the mirroring of federal law.

CHAIRMAN GEER: Is there anything else? I'm going to have a long pause here; so everyone can think for a second and then move on. Mike, did we cover everything? All right well thanks for that discussion. Like I said, the PDT will be working; and we'll be back with this in May.

CONSIDERATION OF THE FMP REVIEW AND STATE COMPLIANCE REPORTS FOR SPOT

CHAIRMAN GEER: Moving on to the next agenda item, which is Consideration of the FMP Review and State Compliance Reports for spot**.** Mike.

DR. SCHMIDTKE: This is the 2018 FMP Review for spot. We get those compliance reports a little bit later in the year, so we're going to be looking at the 2017 fishing year. As a reminder, in July of last year MRIP did their recalibration of recreational harvest estimates from the Coastal Household Telephone Survey to the mail-based Fishing Effort Survey.

Here we see time series of the recreational harvest using each of the different calibrations; and in general spot increased by about double, but it's fairly proportional for those recreational landings. As this species does not have any regulations based on the weight or the number of the recreational harvest, the estimates that are presented today will use those new FES numbers.

Here we see commercial harvest in black and recreational harvest in gray from 1950 to the present. Total landings of spot in 2017 are estimated at ten million pounds; an increase of about six million pounds from 2016, and 317,000 pounds less than the average of the last ten years. The commercial fishery accounted for 24 percent of these landings; with 2.4 million pounds, that's a 277 percent increase from the time series low in 2016.

Virginia landed approximately 74 percent of the commercial harvest; followed by North Carolina with 18 percent. Here we see recreational catch in millions of fish. The black bars are the fish harvested, and gray bars are those that were caught and released. Recreational harvest of spot along the Atlantic Coast has varied throughout the time series; between 13 and 55 million fish.

In 2017 recreational harvest was 23.7 million fish or 10 million pounds. This is about 10 million fish more than the 2016 harvest. Anglers in Virginia caught 67 percent of the 2017 harvest; followed by anglers in Maryland and North Carolina. The estimated number of spot released by recreational anglers in 2017 was about eight million fish; and that's about a 2.5 million decrease from the 2016 releases.

Addendum I established the use of a traffic light analysis to monitor stock status in the absence of an assessment. It set a threshold of 30 percent, which is shown by the black line that represents moderate concern for the fishery. If thresholds for both the harvest and abundance indices are exceeded over a two year period then management action is tripped.

The results shown here and on the next slide are the current TLA; and they do not include adjustments that were recently recommended by the Atlantic Croaker TC and Spot PRT. This graph shows the Composite Harvest Index, which is comprised of commercial and recreational data from the entire coast.

This index has shown recent decline; and did trip in 2017 with red proportions in 2016 and '17, both exceeding 30 percent. Here we see the composite abundance index; which is comprised of adult spot abundance estimated by the NMFS and SEAMAP surveys. This index has shown some sporadic declines; but nothing consistent, and it did not trip in 2017. The 2017 percent red is just under 30 at 29.4 percent; so despite the triggering of the harvest index, management action is not triggered this year and would not be triggered next year, as you need two consecutive years to trigger management. Spot are currently managed under the Omnibus Amendment approved in 2011. This amendment does not require a specific fishery management measures in either the recreational or commercial fisheries for states within the management unit. A state qualifies for de minimis status if its past three-year average of the combined commercial and recreational catch, is less than 1 percent of the past three-year average for the coastwide commercial and recreational catch.

Those states that qualify for de minimis are not required to implement any monitoring requirements; and there aren't any monitoring requirements to include for this plan. New Jersey and Georgia have both requested and qualified for de minimis status. The PRT recommends that the Board approve the 2018 Spot FMP Review, State Compliance Reports, and de minimis status for New Jersey and Georgia.

In addition the PRT has listed several management research and monitoring recommendations in the FMP Review Report. Specifically the PRT would like to reiterate their recommendation that the Board consider incorporation of adjustments to the TLA. These were submitted in their collaborative memo with the Atlantic Croaker TC.

As I understand states have been working to get public feedback on potential management responses since incorporating the recommended adjustments would trigger management action. That information was not available for all states in time for this meeting; so the plan is for the Board to address that issue in May. With that I will take any questions.

CHAIRMAN GEER: Are there any questions for Mike? I believe so far Maryland and Virginia have had their public meeting; North Carolina is slated this month. Are any other states considering having a meeting to discuss possible croaker/spot management? I'm just seeing shaking of heads.

Okay well that is where the bulk of the catch is. Lynn, Chris and I have had several conversations about this. I think we're all kind of on the same page. We'll be able to provide some of the results of those meetings next meeting. We need a motion on this. Lynn.

MS. FEGLEY: I move to approve the 2018 Spot FMP Review, State Compliance Reports and de minimis status for New Jersey and Georgia.

CHAIRMAN GEER: Seconded by Malcolm. Is there any further discussion; any opposition? Hearing none; it's approved by consent. Is there anything else to come? Oh, I have to read it, I'm sorry I forgot to read it, forgive me. Move to approve the 2018 Spot FMP Review, State Compliance Reports and de minimis status for New Jersey and Georgia.

Motion by Ms. Fegley, and seconded by Dr. Rhodes. Hearing any opposition to the motion? Hearing none; the motion is accepted by consent. I apologize for that. Is there any other business to come before this Board today? Malcolm.

DR. RHODES: Mike and Lynn and I were talking earlier; and I just wanted to clear in my head. It's SEDAR 28 for cobia will be like a year, is that right?

DR. SCHMIDTKE: It's 58, and that is projected to be finished by the end of this calendar year. The original final report date was in October; so even with the shutdown if it gets moved a month or so that information wouldn't have been available until our February meeting anyway. As long as we get it done by beginning of January, then we should still be on track to have that available in February or next year.

ADJOURNMENT

CHAIRMAN GEER: Is there anything else? Hearing none; motion to adjourn, Malcolm, and seconded by I thought I saw a couple of hands over here. I'll say Lynn. Meeting is adjourned.

(Whereupon the meeting adjourned at 12:00 o'clock p.m. on February 6, 2019)

DRAFT DOCUMENT FOR BOARD DISCUSSION; NOT FOR PUBLIC COMMENT

Atlantic States Marine Fisheries Commission

Draft Amendment 1 to the Interstate Fishery Management Plan for Atlantic Migratory Group Cobia

Sustainably Managing Atlantic Coastal Fisheries

May 2019

DRAFT DOCUMENT FOR BOARD DISCUSSION; NOT FOR PUBLIC COMMENT

Amendment 1 to the Interstate Fishery Management Plan for Atlantic Migratory Group Cobia

Prepared by

Atlantic States Marine Fisheries Commission
Cobia Plan Development Team

Plan Development Team Members:
Alex Aspinwall, Virginia Marine Resources Commission
Pat Geer, Virginia Marine Resources Commission
Chris Batsavage, North Carolina Division of Marine Fisheries
Anne Markwith, North Carolina Division of Marine Fisheries
Mike Denson, South Carolina Department of Natural Resources
Kathy Knowlton, Georgia Department of Natural Resources
Spud Woodward, South Atlantic State/Federal Fisheries Management Board
Ray Rhodes, College of Charleston
Andrew Scheld, Virginia Institute for Marine Science
Michael Schmidtke (Chair), Atlantic States Marine Fisheries Commission

This is a report of the Atlantic States Marine Fisheries Commission pursuant to U.S. Department of Commerce, National Oceanic and Atmospheric Administration Award No. NA15NMF4740069.

The Atlantic States Marine Fisheries Commission seeks your input on Draft Amendment 1 to the Atlantic Cobia Fishery Management Plan.

The public is encouraged to submit comments regarding this document during the public comment period. Comments must be received by **5:00 PM (EST) on XXXXX.** Regardless of when they were sent, comments received after that time will not be included in the official record. The South Atlantic State/Federal Fisheries Management Board will consider public comment on this document before finalizing Amendment 1.

You may submit public comment by attending a public hearing held in your state or jurisdiction or mailing, faxing, or emailing written comments to the address below. Comments can also be referred to your state's members on the South Atlantic State/Federal Fisheries Management Board or Advisory Panel; however, only comments received at a public hearing or written comments submitted to the Commission will become part of the public comment record.

Mail: Dr. Michael Schmidtke
Atlantic States Marine Fisheries Commission
1050 N. Highland Street, Suite 200 A-N
Arlington VA. 22201

Email: comments@asmfc.org
(Subject: Cobia Amend 1)
Phone: (703) 842-0740
Fax: (703) 842-0741

If your organization is planning to release an action alert in response to Draft Amendment 1, or if you have questions, please contact Dr. Michael Schmidtke, Fishery Management Plan Coordinator, at 703.842.0740.

The process and current timeline for completion of Amendment 1 is as follows:

Step	**Anticipated Date**
Approval of Draft PID by the Board	Aug 2018
Public review and comment on PID	Aug – Oct 2018
Board review of public comment; Board direction on what to include in Draft Amendment 1	Oct 2018
Preparation of Draft Amendment 1	Oct 2018 – May 2019
Review and approval of Draft Amendment 1 by Board for public comment ***Current step***	May 2019
Public review and comment on Draft Amendment 1	May – Aug 2019
Board review of public comment on Draft Amendment 1	Aug 2019
Review and approval of the final Amendment 1 by the Board, Policy Board and Commission	Aug 2019

Table of Contents

1.0 INTRODUCTION

The Atlantic States Marine Fisheries Commission (Commission), under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), is responsible for managing the Atlantic Migratory Group of cobia (Atlantic cobia) (*Rachycentron canadum)* from Georgia through New York. The Commission has coordinated the interstate management of Atlantic cobia in state waters (0-3 miles) since 2017. Amendment 1 to the Interstate Fishery Management Plan for Atlantic Migratory Group Cobia (FMP) establishes management measures that transition the FMP from complementary management with the South Atlantic and Gulf of Mexico Fishery Management Councils' (SAFMC and GMFMC, respectively) Fishery Management Plan for Coastal Migratory Pelagic Resources in the Gulf of Mexico and Atlantic Region (CMP FMP) to sole management by the Commission. Amendment 1 to the FMP was initiated in response to Regulatory Amendment 31 to the CMP FMP, which removes Atlantic cobia from the CMP FMP. Management authority in the exclusive economic zone (3-200 miles from shore) lies with the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries), but the Commission, through the ACFCMA, is able to recommend management measures in this area for implementation by NOAA Fisheries.

Updates from the FMP have been made to introductory sections to reflect the most up-to-date information about the Atlantic cobia fishery.

1.1 BACKGROUND INFORMATION

At their May 2018 meeting, the South Atlantic State/Federal Fisheries Management Board (Board) initiated the development of Amendment 1 to the Cobia FMP to establish recommended management for Atlantic cobia in federal waters and a process by which aspects of harvest regulations may be specified through a Board vote. The Board approved the Amendment 1 Public Information Document for public comment in August 2018. Public comment was received and hearings were held between August 2018 and October 2018. At their October 2018 meeting, the Board tasked the Plan Development Team (PDT) with developing Draft Amendment 1.

1.1.1 Statement of Problem

1.1.1.1 Recommended Management for Federal Waters

In June 2018, the SAFMC and GMFMC approved Regulatory Amendment 31 to the CMP FMP, which would remove Atlantic cobia from the CMP FMP (SAFMC, 2018a). This removal was approved and became effective on March 21, 2019. Therefore, the SAFMC no longer manages Atlantic cobia, and the Commission has sole management authority for this stock. The SAFMC is the management body that previously recommended the annual catch limit (ACL) and other measures used by NOAA Fisheries to manage federal waters. Additionally, the Recreational Harvest Limit (RHL) from the FMP is currently dependent on the federal ACL, and state commercial fisheries are required to close if a federal closure occurs due to the commercial ACL being met. To accommodate the SAFMC's and GMFMC's action to remove Atlantic cobia from the CMP FMP, the Commission is working to establish a mechanism for recommending management measures to NOAA Fisheries for implementation in federal waters, through authority and process defined in the ACFCMA.

1.1.1.2 Harvest Specification Process

Recent concerns for the Atlantic cobia fishery include multiple overages of the commercial and recreational ACLs, early fishing season closures due to the ACLs being met or exceeded, and in-season evaluation of recreational harvest estimates from the Marine Recreational Information Program (MRIP) against the recreational ACL. Recent ACL overages have caused concern among managers about the status of this stock, which was last assessed in 2013 (Southeast Data, Assessment, and Review [SEDAR], 2013). Additionally, the recent transition of MRIP from estimating effort through the Coastal Household Telephone Survey to the current, mail-based Fishing Effort Survey in 2018 required a re-calibration of previous recreational effort and harvest estimates. The change in harvest estimates is likely to impact stock assessment results. Thus, assessments must be conducted to update biological reference points and better inform future management for species impacted by the re-calibration, including cobia. A stock assessment is currently being conducted for Atlantic cobia through the SEDAR process (SEDAR 58). Assessment results are anticipated to be available for management use early in 2020.

In order to quickly respond to assessment results and to address other areas of concern in the fishery, management through a harvest specification process is considered in this draft amendment. Several Commission-managed species are managed through a harvest specification process, a process by which the Management Board may specify regulations controlling future harvest within a meeting, through a Board vote. Typically, regulations are annually specified for the following year. However, one of the primary desires expressed by managers and stakeholders is for regulatory stability. Thus, a multi-year specification process is also considered in this draft amendment.

1.1.2 Benefits of Implementation

Amendment 1 is designed to respond to the removal of Atlantic cobia from SAFMC management. Amendment 1 will establish a process for recommending how NOAA Fisheries should enforce management regulations in federal waters. Since the approval of Regulatory Amendment 31 to the CMP FMP in March, 2019, the Commission is now the only management body that will make such recommendations.

Amendment 1 will also establish a process by which the Board may specify harvest regulations for one or more future years. Through this process, the Board can implement regulations that remain in place throughout entire fishing seasons or across multiple seasons, allowing for increased regulatory stability. An additional advantage of management through this approach is increased flexibility for states to establish or revise measures in response to changes in the fishery or stock status, without needing to alter the FMP through an addendum or amendment. Measures that may be set through the specification process are defined in *Section 4.1*.

1.1.2.1 Social and Economic Benefits

Draft Amendment 1 proposes a management regime that will help ensure the long-term sustainability of the Atlantic cobia population, enhancing the social and economic benefits attributable to Atlantic cobia fisheries in Commission member states. In addition to ensuring the cobia fishery for future generations, socioeconomic benefits of implementation may arise from increased flexibility and the capacity to accommodate differences in member state fisheries and fishery management regimes. Amendment 1 will also enable the Board to specify harvest regulations for periods possibly exceeding one year. Increased stability in harvest regulations could be beneficial for individuals, businesses, and communities that depend on cobia fisheries financially or otherwise. In addition, the recognition of important socioeconomic monitoring requirements and research needs in Amendment 1 will increase the likelihood of implementing and/or continuing those monitoring and research tasks essential for effective fishery management at the state and regional levels.

1.2 DESCRIPTION OF THE RESOURCE

1.2.1 Species Life History

Cobia are a member of the family Rachycentridae and are distributed worldwide in tropical, subtropical and warm-temperate waters. In the western Atlantic they occur from Nova Scotia, Canada, south to Argentina, including the Caribbean Sea. They are abundant in warm waters off the coast of the U.S. from the Chesapeake Bay south and throughout the Gulf of Mexico (Gulf). Cobia prefer water temperatures between 68-86°F. As a pelagic fish, cobia are found over the continental shelf as well as around offshore natural and artificial reefs. Cobia frequently reside near any structure that interrupts the open water such as pilings, buoys, platforms, anchored boats, and flotsam, and are often seen under or accompanying rays, large coastal sharks, and sea turtles. Cobia are also found inshore inhabiting bays, inlets, and mangroves.

1.2.1.1 Stock Structure and Migration

Microsatellite-based analyses demonstrated that tissue samples collected from North Carolina, South Carolina, east coast Florida (near St. Lucie), Mississippi, and Texas showed disparate allele frequency distributions, and subsequent analysis of molecular variance showed population structuring occurring between the states (Darden et al., 2014). Results showed that the Gulf of Mexico stock appeared to be genetically homogeneous and that a segment of the population continued around the Florida peninsula to St. Lucie, FL, with a genetic break somewhere between St. Lucie, FL, and Port Royal Sound, SC. However, no samples were available from Cape Canaveral, FL, to Hilton Head Island, SC. Tag-recapture data across multiple studies and locations also suggested two stocks of fish that overlap at Brevard County, FL, corroborating the genetic findings (Burns and Neidig, 1992; Hendon and Franks, 2010; Wiggers, 2010; Denson, 2012; Orbesen, 2012; Perkinson and Denson, 2012).

The Atlantic and Gulf stocks were separated at the Florida-Georgia (FL/GA) line during SEDAR 28 because genetic data suggested that the split is north of the Brevard/Indian River County line and tagging data did not dispute this split (SEDAR, 2013). The FL/GA line was selected as the stock boundary based on recommendations from the commercial and recreational work groups and comments that this boundary would allow easier management and did not conflict with the life history information available. However, there was not enough resolution in the genetic or tagging data to suggest that a biological stock boundary exists specifically at the FL-GA line, only that a mixing zone occurs around Brevard County, FL, and potentially to the north. The Atlantic stock was determined to extend northward, as far as New York.

In preparation for SEDAR 58, a Stock Identification Workshop was conducted in 2018. This workshop found similar results to those of SEDAR 28 using more recent tagging and genetic data. The Stock ID Workshop identified biologically distinct Atlantic and Gulf stocks separated by a transition zone that occurs from the southern boundary of Brevard County, FL, to Brunswick, GA (SEDAR, 2018). Data that would categorize cobia within the transition zone as belonging to either of the two defined stocks (Atlantic or Gulf) are not available. Additionally, this Workshop identified sub-regional population structure within the Atlantic stock, in which inshore populations from SC were biologically distinct from those in NC/VA. However, data did not support fish found in NC/SC offshore areas as being biologically distinct from either of these populations. Due to uncertainty surrounding biological structure within the Atlantic stock, the Workshop recommended to continue assessing this region as a single stock, from the FL/GA border north through New York.

Several ongoing research projects are expanding sample collection throughout coastal Georgia and northern Florida, which may help provide better resolution within the transition zone. In addition, a few hundred cobia have been tagged with acoustic tags in South Carolina, Georgia, and the east coast of Florida to evaluate movement patterns along the South Atlantic (FL-NC) coast of the United States.

During autumn and winter months, cobia presumably migrate south and offshore to warmer waters. In early spring, migration occurs northward along the Atlantic coast. However, tagging information from the 2018 Stock ID Workshop suggests a greater amount of inshore-offshore movement than was previously thought. Significant efforts are currently underway using various tagging methods to better understand the migratory behavior of cobia.

1.2.1.2 Age and Growth

Weighing up to a record 135 pounds whole weight (lb ww), cobia are more common along the US Atlantic coast at weights of approximately 40 lb ww (SEDAR, 2013). In this region, they reach lengths exceeding 160 cm (63 inches). Cobia grow quickly and have a moderately long life span. Maximum ages observed for Atlantic cobia were 15 and 16 years for males and females, respectively (SEDAR, 2013). Cobia sexual maturity is more closely linked to size than age, with nearly all females maturing by the time they reach 80 cm (31.5 inches, approximately 2-3 years old) (SEDAR, 2013).

1.2.1.3 Spawning and Reproduction

Cobia form large aggregations, spawning during daylight hours between June and August in the Atlantic Ocean near the Chesapeake Bay and off South and North Carolina in May and June, respectively (SEDAR, 2013). Spawning is done through the release of multiple batches during the spawning season, at a frequency of once every 4-6 days (Brown-Peterson et al., 2001; Lefebvre and Denson, 2012; SEDAR, 2013). During spawning, cobia undergo changes in body coloration from brown to a light horizontal-striped pattern, releasing eggs and sperm into offshore open water. Cobia have also been observed spawning in estuaries and shallow bays with the young heading offshore soon after hatching. Cobia eggs are spherical, averaging 1.24 mm in diameter. Larvae are released approximately 24-36 hours after fertilization.

Newly hatched larvae are 2.5 mm (1 inch) long and lack pigmentation. Five days after hatching, the mouth and eyes develop, allowing for active feeding. A pale yellow streak is visible, extending the length of the body. By day 30, juveniles take on the appearance of adult cobia with two color bands running from the head to the posterior end.

1.2.2 Stock Assessment Summary

1.2.2.1 SEDAR 28

As described in *Section 1.2.1.1*, the most recent stock assessment, SEDAR 28, established the stock boundary between Atlantic and Gulf of Mexico cobia at the FL/GA border, based on tagging and genetic information and applicability to management (SEDAR, 2013). Therefore, the stock boundary for the assessment was also established at the FL/GA line. The Atlantic stock extends northward to New York.

The primary model used in SEDAR 28 was the Beaufort Assessment Model (BAM), a forward-projecting statistical catch-at-age model (SEDAR, 2013). This model included data from two fishery-dependent surveys and the recreational and commercial fisheries. Results of this assessment are summarized in the following sections.

1.2.2.1.1 *Abundance and Structure*

Estimated abundance at age since the 1990s showed a slight truncation of the oldest ages compared to the 1980s, but in general there was little obvious change in age structure over time. Total estimated abundance has varied about two-fold since the 1980s with a general decline since 2005. A strong year class was predicted to have occurred in 2005 comparable to those predicted periodically in the late 1980s and throughout the 1990s. However, predicted recruitment in later years (2007-2009) was below average.

1.2.2.1.2 *Fishing Mortality*

The estimated time series of fishing mortality rates (F) from the BAM was highly variable, with F for fully selected ages varying greater than four-fold since the 1980s. There was a drop in F in the 1990s following the implementation of the 2-fish per person bag limit, but there was a notable increase since the early 2000s. Since 2003, estimates of F averaged about 0.30. The recreational fleet has been the largest contributor to total F throughout the time series.

The estimated time series of F divided by F producing Maximum Sustainable Yield (F_{MSY}) from the base run suggested that overfishing has not been occurring over the course of the assessment period but with considerable uncertainty, particularly since the mid-2000s. Current fishery status, with current F represented by the geometric mean from 2009-2011, is estimated by the base run to be $F_{2009\text{-}2011}/F_{MSY} = 0.599$, but with much uncertainty in that estimate. As current F is less than F_{MSY}, overfishing is not occurring.

1.2.2.1.3 *Spawning Stock Biomass*

Estimated biomass at age followed the same general pattern as estimated abundance at age. Total biomass and spawning biomass showed similar trends - generally higher biomass in the 1990s and early 2000s compared to the 1980s and a decline in more recent years. The stock was estimated to be at its lowest point in the late 1980s and was estimated to be at a comparable level in the terminal year.

Estimated time series of stock status (Spawning Stock Biomass [SSB]/ Minimum Stock Size Threshold [MSST], SSB/SSB producing Maximum Sustainable Yield [SSB_{MSY}]) showed a general decline through the 1980s, an increase in the late 1980s and early 1990s, followed by a decline in more recent years. The increase in stock status in the 1990s may have been driven by several strong year classes and perhaps reinforced by the 2-fish per person bag limit implemented in 1990. Base run estimates of spawning biomass have remained above MSST throughout the time series. Current stock status from the base run was estimated to be $SSB_{2011}/MSST = 1.75$, indicating that the stock is not overfished. Age structure estimated from the base run shows more old fish than the (equilibrium) age structure expected at MSY. However, in the most recent year, ages 1-7 approached the MSY age structure.

1.2.2.2 SEDAR 58

Another stock assessment, SEDAR 58, is currently ongoing and scheduled for completion by the beginning of 2020. A Stock Identification Workshop was conducted in 2018 to prepare for this assessment. This Workshop maintained the FL/GA border as the stock boundary, because this border is within a transition zone that occurs from the southern boundary of Brevard County, FL, to Brunswick, GA (SEDAR, 2018). Data that would categorize cobia within the transition zone as belonging to either of the two defined stocks (Atlantic or Gulf) are not available.

1.2.3 Current Stock Status

The Gulf and Atlantic migratory groups of cobia were last assessed by SEDAR 28 in 2013. The SEDAR 28 stock assessment for Atlantic migratory group cobia (Atlantic cobia) determined that the stock is not overfished nor experiencing overfishing.

1.3 DESCRIPTION OF THE FISHERY

1.3.1 Commercial Fishery

Commercial fisheries statistics throughout this amendment were obtained from the Atlantic Coastal Cooperative Statistics Program (ACCSP), unless otherwise stated.

From 2010 through 2017, annual commercial landings of Atlantic cobia ranged from approximately 33,000 to 91,000 lb ww (Table 1). Total coastwide dockside revenues in constant 2017 dollars from those landings have generally increased since 2010, ranged from approximately $80,000 to $ $235,000 in 2016 (Table 1). The annual average dockside price in 2017 dollars for those eight years was $2.43 per lb ww. The highest landings and revenues occurred in 2016, whereas the lowest for both landings and revenues occurred in 2011. When the Florida east coast zone was still part of the management area for Atlantic cobia, commercial harvest reached the sector's quota of 125,712 lb ww in 2014 and closed on December 11, 2014. Under the modified management area excluding the Florida east coast zone (SAFMC Amendment 20B to CMP FMP – May 2014), the quota for Atlantic cobia was revised to 60,000 lb landed weight (lw) in 2015 and 50,000 lb lw in 2016 and thereafter. Although landings exceeded the 2015 quota, no quota closure was imposed. Commercial landings for 2016 were 90,887 lb (ACCSP, queried April, 2019) and the federal commercial fishery closed on December 6, 2016. Although 2018 landings are not finalized, the 50,000 lb quota was exceeded each of the past two years (2017: 61,817 lb, 2018: TBD) with the federal commercial fishery closing September 5th of each year (Table 1).

Commercial landings of Atlantic cobia have predominantly come from North Carolina, followed by Virginia and South Carolina (Table 1). Georgia landings are relatively small and confidential. Cobia landings north of Virginia are relatively rare and sporadic, thus, Virginia is considered the northernmost major contributor to the commercial Atlantic cobia fishery. One notable feature for Virginia is the surge in landings since 2014, although they were still typically lower than landings in North Carolina. However, after 2016, North Carolina commercial cobia landings and related dockside revenues declined substantially and were much lower than Virginia.

Commercial fishermen harvest cobia using a variety of gear types. Table 2 shows commercial Atlantic cobia landings and revenues by major gear types. Gill nets are the foremost gear type used in harvesting cobia for most years (Table 2), followed by hook and line. Hand line landings have increased substantially since 2010. Longline has been a minor gear type in the commercial harvest of cobia. The 8-year averages for annual dockside revenues from major gear categories range from $80,000-$235,000 (Table 2).

Table 1. Annual commercial Atlantic cobia landings (lb ww) and dockside revenues (2017 $) by state/area 2010-2017. State landings outside of VA-SC are small and may be confidential. Coastwide total landings include all commercial landings in the management unit, GA-NY. Source: ACCSP, queried April, 2019.

Year	SC	NC	VA	Coastwide Total	Federal Season Close Date
	Pounds (whole weight)				
2010	2,749	43,715	8,852	56,255	
2011	4,466	19,924	8,522	33,708	
2012	3,731	31,972	5,389	42,401	
2013	4,254	35,456	11,073	53,313	
2014	3,880	41,798	22,345	69,366	12/12/2014*
2015	2,763	52,684	27,722	84,367	
2016	4,532	48,244	36,460	90,887	12/6/2016
2017	4,590	20,842	36,384	66,289	9/5/2017
2018					9/5/2018
Average	3,871	36,829	19,593	62,073	

Year	SC	NC	VA	Coastwide Total	Federal Season Close Date
	Annual Dockside (Ex-vessel) Revenues in Constant 2017 Dollars[a]				
2010	$10,709	$72,722	$19,511	$105,149	
2011	$19,578	$38,395	$19,994	$80,182	
2012	$15,063	$66,591	$12,036	$97,340	
2013	$15,253	$77,638	$29,569	$129,432	
2014	$11,666	$91,457	$61,993	$169,305	12/12/2014*
2015	$9,043	$114,602	$79,052	$205,779	
2016	$16,664	$110,120	$104,507	$235,023	12/6/2016
2017	$17,409	$50,076	$110,123	$186,964	9/5/2017
2018					9/5/2018
Average	$14,423	$77,700	$54,598	$151,147	

* Included Florida

[a] Nominal dollars converted to 2017 constant dollars using the annual, not seasonally adjusted, GDP implicit price deflator (Index = 2015) provided by the U.S. Bureau of Economic Analysis.

Table 2. Commercial Atlantic cobia landings (lb ww) and dockside revenues (2017 $) by gear, 2010-2017. Source: ACCSP, queried April, 2019.

	Hook and Line	Gill nets	Hand Line	Others	Total
Year	Pounds (Whole Weight)				
2010	14,474	23,327	3,899	14,554	56,255
2011	10,651	9,168	5,463	8,426	33,708
2012	9,854	21,027	2,651	8,869	42,401
2013	20,512	13,279	5,285	14,237	53,313
2014	18,779	23,416	12,895	14,276	69,366
2015	18,535	36,737	16,510	12,585	84,367
2016	17,471	35,426	22,529	15,462	90,887
2017	12,994	21,397	19,348	12,550	66,289
Average	15,409	22,972	11,072	12,620	62,073
Year	Annual Dockside (Ex-vessel) Revenues in Constant 2017 Dollars[a]				
2010	$30,884	$39,643	$9,344	$25,279	$105,149
2011	$30,707	$18,476	$13,877	$17,122	$80,182
2012	$27,683	$43,649	$6,177	$19,831	$97,340
2013	$51,298	$29,339	$14,905	$33,889	$129,432
2014	$45,702	$51,884	$38,621	$33,098	$169,305
2015	$46,786	$80,467	$49,060	$29,465	$205,779
2016	$48,112	$81,962	$64,992	$39,956	$235,023
2017	$39,682	$53,233	$59,516	$34,533	$186,964
Average	$40,107	$49,832	$32,061	$29,147	$151,147

[a] Nominal dollars converted to 2017 constant dollars using the annual, not seasonally adjusted, GDP implicit price deflator (Index = 2015) provided by the U.S. Bureau of Economic Analysis.

1.3.1.1 State-Specific Commercial Fisheries

1.3.1.1.1 *Virginia*

Virginia has had variable commercial landings of cobia since the Virginia Marine Resources Commission instituted mandatory reporting in 1993, with landings being high in the mid-1990s (Appendix I, Table A1), lower in the mid-2000s, steadily increasing from 2013-2017, and peaking in 2016 and 2017. There was a decline in commercial landings in 2018 (preliminary from VMRC; Appendix I, Table A1) contributed in part to state regulations limiting harvest to two fish per commercial license holder, or six per vessel. In most circumstances, there is only one licensed fishermen onboard each vessel, restricting daily landings to two fish. There is a small but directed hook-and-line fishery, which has been the prominent gear since 2007 with over 71% of the harvest the past ten years. Bycatch landings occur from gillnets (12.1%) and pound nets (8.2%), although these landings can be sizable. Other gears that have caught cobia include haul seines (1.34%) and trawls (1.99%).

1.3.1.1.2 *North Carolina*

Commercial landings of cobia in North Carolina are available from 1950 to the present.

However, monthly landings are not available until 1974. North Carolina instituted mandatory reporting of commercial landings through their Trip Ticket Program, starting in 1994. Landings information collected since 1994 are considered the most reliable. The primary fisheries associated with cobia in North Carolina are the snapper-grouper, coastal pelagic troll, and the large mesh estuarine gill net fisheries. Cobia landings from 1950 – 2018 have ranged from a low of 600 lb (1951; 1955) to a high of 52,684 lb (2015) with average landings of 16,730 lb over the 68-year time series (landings since 1981 shown in Appendix I, Table A1). Since 2010, landings have ranged from 19,924 lb (2011) to 52,684 lb (2015), averaging 36,829 lb (Table 1).

The primary commercial gear used to harvest cobia has changed over time. This is most likely due to changing fisheries and the fact that it is mostly considered a marketable bycatch fishery, especially after North Carolina adopted the CMP FMP measures of 33-inches minimum FL and two-per person possession limit in 1991. From 1950 to the late 1970s, cobia were mostly landed out of the haul seine fishery. Most landings that occurred during the 1980s came from the pelagic troll and hand line fishery with modest landings from the haul seine and anchored gill net fishery. From 1994-2018, the majority of landings have occurred from the anchored gill net and pelagic troll and hand line fisheries with gill nets being the top gear during most of those years.

1.3.1.1.3 *South Carolina*

There is a limited commercial fishery for cobia in South Carolina. Cobia are a state-designated Gamefish, and as such, cobia landed in state waters may not be sold commercially. However, cobia landed in Federal waters can be sold commercially under current regulations. Commercial cobia landings have ranged from 2,700-4,600 lb per year with an annual mean of 3,800 lb per year for 2010-2017 and dollar values (2017 dollars) ranging from $9,000-$19,600 annually (Table 1).

1.3.1.1.4 *Georgia*

There is no directed commercial fishery for cobia in Georgia. Commercial landings may occur but they are typically the result of bycatch in other targeted fisheries. Some illegal sale of recreationally-caught cobia may occur; however, the total amount and dockside value is relatively small. The greatest recorded landings in Georgia (since annual landings became available in 1979) occurred in 1993 when 2,730 lb of cobia were landed resulting in a market value of $4,728 (in nominal dollars).

1.3.2 Recreational Fishery

The recreational sector is comprised of a private component and a for-hire component. The private component includes anglers fishing from shore (including all land-based structures) and private/rental boats. The for-hire component is composed of charter boats and headboats (also called partyboats). Although charter boats tend to be smaller, on average, than headboats, the key distinction between the two types of operations is how the fee is typically determined. On a charter boat trip, the fee charged is for the entire vessel, regardless of how many passengers are carried, whereas the fee charged for a headboat trip is paid per individual angler.

1.3.2.1 Permits

There are no specific federal permitting requirements for recreational anglers to fish for or harvest cobia. Instead, anglers are required to possess either a state recreational fishing permit that authorizes saltwater fishing in general, or be registered in the federal National Saltwater Angler Registry system, subject to appropriate exemptions.

Recently, the states of North Carolina and Virginia have developed programs to survey recreational cobia fishermen. These programs may provide information in the future that would help characterize the cobia fisheries in these states.

1.3.2.2 Harvest

In July, 2018, the MRIP began releasing recreational harvest information with fishing effort estimated or calibrated according to the mail-based Fishing Effort Survey (FES), rather than the previously used Coastal Household Telephone Survey (CHTS). Recreational landings shown in this section and throughout the amendment are shown as FES estimates/calibrations, although 2018 and 2019 regulations and landings are based on calibrations to CHTS effort. The FES calibrations and estimates are being incorporated into the ongoing stock assessment. Upon completion of the stock assessment and acceptance by the Board for management use, FES estimates will be used for setting quotas and targets and evaluating recreational harvests. For comparative and short-term management purposes, Appendix I, Table A2, shows recreational harvest estimates in pounds since 1981 based on the CHTS effort estimates or calibrations. Appendix I, Table A3, shows recreational harvest estimates in pounds since 1981 based on the FES effort estimates or calibrations.

On average, from 2010 through 2018, the recreational sector landed approximately 1,837,610 lb ww of Atlantic cobia (Table 3). North Carolina has been the dominant state in recreational landings of cobia, followed by Virginia, South Carolina, and Georgia. Cobia landings north of Virginia are relatively rare and sporadic, thus, Virginia is considered the northernmost major contributor to the recreational Atlantic cobia fishery. However, in 2018, recreational landings of cobia were reported in Delaware, as well as outside of the management unit in Connecticut. Harvests from these states are considered minimal, however this information could indicate that cobia migrate further north than expected.

The private/rental mode has been the most dominant fishing mode for harvesting cobia (Table 4). Party boats have provided the lowest contribution to recreational landings of cobia. Information reported in Table 4 indicates that harvest estimates in 2018 were the highest across all modes in the time-series except for the private/rental mode in 2015. Harvest levels in 2018 were also higher across all modes in comparison to the long-term average (2010 through 2018).

Table 3. Annual recreational landings (lb ww) of Atlantic cobia, by state, 2010-2018 preliminary). Source: MRIP, queried April, 2019.

Year	NJ	DE	MD	VA	NC	SC	GA	Total
2010	0	0	1,179	557,907	808,227	100,614	230,865	1,698,792
2011	0	0	0	341,751	399,192	0	182,799	923,742
2012	60,473	0	0	47,547	102,077	214,512	512,499	937,108
2013	0	0	0	488,181	980,541	24,005	43,915	1,536,642
2014	0	0	0	499,218	645,427	79,171	42,481	1,266,297
2015	0	0	0	1,166,000	1,925,762	434,899	102,917	3,629,578
2016	0	0	307	1,505,528	838,363	159,345	0	2,503,543
2017	0	0	0	488,287	872,861	0	390	1,361,538
2018	0	9,664	3,254	1,936,274	561,526	160,191	6,226	2,677,135
Average	6,719	1,074	527	781,188	792,664	130,304	124,677	1,837,153

Source: MRIP, queried April, 2019.

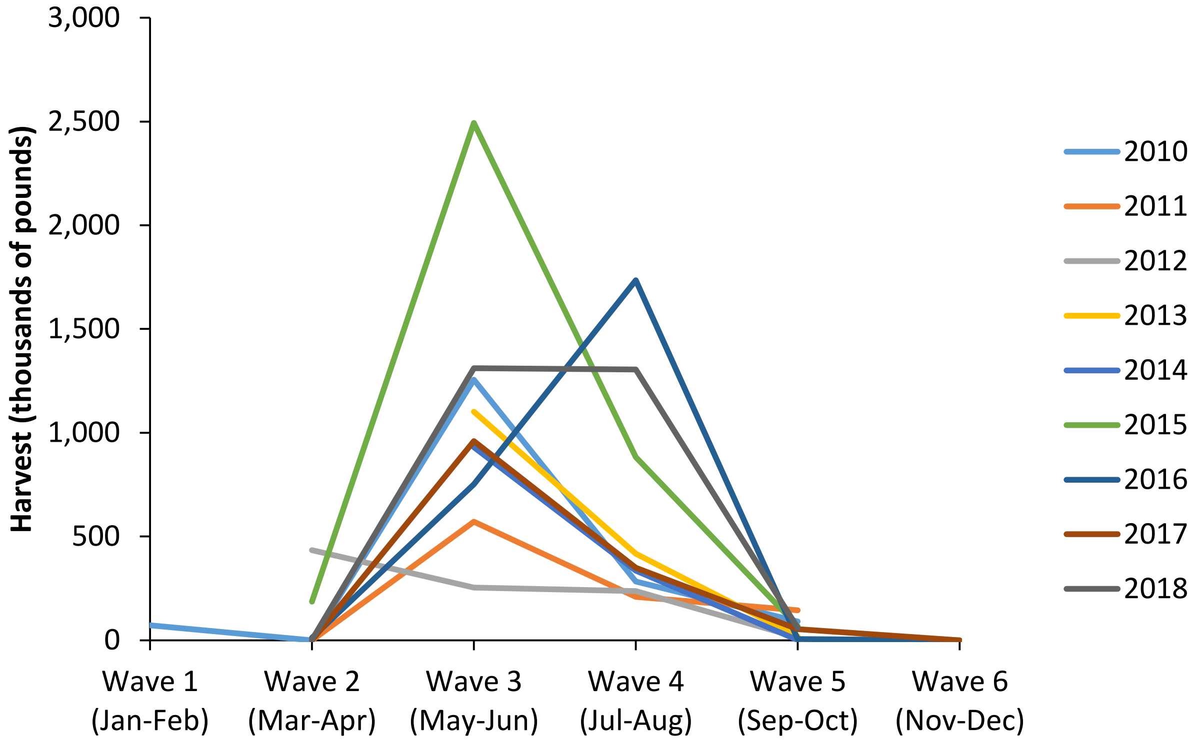
Table 4. Annual recreational landings (lb ww) of Atlantic cobia, by fishing mode, 2010-2018 (preliminary).

Year	CHARTER BOAT	PRIVATE/RENTAL BOAT	SHORE	Grand Total
2010	99,424	1,550,698	48,670	1,698,792
2011	17,668	771,218	134,856	923,742
2012	21,605	855,030	60,473	937,108
2013	98,524	1,438,118	0	1,536,642
2014	56,727	1,057,192	152,377	1,266,296
2015	70,342	3,303,860	255,375	3,629,577
2016	116,598	1,921,275	465,671	2,503,544
2017	47,407	1,314,131	0	1,361,538
2018	138,276	1,977,726	559,635	2,675,637
Average	74,063	1,576,583	186,340	1,836,986

Source: MRIP, queried April, 2019.

Peak recreational landings of cobia typically occur in Wave 3 (May-June) each year (Figure 1). In 2016, recreational landings peaked in Wave 4 (July-August). Recreational landings steeply increased from Wave 2 (March-April) to their peak and also steeply declined after the peak wave. Landings are concentrated around the Waves 3 and 4. In 2018, the peak was broader with similar landings in Waves 3 and 4.

Figure 1. Distribution of Atlantic cobia recreational harvest, by wave, 2010-2018 (preliminary). Source: MRIP, queried April, 2019.



1.3.2.3 Effort

Recreational effort derived from the Marine Recreational Fisheries Statistics Survey (MRFSS)/MRIP database can be characterized in terms of the number of trips as follows:

Target effort - The number of individual angler trips, regardless of duration, where the intercepted angler indicated that the species or a species in the species group was targeted as either the first or second primary target for the trip. The species did not have to be caught.

Catch effort - The number of individual angler trips, regardless of duration and target intent, where the individual species or a species in the species group was caught. The fish did not have to be kept.

Total recreational trips - The total estimated number of recreational trips in the Atlantic, regardless of target intent or catch success.

Other measures of effort are possible, such as the number of harvest trips (the number of individual angler trips that harvest a particular species regardless of target intent), and directed trips (the number of individual angler trips that either targeted or caught a particular species), but the three measures of effort listed above are used in this assessment.

Estimates of annual Atlantic cobia effort (in terms of individual angler trips) for 2010-2018 are provided in Table 5 for target trips and Table 6 for catch trips. Target and catch trips are shown by fishing mode (charter, private/rental, shore) for Georgia, South Carolina, North Carolina, and Virginia. These are trips for cobia in state or federal waters off of these states. Estimates of cobia target and catch trips for additional years, and other measures of directed effort, are available at http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-dataquery/queries/index.

Cobia is one of the few species where target trips generally exceed catch trips. The 2010-2018 average target trips were 4,721 for the charter mode, 291,682 for the private/rental mode, and 143,999 for the shore mode (Table 5). In contrast, the average catch trips were 2,896 for the charter mode, 38,965 for the private/rental mode, and 3,240 for the shore mode (Table 6). This is suggestive of a relatively strong interest in fishing for cobia among recreational anglers across all fishing modes. For each state, the private/rental mode has been the most dominant fishing mode both in target and catch effort.

Headboat data in the Southeast do not support the estimation of target or catch effort because target intent is not collected and the harvest data (the data reflects only harvest information and not total catch) are collected on a vessel basis and not by individual angler. Table 7 contains estimates of the number of headboat angler days for the South Atlantic states for 2010-2017. Georgia and South Carolina data are combined for confidentiality purposes. Virginia information was not available because only South Atlantic headboats are included in the SRHS.

Table 5. Target trips for Atlantic cobia, by fishing mode and state, 2010-2018 (preliminary). Source: NOAA Fisheries, Fisheries Statistics Division, queried April, 2019.

Year	Georgia	S. Carolina	N. Carolina	Virginia	Total
			Charter		
2010	0	3,239	1,904	499	5,642
2011	21	1,423	1,386	245	3,075
2012	0	987	251	10	1,248
2013	0	0	2,446	24	2,470
2014	0	1,247	1,463	299	3,009
2015	658	1,430	2,541	1,430	6,059
2016	0	1,477	4,192	519	6,188
2017	0	1,409	3,723	678	5,810
2018	359	570	6,953	1,103	8,985
Average	115	1,309	2,762	534	4,721
			Private/Rental		
2010	5,725	28,751	74,155	159,971	268,602
2011	8,774	46,087	39,326	105,236	199,423
2012	12,959	96,256	40,374	52,301	201,890
2013	38,131	60,983	97,360	121,668	318,142
2014	1,754	37,370	111,211	125,694	276,029
2015	47,929	36,447	146,966	120,189	351,531
2016	7,332	42,256	147,313	192,557	389,458
2017	402	1,352	140,667	152,785	295,206
2018	3,861	14,945	69,677	236,378	324,861
Average	14,096	40,494	96,339	140,753	291,682
			Shore		
2010	0	0	26,791	32,717	59,508
2011	0	0	23,836	10,078	33,914
2012	0	5,304	36,502	92,793	134,599
2013	0	3,528	58,781	21,160	83,469
2014	0	77,879	49,807	77,879	205,565
2015	0	1,583	106,171	96,147	203,901
2016	0	171	132,730	85,610	218,511
2017	0	0	102,087	130,665	232,752
2018	0	11,563	75,279	36,931	123,773
Average	0	11,114	67,998	64,887	143,999

Table 6. Catch trips for Atlantic cobia, by fishing mode and state, 2010-2018 (preliminary). Source: NOAA Fisheries, Fisheries Statistics Division, queried April, 2019.

Year	Georgia	S. Carolina	N. Carolina	Virginia	Total
	Charter				
2010	74	942	3,297	179	4,492
2011	369	0	778	25	1,172
2012	63	0	306	10	379
2013	160	48	1,802	24	2,034
2014	54	0	1,702	0	1,756
2015	0	598	2,047	1,302	3,947
2016	0	809	2,818	208	3,835
2017	37	0	1,237	133	1,407
2018	314	796	5,173	759	7,042
Average	119	355	2,129	293	2,896
	Private/Rental				
2010	7,776	2,322	15,713	15,876	41,687
2011	7,898	0	4,870	5,867	18,635
2012	15,090	5,830	2,946	1,348	25,214
2013	788	1,566	28,193	15,753	46,300
2014	3,667	4,727	18,101	17,444	43,939
2015	8,934	13,320	35,080	9,744	67,078
2016	0	5,892	8,392	13,863	28,147
2017	0	0	16,982	10,652	27,634
2018	0	4,521	11,151	36,378	52,050
Average	4,906	4,242	15,714	14,103	38,965
	Shore				
2010	0	0	2,447	0	2,447
2011	0	0	6,583	0	6,583
2012	0	0	0	0	0
2013	0	0	0	0	0
2014	0	0	5,437	0	5,437
2015	0	0	7,591	0	7,591
2016	0	0	4,918	0	4,918
2017	0	0	0	0	0
2018	0	1,375	806	0	2,181
Average	0	153	3,087	0	3,240

Table 7. South Atlantic headboat angler days, by state, 2010-2017. Source: NOAA Fisheries Southeast Region Headboat Survey (SRHS).

Year	GA/SC	NC	TOTAL
2010	46,908	21,071	67,979
2011	46,210	18,457	64,667
2012	42,064	20,766	62,830
2013	42,853	20,547	63,400
2014	44,092	22,691	66,783
2015	41,479	22,716	64,195
2016	43,954	21,565	65,519
2017	38,655	20,170	58,825
Average	43,277	20,998	64,275

1.3.2.4 State Specific Recreational Fisheries

1.3.2.4.1 *Virginia*

Virginia's recreational landings of cobia have been highly variable since the mid-1980s, with the lowest estimate being 21,167 lb in 1987 and the highest being 1,936,274 lb in 2018. The recreational fishery seems to have grown in recent years, both in the number of participants, and the effectiveness of fishing due to the advent of sight-casting – especially when aided by "cobia towers." Traditionally, cobia had been targeted using live-bait bottom-fishing, but these new techniques are causing a shift in preference among anglers.

Other states experience pulses of abundance in cobia as they migrate up and down the Atlantic coast. However, the amount of time cobia spend in Virginia waters is substantially longer that of other Mid-Atlantic states. Cobia can be found in Virginia waters from mid-May through the end of October.

In 2016, Virginia developed a monitoring program to survey recreational cobia fisherman. The program was developed to characterize Virginia's cobia fishery for future management.

1.3.2.4.2 *North Carolina*

Historically, recreational fisherman targeted cobia from a vessel by anchoring and fishing with dead, live, or a mixture of both bait types near inlets and deep water sloughs inshore (Manooch, 1984). Fish were also harvested from shore or off of piers using dead or live bait. In the early 2000s, fishermen began outfitting their vessels with towers to gain a higher vantage point to spot and target free-swimming cobia along tidelines and around bait aggregations. This method of fishing actively targets cobia in the nearshore coastal zone and has become the primary mode of fishing in most parts of the state.

Recreational harvests of cobia in North Carolina from 1981-2018 have ranged from a low of 0 lb (1983) to a high of 1,925,762 lb (2015) (Appendix I, Table A3). Landings during the 1980s and 1990s remained relatively constant from year to year. Landings began to increase and become more variable beginning in the mid-2000s. From 2010-2018, recreational cobia landings in North Carolina ranged from 102,077 to 1,925,762 lb (792,664 lb on average). Seasonally, cobia are landed mostly in the spring and summer months corresponding with their spring spawning migration (Smith, 1995). Peak landings occur during the latter part of May into June and quickly diminish thereafter. However, recreational landings of cobia can occur through the month of October.

1.3.2.4.3 *South Carolina*

The recreational fishery accounts for the majority of cobia landings in South Carolina. The fishery occurs in both nearshore waters and around natural and artificial reefs offshore. Historically, the majority of cobia landings have occurred in state waters in and around spawning aggregations from April through May. However, due to intense fishing pressure in the inshore zone, annual landings of cobia have fallen drastically since 2009, such that the majority of recreationally caught cobia in South Carolina now come from offshore (federal) waters. Anglers begin targeting cobia in late April-early May with the peak of the season typically occurring May into early June. Late season catches can occur on nearshore reefs through October depending on water temperatures.

1.3.2.4.4 *Georgia*

A large recreational fishery exists for cobia in Georgia. The majority of this fishery occurs in nearshore waters around natural and artificial reefs. While there are some instances of cobia being caught inshore and on beach front piers in Georgia, most landings come from outside state waters. Anglers begin targeting cobia in late April-early May with the peak of the season typically occurring in June. Late season catches often occur on nearshore reefs through October depending on water temperatures. However, these fall runs of fish are sporadic and are often missed by anglers.

1.3.3 Subsistence Fishing

No subsistence fisheries for Atlantic cobia have been identified at this time.

1.3.4 Non-Consumptive Factors

No significant non-consumptive factors for Atlantic cobia have been identified at this time.

1.3.5 Interactions with Other Fisheries

The recreational cobia fishery tends to be a targeted fishery. Various small and large coastal sharks and ray species are the most common bycatch. Cobia are encountered as bycatch in the troll and live bait fisheries for king and Spanish mackerel, dolphin, and other pelagic species.

Additionally, cobia are taken incidental to offshore bottom fishing activities for snapper/grouper species.

The commercial cobia fishery is primarily bycatch in the same troll fisheries and taken incidental to snapper/grouper fisheries. Some directed harvest does occur; however, low limits preclude a large scale fishery.

1.4 HABITAT CONSIDERATIONS

1.4.1 Habitat Important to the Stocks

1.4.1.1 Description of the Habitat

1.4.1.1.1 *Spawning Habitat*

Cobia spawn in nearshore waters along the South Atlantic coast from April through June. Nearby states (South Carolina) have documented the presence of inshore spawning aggregations of cobia (Lefebvre and Denson, 2012). However, there have been no such aggregations identified in Georgia. Eggs and larvae are typically found in nearshore waters and juveniles most often occur inshore or in protected nearshore waters.

Cobia enter nearshore waters along the south Atlantic Coast when water temperatures reach 20-21 °C, usually late April and aggregate to spawn through June. Histological evaluation of gonads from these nearshore collections suggest cobia are mature and spawning in inshore waters of high salinity estuaries (Callibogue, Port Royal Sound and St. Helena Sound in SC) (Lefebvre and Denson, 2012). The inshore spawning aggregations in South Carolina have been determined to be genetically distinct from the Atlantic stock of cobia (Darden et al., 2014). These findings are corroborated by conventional tag-recapture information and show estuarine fidelity for spawning fish and natal homing annually into estuaries. Eggs and larvae are typically found in nearshore waters where there is significant retention time of estuarine waters; however, juveniles (< 2yrs of age) are only occasionally caught inshore or in protected nearshore waters making it unclear what habitat the majority of this life stage utilizes until they mature and join spawning aggregations (Lefebvre and Denson, 2012).

1.4.1.1.2 *Larval Habitat*

Little is known about the larval stages of cobia. Larvae have been collected in pelagic waters of the Gulf of Mexico (65-134 m isobaths), within a meter of the water column (Ditty and Shaw, 1992).

1.4.1.1.3 *Juvenile Habitat*

Juveniles, like larvae, have also been found in pelagic waters of the Gulf of Mexico, and are believed to utilize floating *Sargassum* as habitat in such areas (Ditty and Shaw, 1992). Early juveniles then move to high-salinity, inshore areas along beaches, river mouths, barrier islands, and bays/inlets (Swingle, 1971; McClane, 1974; Hoese and Moore, 1977; Benson, 1982).

1.4.1.1.4 *Adult Habitat*

Adults enter estuaries on a seasonal basis but otherwise inhabit coastal waters and the continental shelf (Collette et al., 1978; Benson, 1982; Robins and Ray, 1986). Although generally considered pelagic, adult cobia are found at various depths throughout the water column (Freeman and Walford, 1976). They do not appear to be substratum-specific, but extensive tagging research is currently being conducted by various states along the U.S. Atlantic coast to better determine movement and habitat usage.

1.4.1.1.4.1 South Atlantic Region

The continental shelf off the southeastern U.S., extending from the Dry Tortugas, FL, to Cape Hatteras, NC, encompasses an area in excess of 100,000 square km (Menzel, 1993). Based on physical oceanography and geomorphology, this environment can be divided into two regions: Dry Tortugas, FL, to Cape Canaveral, FL, and Cape Canaveral, FL, to Cape Hatteras, NC. The continental shelf from the Dry Tortugas, FL, to Miami, FL, is approximately 25 km wide and narrows to approximately 5 km off Palm Beach, FL. The shelf then broadens to approximately 120 km off Georgia and South Carolina before narrowing to 30 km off Cape Hatteras, NC. The Florida Current/Gulf Stream flows along the shelf edge throughout the region. In the southern region, this boundary current dominates the physics of the entire shelf (Lee et al., 1994).

In the northern region, additional physical processes are important and the shelf environment can be subdivided into three oceanographic zones (Atkinson et al., 1985; Menzel, 1993), the outer shelf, mid-shelf, and inner shelf. The outer shelf (40-75 meters (m)) is influenced primarily by the Gulf Stream and secondarily by winds and tides. On the mid-shelf (20-40 m), the water column is almost equally affected by the Gulf Stream, winds, and tides. Inner shelf waters (0-20 m) are influenced by freshwater runoff, winds, tides, and bottom friction.

Water masses present from the Dry Tortugas, FL, to Cape Canaveral, FL, include Florida Current water, waters originating in Florida Bay, and shelf water. Spatial and temporal variation in the position of the western boundary current has dramatic effects on water column habitats. Variation in the path of the Florida Current near the Dry Tortugas induces formation of the Tortugas Gyre (Lee et al., 1992; Lee et al., 1994). This cyclonic eddy has horizontal dimensions of approximately 100 km and may persist near the Florida Keys for several months. The Pourtales Gyre, which has been found to the east, is formed when the Tortugas Gyres moves eastward along the shelf. Upwelling occurs in the center of these gyres, thereby adding nutrients to the near surface (<100 m) water column. Wind and input of Florida Bay water also influence the water column structure on the shelf off the Florida Keys (Smith, 1994; Wang et al., 1994). Further downstream, the Gulf Stream encounters the “Charleston Bump”, a topographic rise on the upper Blake Ridge where the current is often deflected offshore resulting in the formation of a cold, quasi-permanent cyclonic gyre and associated upwelling (Brooks and Bane, 1978). On the continental shelf, offshore projecting shoals at Cape Fear, Cape Lookout, and Cape Hatteras, NC, affect longshore coastal currents and interact with Gulf Stream intrusions to produce local upwelling (Blanton et al., 1981; Janowitz and Pietrafesa, 1982). Shoreward of the Gulf Stream, seasonal horizontal temperature and salinity gradients define the mid-shelf and inner-shelf fronts. In coastal waters, river discharge and estuarine tidal plumes contribute to the water column structure.

The water column from Dry Tortugas, FL, to Cape Hatteras, NC, serves as habitat for many marine fish and shellfish. Most marine fish and shellfish release pelagic eggs when spawning and thus, most species utilize the water column during some portion of their early life history (Leis, 1991; Yeung and McGowan, 1991). Many fish inhabit the water column as adults. Pelagic fishes include numerous clupeoids, flying fish, jacks, cobia, bluefish, dolphin, barracuda, and the mackerels (Schwartz, 1989). Some pelagic species are associated with particular benthic habitats, while other species are truly pelagic.

1.4.1.1.4.2 Mid-Atlantic Region

Information about the physical environment of the Mid-Atlantic region was provided by the Mid-Atlantic Fishery Management Council (MAFMC) and adapted from the 2016 Mackerel, Squid, and Butterfish Specifications Environmental Assessment, available at: http://www.greateratlantic.fisheries.noaa.gov/regs/2016/January/16msb2016specspr.html.

Climate, physiographic, and hydrographic differences separate the Atlantic Ocean from Maine to Florida into the New England-Middle Atlantic Area and the South Atlantic Area (division/mixing at Cape Hatteras, NC). The inshore New England-Middle Atlantic area is fairly uniform physically and is influenced by many large coastal rivers and estuarine areas. The continental shelf (characterized by water less than 650 ft. in depth) extends seaward approximately 120 miles off Cape Cod, narrows gradually to 70 miles off New Jersey, and is 20 miles wide at Cape Hatteras. Surface circulation is generally southwesterly on the continental shelf during all seasons of the year, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. Water temperatures range from less than 33^{o}F from the New York Bight north in the winter to over 80^{o}F off Cape Hatteras in summer.

Within the New England-Middle Atlantic Area, the Northeast U.S. Continental Shelf Large Marine Ecosystem includes the area from the Gulf of Maine to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream. The Northeast U.S. Continental Shelf Large Marine Ecosystem is a dynamic, highly productive, and intensively studied system providing a broad spectrum of ecosystem goods and services. This region, encompassing the continental shelf area between Cape Hatteras and the Gulf of Maine, spans approximately 250,000 km^2 and supports some of the highest revenue fisheries in the U.S. The system historically underwent profound changes due to very heavy exploitation by distant-water and domestic fishing fleets. Further, the region is experiencing changes in climate and physical forcing that have contributed to large-scale alteration in ecosystem structure and function. Projections indicate continued future climate change related to both short and medium-term cyclic trends as well as non-cyclic climate change.

A number of distinct subsystems comprise the region. The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and fast-moving currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC. Detailed information on the affected physical and biological environments inhabited by the managed resources is available in Stevenson et al. (2004).

1.4.2 Identification and Distribution of Habitat and Habitat Areas of Particular Concern

Habitat information for Atlantic cobia is sparse. Few, if any, fishery independent surveys consistently interact with cobia in numbers adequate to develop any trends or conclusions. Much of the habitat data presented is generic for the coastal migratory pelagic fishes that include king and Spanish mackerel. Species-specific habitat information is a data and research need.

A description of the Habitat Areas of Particular Concern (HAPC) for CMP species is provided in Amendment 18 to the CMP FMP (GMFMC and SAFMC, 2011), and is incorporated herein by reference. Areas which meet the criteria for HAPCs include sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream; The Point, the Ten-Fathom Ledge, and Big Rock (North Carolina); The Charleston Bump and Hurl Rocks (South Carolina); The Point off Jupiter Inlet (Florida); *Phragmatopoma* (worm reefs) reefs off the central east coast of Florida; nearshore hard bottom south of Cape Canaveral; The Hump off Islamorada (Florida); The Marathon Hump off Marathon (Florida); The “Wall” off of the Florida Keys; Pelagic *Sargassum*; and Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the Estuarine Living Marine Resources Program. Estuaries meeting this criteria for Spanish mackerel include Bogue Sound and New River (North Carolina), for cobia, Broad River (South Carolina).

1.4.3 Present Condition of Habitats and Habitat Areas of Particular Concern

1.4.3.1 Coastal Spawning Habitat: Condition and Threats Coastal Spawning

It is reasonable to assume that areas where coastal development is taking place rapidly, habitat quality may be compromised. Coastal development is a continuous process in all states and all coastal areas in the nation are experiencing significant growth. The following section describes particular threats to the nearshore habitats in the South Atlantic that meet the characteristics of suitable spawning habitat for cobia.

One threat to the spawning habitat for cobia is navigation and related activities such as dredging and hazards associated with ports and marinas (ASMFC, 2013). According to the SAFMC (1998), impacts from navigation related activities on habitat include direct removal/burial of organisms from dredging and disposal of dredged material, effects due to turbidity and siltation; release of contaminants and uptake of nutrients, metals, and organics; release of oxygen-consuming substances, noise disturbance, and alteration of the hydrodynamic regime and physical characteristics of the habitat. All of these impacts have the potential to substantially decrease the quality and extent of cobia spawning habitat.

Besides creating the need for dredging operations that directly and indirectly affect spawning habitat for cobia, ports also present the potential for spills of hazardous materials. The cargo that arrive and depart from ports include highly toxic chemicals and petroleum products. Although spills are rare, constant concern exists, since huge expanses of productive estuarine and nearshore habitat are at stake. Additional concerns related to navigation and port utilization are discharge of marine debris, garbage, and organic waste into coastal waters.

Maintenance and stabilization of coastal inlets is of concern in certain areas of the southeastern U.S. Studies have implicated jetty construction to alterations in hydrodynamic regimes, thus, affecting the transport of estuarine-dependent organisms' larvae through inlets (Miller et al., 1984; Miller, 1988).

1.4.3.2 Estuarine Nursery, Juvenile and Sub-adult Habitat: Condition and threats

Coastal wetlands and their adjacent estuarine waters likely constitute primary nursery, juvenile, and sub-adult habitat for cobia along the coast. Between 1986 and 1997, estuarine and marine wetlands nationwide experienced an estimated net loss of 10,400 acres. However, the rate of loss was reduced over 82% since the previous decade (Dahl, 2000). Most of the wetland loss resulted from urban and rural activities and the conversion of wetlands for other uses. Along the southeast Atlantic coast, the state of Florida experienced the greatest loss of coastal wetlands due to urban or rural development (Dahl, 2000). However, the loss of estuarine wetlands in the southeast has been relatively low over the past decade, although there is some evidence that invasion by exotic species, such as Brazilian pepper (*Schinus terebinthifolius*), in some areas could pose potential threats to fish and wildlife populations in the future (T. Dahl, pers. comm.).

Throughout the coast, the condition of estuarine habitat varies according to location and the level of urbanization. In general, it can be expected that estuarine habitat adjacent to highly developed areas will exhibit poorer environmental quality than more distant areas. Hence, environmental quality concerns are best summarized on a watershed level.

Threats to estuarine habitats of the southeast were described in Amendment 2 to the Red Drum FMP (ASMFC, 2002). Due to the cobia's similar dependence on estuarine habitats throughout its early life history, these same threats are likely to impact cobia as well.

Nutrient enrichment of estuarine waters throughout the southeast is a major threat to the quality of estuarine habitat. Forestry practices contribute significantly to nutrient enrichment in the southeast. Areas involved are extensive and many are in proximity to estuaries. Urban and suburban developments are perhaps the most immediate threat to cobia habitat in the southeast. The almost continuous expansion of ports and marinas in the South Atlantic poses a threat to aquatic and upland habitats. Certain navigation-related activities are not as conspicuous as port terminal construction but have the potential to significantly impact the estuarine habitat upon which cobia depend. Activities related to watercraft operation and support pose numerous threats including discharge of pollutants from boats and runoff from impervious surfaces, contaminants generated in the course of boat maintenance, intensification of existing poor water quality conditions, and the alteration or destruction of wetlands, shellfish and other bottom communities for the construction of marinas and other related infrastructure.

Estuarine habitats of the southeast can be negatively impacted by hydrologic modifications. The latter include activities related to aquaculture, mosquito control, wildlife management, flood control, agriculture and silviculture. Also, ditching, diking, draining, and impounding activities associated with industrial, urban, and suburban development qualify as hydrologic modifications that may impact the estuarine habitat. Alteration of freshwater flows into estuarine areas may change temperature, salinity, and nutrient regimes as well as alter wetland coverage. Studies have demonstrated that changes in salinity and temperature can have profound effects in estuarine fishes (Serafy et al., 1997) and that salinity partly dictates the distribution and abundance of estuarine organisms (Holland et al., 1996). Cobia may be similarly susceptible to such changes in the physical regime of their environment.

1.4.3.3 Adult Habitat: Condition and Threats

Threats to the cobia's adult habitat are not as numerous as those faced by postlarvae, juveniles, and sub-adults in the estuarine and coastal waters. Current threats to the nearshore and offshore habitats that adult cobia utilize in the South Atlantic include navigation and related activities, dumping of dredged material, mining for sand and minerals, oil and gas exploration, offshore wind facilities, and commercial and industrial activities (SAFMC, 1998).

An immediate threat is the sand mining for beach nourishment projects. Associated threats include burial of bottoms near the mine site or near disposal sites, release of contaminants directly or indirectly associated with mining (i.e. mining equipment and materials), increases in turbidity to harmful levels, and hydrologic alterations that could result in diminished desirable habitat.

Offshore mining for minerals may pose a threat to cobia habitat in the future. Currently, no mineral mining activities are taking place in the South Atlantic. However, various proposals to open additional areas off the Atlantic coast to seabed mining have been introduced by the Federal Executive and Legislative branches.

Offshore wind farms may also pose a threat to cobia habitat throughout different life stages in the future (ASMFC, 2012). The first US offshore wind farm was established in 2016. Several additional wind farm projects have been proposed, including locations off the US Mid-Atlantic, which could impact cobia habitat.

1.5 IMPACTS OF THE FISHERY MANAGEMENT PROGRAM

1.5.1 Biological and Environmental Impacts

Significant recreational fishery overages of the ACL in 2015 and 2016 raise concerns over the future status of the stock and potential of the stock becoming overfished. Adoption of coastwide management measures can provide flexibility to states while maintaining harvest within the ACL and protecting a portion of the spawning stock. Limits on catch can provide additional protection throughout cobia's geographic range to support a sustained population and fishery.

1.5.2 Social Impacts

This section and the following, *1.5.3 Economic Impacts*, summarize selected impact considerations that are mainly based on social and economic analyses in Chapters 3 and 4 of Amendment 31 to the CMP FMP (see SAFMC, 2018) and Amendment 20B to the CMP FMP (GMFMC and SAFMC, 2014).

In order to understand the possible social impacts that any proposed and/or new rules and regulations may have on participants in any fishery, in-depth community profiles are needed. Very limited applied social science research has been conducted on recreational and commercial fishing communities identified as being linked to Atlantic cobia harvesting. Therefore, adequate information to qualitatively or quantitatively address the possible social impacts of proposed cobia fishery management actions on communities are not currently available.

Regardless, notable social science research completed during the previous decade included a NOAA funded project that employed rapid assessment methods to document the location, type, and history of fishing communities in the South Atlantic region. SAFMC staff worked collaboratively with the University of Florida on a project that described fishing communities in a broad manner (for example, whether the community is characterized mostly by the commercial fishing sector, the for-hire component, the recreational angler component or some combination of these), and linked on-the-ground fieldwork with the collection of secondary data including U.S. Census records, landings, permits, and state information (see Jepson et al., 2005). This research contributed to forming an important historical South Atlantic fishery baseline dataset that has assisted in the measurement of social and economic impacts related to fishery management actions and has also helped to better understand external socioeconomic factors (e.g. demand for coastal waterfront property) influencing South Atlantic fishing communities.

Limited, currently available social impact information includes demographic descriptions of South Atlantic fishing communities (see the SERO (2019) Community Snapshots 10[1]) as well as three sets of 2016 indices generated to judge the potential social vulnerability of Atlantic fishing communities (SAFMC, 2018a). The indices' variables were identified through the literature as being important components that contribute to a community's vulnerability (Jepson and Colburn, 2013; Jacob et al., 2013). While this information is useful in broadly characterizing fishing communities, there is currently no social impact information available that is specific to Atlantic cobia fisheries.

1.5.2.1 Recreational Fishery

The recreational sector of the Atlantic cobia fishery is much larger than the commercial sector, and cobia is an important species for the recreational sector that includes the private angler and for-hire components. Recreational landings estimates indicate that private recreational anglers constitute the dominant component of the fishery (Table 4), and most landings are associated with Virginia and North Carolina (Table 3). Therefore, implementation of Amendment 1 to the cobia FMP is expected to impact the recreational sector. Specifically, it is likely that social impacts would be most significant for private recreational fishermen and related businesses as well as for-hire businesses and their angler customers in Virginia and North Carolina.

Using 2016 data, South Atlantic (excluding Florida) fishing communities were evaluated according to recreational engagement scores, which were based on a factor analysis of several criteria including the number of charter permits and level of recreational fishing infrastructure (SAFMC, 2018). This metric was not specific to cobia, so it was assumed that the overall recreational engagement measure would be generally congruent with engagement specific to cobia. SAFMC (2018) concluded that the South Atlantic communities of Atlantic Beach, Hatteras, Manteo and Morehead City, North Carolina, and Charleston, Hilton Head, Little River and Murrells Inlet, South Carolina all exceeded the 2016 ranking threshold of 1 standard deviation and therefore would "…likely have some dependence upon recreational fishing."

With regard to Virginia recreational fishing communities, SAFMC (2018) noted that recreational fishing communities of Northumberland and Hampton have seen recent increases (e.g. during 2015 and/or 2016) in their cobia harvest. Input from public comments and attendance at public hearings also indicted that Virginia Beach, Virginia, is an important community for recreational cobia harvesting.

---

[1] https://sero.nmfs.noaa.gov/sustainable_fisheries/social/community_snapshot/index.html

1.5.2.2 Commercial Fishery

The commercial sector has historically operated primarily as a bycatch fishery. The 2019 ACL for the commercial fishery is 50,000 lb from Georgia-New York. Current measures and those proposed in this document essentially maintain status quo for the commercial fishery. Depending on the timing of any closure, social impacts would vary.

Based on a regional quotient (RQ) metric, the SAFMC (2018a) identified and ranked the top 16 coastal communities in terms of their annual commercial landings of cobia within the South Atlantic states using 2010-2016 dealer data aggregated at the community level. The RQ measures how commercial harvest is distributed throughout a region and can be used to identify “top commercial communities”. This is helpful in determining which communities might be most affected by changes to commercial cobia management. During the analysis period, the community of Washington, NC, saw a marked increase in its cobia RQ in 2015 and 2016, especially since it had little to no reported landings before 2015. Avon, NC, had a marked decline in their 2014 RQ, followed by an increase in 2015 and 2016. Wanchese, NC, was previously in the top 16 but has dropped out in recent years (2015-2016). In general, most of the Carolinas’ commercial fishing communities that engaged in cobia harvesting had a decline in their RQs (SAFMC, 2018). Commercial landings of cobia in Virginia have been increasing recently, though no communities displayed consistently high RQs.

1.5.3 Economic Impacts

1.5.3.1 Recreational Fishery

Consumer spending on various goods and services needed for recreational fishing generates economic activity that spurs direct, indirect and induced economic effects or economic contribution effects[2] that ripple through the region. Estimates of the business activity, i.e. economic contribution effects, associated with recreational angling for Atlantic cobia annually averaged for the 2012-2016 period were approximated by the SAFMC (2018a) using average trip-level impact coefficients (NOAA Fisheries, 2017) and related data provided by the NOAA Fisheries Office of Science and Technology. The SAFMC estimated that the total average annual (2012-2016) economic contribution sales effects (in 2016 dollars) attributable to Atlantic recreational cobia target trips based on aggregating state-level effects for the Carolinas, Georgia and Virginia cobia were approximately $13.0 million and these sales generated about

2 In this section, the term “economic contribution” denotes an economic distributional analysis that estimates the status quo economic contributions (e.g. jobs and household income) to local and/or regional economies (see Watson et al., 2007) due to economic activities such as those associated with recreational or commercial fishing. However, economic contribution analysis results (e.g. total economic contribution sales and income effects) should not be interpreted to represent the net economic impact effects if managed fish species were not available for harvest or purchase (SAFMC, 2018b).

$4.6 million in income and 130 jobs in the recreational harvest sector (SAFMC, 2018a). However, the SAFMC (2018b) noted that these figures were based upon MRIP trip estimates before effort recalibrations took place in 2018. Economic contribution effects may be several times larger if based on recalibrated MRIP effort estimates. Additionally, these estimates may represent lower bounds on the economic activities associated with recreational cobia fishing because expenditures on durable goods were not included (SAFMC, 2018a). Furthermore, as noted by the SAFMC (2018b), aggregating state-level economic contribution estimates to produce a regional four state total most likely underestimates the actual amount of total business activity because state-level economic contribution multipliers do not account for interstate and interregional trading (IMPLAN, 2019).

The Commission currently limits Atlantic cobia recreational harvests to the recreational Atlantic cobia ACL established by the SAFMC (ASMFC, 2017). Upon approval of Amendment 1, the level of recreational harvest allowed by the previous ACL would be maintained as the recreational quota, at least until completion of the next stock assessment. However, if Board actions following a future assessment lead to changes in the recreational quota, this could lead to shifts in benefits for the recreational sector due to changes in the amount or quality of fishing trips. Recreational sector quota changes might also lead to changes in local economic contribution effects due to shifts in Atlantic cobia fishing-related expenditures by recreational anglers and individuals in the for-hire component (e.g., local spending on lodging, restaurant meals, groceries, etc.).

While SAFMC estimates of cumulative economic effects of previous closures of the Atlantic cobia fishery in federal waters are not available, it is apparent that these in-season closures had a proportionally more negative economic effect on recreational and related fishing communities in Georgia and South Carolina compared to those found further north (SAFMC, 2018a). If Amendment 1 reduces the likelihood or frequency of fishery closures in federal waters, it could possibly generate additional beneficial effects in the social and economic environments of these states.

1.5.3.2 Commercial Fishery

The commercial fishery for Atlantic cobia is small, though landings have been increasing in Virginia recently (see Table 1). Dockside prices (in 2017 $) are typically between $2/lb and $3/lb and total dockside revenues for the fishery are usually less than $200,000 annually, although they did exceed $200,000 (in 2017 $) in 2015 and 2016. Commercial vessels landing Atlantic cobia rely on other species for the majority of their revenues, with cobia accounting for less than 1% of annual all-species revenues (in 2016 $) on average for vessels landing cobia in Georgia, South Carolina, and North Carolina, from 2012 through 2016 (SAFMC 2018a). Using an input-output model developed to look at economic impacts of the seafood sectors broadly, SAFMC estimates that the commercial fishery for Atlantic cobia contributes 21 jobs, $1.6 million in sales impacts, and $0.8 million in value added impacts to the regional economy (SAFMC 2018a).

If Commission Atlantic cobia commercial fishery management measures implemented in the FMP are similar to the current federal CMP FMP regulations, the SAFMC (2018a) concluded that there should be no substantial near-term changes in commercial fishery economic value and economic impact effects compared to the current federal management regime. However, the SAFMC noted that it was uncertain how future Commission regulations might affect Atlantic cobia commercial harvest in federal waters (SAFMC, 2018a), hence making the distribution, magnitude, and direction (negative or positive) of possible economic effects unclear.

1.5.4 Other Resource Management Efforts

1.5.4.1 Artificial Reef Development/Management

Approximately 120,000 acres (155 nm^2) of ocean and estuarine bottom along the South Atlantic coast have been permitted for the development of artificial reefs (ASMFC, 2002). The Georgia Department of Natural Resources is responsible for the development and maintenance of a network of man-made reefs both in estuarine waters and in the open Atlantic Ocean. Funding for the artificial reef program is provided by Federal Aid in Sport Fish Restoration, fishing license revenues, and private contributions. To date, there are 15 reefs within the estuary proper, which are constructed of a variety of materials including concrete rubble, metal cages, and manufactured reef units. These provide habitat for juvenile cobia and other species of recreationally important fishes. In 2001, three "beach" reefs were constructed in locations within Georgia's territorial waters just off the barrier island beaches. These are experimental in nature, but should provide some habitat for juvenile and adult cobia. There are 19 man-made reefs in the U.S. Exclusive Economic Zone (EEZ) ranging from depths of 40 to 130 feet. These reefs are constructed of a variety of materials including surplus vessels, concrete rubble, barges, bridge spans, and manufactured reef units. Both juvenile and adult cobia are known to use these reefs.

New Jersey has also developed and invested in an artificial reef program, with the state agency involved since 1984. Similarly, Delaware has invested in an artificial reef program, with 14 reef sites within Delaware Bay. Artificial reef construction is especially important in the Mid-Atlantic region, where near shore bottom is usually featureless sand or mud.

States should continue support for habitat restoration projects, including oyster shell recycling and oyster hatchery programs as well as seagrass restoration, to provide areas of enhanced or restored bottom habitat.

1.5.4.2 Bycatch

Cobia are uncommon bycatch components in most U.S. South and Mid-Atlantic fisheries. Mortalities resulting from cobia released from varying depths in the hook and line fisheries and regulatory discards from the large mesh gill fisheries in North Carolina are unknown.

2.0 GOALS AND OBJECTIVES

2.1 HISTORY OF MANAGEMENT

The Commission's Interstate Fishery Management Plan for Atlantic Migratory Group Cobia (FMP) was approved in November 2017 and first implemented in the 2018 fishing year (ASMFC, 2017). This FMP established the Commission's first involvement in Atlantic cobia management. The FMP was designed to complement federal management of Atlantic cobia by the SAFMC through the CMP FMP. Complementary measures mirrored by the FMP included vessel, bag/possession, and minimum size limits. Under Commission management, states were allowed to establish measures up to, but not exceeding, several measures that matched those of the CMP FMP. The Commission's FMP also established a Recreational Harvest Limit (RHL), derived from the federal Annual Catch Limit. The RHL is allocated among non-*de minimis* states (those harvesting greater than one percent of the coastwide recreational harvest) as state harvest targets (Table 8). Average landings over 3-year periods are evaluated against harvest targets to determine whether states can maintain their current recreational vessel limit and season or must adjust these measures to achieve their target. The FMP also established *de minimis* criteria and management options for the recreational fishery.

Table 8. State recreational harvest targets (lb) as established through the Commission's Cobia FMP. These targets were set based on recreational landings estimated with effort estimates from the Coastal Household Telephone Survey (CHTS). Therefore, these targets should only be compared to CHTS landings estimates (Appendix I, Table A2).

State	Recreational Harvest Target (lb)
VA	244,292
NC	236,316
SC	74,885
GA	58,311

2.2 PURPOSE AND NEED FOR ACTION

Currently, the Commission's FMP is designed for complementary management with the CMP FMP, with several management measures dependent upon the CMP FMP or SAFMC management. Since Regulatory Amendment 31 to the CMP FMP was approved and the Final Rule's implementation began on March 21, 2019 (NOAA, 2019), Atlantic cobia is no longer managed by a federal FMP. Additionally, this means that the SAFMC will no longer be recommending management measures for Atlantic cobia in federal waters to NOAA Fisheries.

Previous management relied on the SAFMC to set the ACL, then adapted that figure to the needs of Commission management. However, with the transition to sole management by the Commission comes the responsibility of specifying acceptable harvest levels. A harvest specification process allows such levels to be set in an expedient manner, allowing a quick response to significant events such as stock assessments, but also within bounds specified in this amendment. Certain aspects of management that are outside the specification process would require longer processes with more opportunities for public input.

2.3 GOAL

The goal of Amendment 1 is to provide for an efficient management structure that implements coastwide management measures*, providing equitable and sustainable access to the Atlantic cobia resource throughout the management unit* in a timely manner.

Italicized language is a recommended amendment from the Cobia Plan Development Team to language in the FMP.

2.4 OBJECTIVES

The following objectives are intended to support the goal of Amendment 1.

1) Provide a flexible management system to address future changes in resource abundance, scientific information, and fishing patterns among user groups or area.
2) *Implement management measures that allow stable, sustainable harvest of Atlantic cobia in both state and federal waters.*
3) *Establish a harvest specification procedure that will allow flexibility to respond quickly to stock assessment results or problems in the fishery, while also providing opportunities for public input on potential significant changes to management.*
4) Promote continued, cooperative collection of biological, economic, and social data required to effectively monitor and assess the status of the cobia resource and evaluate management efforts.
5) Manage the cobia fishery to protect both young individuals and established breeding stock.
6) Develop research priorities that will further refine the cobia management program to maximize the biological, social, and economic benefits derived from the cobia population.

Italicized language is a recommended amendment from the Cobia Plan Development Team to language in the FMP.

2.5 MANAGEMENT UNIT

The management unit is defined as the cobia (*Rachycentron canadum*) resource from Georgia through New York within U.S. waters of the northwest Atlantic Ocean, from the U.S. Atlantic coastal estuaries eastward to the offshore boundaries of the EEZ. The selection of this management unit is based on genetic analysis and tag-recapture data described in *Section 1.2.1.1*.

2.5.1 Management Area

The management area is the Atlantic coast distribution of the resource from Georgia through New York.

2.6 DEFINITION OF OVERFISHING

Prior to this amendment and Amendment 31 to the CMP FMP, the CMP FMP specified that overfishing is occurring when current fishing mortality ($F_{Current}$), defined as the geometric mean of the 3 most recent annual estimates of F, exceeds the maximum fishing mortality threshold (MFMT), set at the fishing mortality that achieves maximum sustainable yield (MSY) (F_{MSY}) (SAFMC, 2011). The CMP FMP also specified that the stock is overfished when the current spawning stock biomass ($SSB_{Current}$), defined as the geometric mean of the 3 most recent annual estimates of SSB, is less than the minimum stock size threshold (MSST), defined as MSST=[(1-M) or 0.5, whichever is greater]*B_{MSY}, where M is natural mortality and B_{MSY} is the biomass at which MSY is achieved (SAFMC, 2011). Estimates for fishing mortality, biomass, and threshold levels are determined through a stock assessment. These levels were unknown at the time of CMP Amendment 18, but were updated following the most recent stock assessment, SEDAR 28, through CMP Amendment 20B (GMFMC and SAFMC, 2014). Through Amendment 1, these overfished and overfishing definitions shall be maintained until the Board accepts new definitions through the process defined below.

Although management of Atlantic cobia will occur solely through Amendment 1, without any complementary SAFMC FMP, stock assessments will primarily continue to be conducted through the Southeast Data, Assessment, and Review (SEDAR) process. The next peer-reviewed assessment is scheduled for completion early in 2020.

To allow flexibility in responding to assessment results, Amendment 1 allows for the incorporation of new, peer-reviewed stock status determination criteria (both the methods used to set reference points and the reference point values), when available, through Board action. This allows flexibility to incorporate changes to the definitions of MFMT or MSST as the best scientific information becomes available, while maintaining objective and measurable status determination criteria for identifying when the stock is overfished. Similar actions have been taken with other Commission-managed species' FMPs (e.g., Addendum XIX to the FMP for Summer Flounder, Scup and Black Sea Bass, Addendum XVI to the FMP for American Lobster, and Amendment 3 to the FMP for Northern Shrimp). To attain this information, stock assessment and peer review terms of reference will include evaluations of existing or proposed biological reference point definitions and values (if estimable).

This action allows for the incorporation of new, peer-reviewed stock status determination criteria as soon as it becomes available, through the harvest specification process (*Section 4.1*), allowing timely use of the best available scientific information in the management of Atlantic cobia. This action does not have a direct influence on fishing effort or fishery removals but, instead, facilitates use of the most current scientific information available to define the status determination criteria for the stock, so that the stock can be managed to prevent overfishing and such that it is not overfished.

The following describes the potential sources of peer-reviewed scientific advice on status determination criteria and the current process of how that scientific advice will move forward in the development of management advice through the Board's specification process.

Specific definitions or modifications to the status determinations criteria and their associated values would result from the most recent peer-reviewed stock assessments and their panelist recommendations. The primary peer-review processes for Atlantic cobia that may be used are:

- The SEDAR Peer Review process, which is the primary mechanism used in the Southeast Region at present to review scientific stock assessment advice, including status determination criteria, for Atlantic cobia. As part of this process, the Commission appoints scientists to serve as reviewers along with those appointed by SEDAR.
- The Commission's Independent External Peer Review process, which follows a similar process to SEDAR in contracting independent experts to review scientific stock assessment advice, including status determination criteria, but allows the Commission more flexibility in determining the timing of a benchmark assessment.

The above list of peer review entities does not preclude groups from bringing independent stock assessments performed for the Atlantic cobia stock forward to the attention of the Commission. The Commission may recommend that these independent reviewed stock assessments pass through either of the peer review processes above, to ensure that sufficient peer review of the information occurs before the scientific advice can be used in the management process.

The SEDAR and Commission review processes both operate with a goal of reaching consensus. If consensus opinion of the peer review is to maintain current definitions of status determination criteria for Atlantic cobia, values produced by current criteria definitions may be updated to reflect the most recent data without any specific Board action, as using updated values is implied in this provision of Amendment 1. In this case, the scientific advice can then move forward such that management advice can be developed. If consensus opinion of the peer review is to recommend changes or different definitions of the status determination criteria and the panelists reach consensus as to how these status determination criteria should be changed, this advice may also move forward without any specific Board action such that management advice can be developed. Under these first two potential scenarios, consensus has been reached. Therefore, the scientific advice moving forward to the Board's management advisory groups should be clear.

A third potential scenario is that peer review scientific advice with respect to the incorporation of status determination criteria are split (consensus is not reached) or uncertain recommendations are provided (weak consensus). In this case, the scientific advice provided by the reviewers may be conflicting or may not be specific enough to provide adequate guidance as to how the MFMT or MSST should be defined. Additionally, the resulting management advice that should be developed from these changes may be unclear. Under these circumstances, the

Board may engage the Commission's Assessment Science Committee (ASC) to review the information and recommendations provided by the peer review panel and Technical Committee. Based on the terms of reference provided to the ASC, they may prepare a consensus report clarifying the scientific advice for the Board as to what the status determination criteria should be. At that point, the scientific advice on how the status determination criteria should be defined will be clear and can move forward such that management advice can be developed.

3.0 MONITORING PROGRAM SPECIFICATION

In order to meet the goals and objectives of Amendment 1, the collection and maintenance of quality data is necessary.

Updates from the FMP have been made to monitoring sections to reflect the most up-to-date information about the Atlantic cobia fishery.

3.1 SUMMARY OF MONITORING PROGRAMS

The FMP included no requirements regarding fishery-dependent monitoring programs, but all state fishery management agencies were encouraged to pursue full implementation of the standards of the Atlantic Coastal Cooperative Statistics Program (ACCSP). The Management Board recommended a transitional or phased-in approach be adopted to allow for full implementation of the ACCSP standards. Participation by program partners in the ACCSP does not relieve states from their responsibilities in collating and submitting harvest/monitoring reports to the Commission as required under the FMP.

3.1.1 Commercial Catch and Landings Program

The ACCSP's standard for commercial catch and effort statistics is mandatory, trip-level reporting of all commercially harvested marine species, with fishermen and/or dealers required to report standardized data elements for each trip by the tenth of the following month.

The current commercial ACL was set by the South Atlantic Fishery Management Council's (SAFMC) CMP FMP Amendment 20B; this was complemented by the ISFMP for Atlantic cobia. Quota monitoring is done by the NOAA Southeast Regional Office and landings are updated on a weekly basis. Monitoring data can be found at https://www.fisheries.noaa.gov/southeast/commercial-fishing/2019-preliminary-south-atlantic-commercial-landings.

Starting in 2020, due to the removal of the Atlantic cobia stock from SAFMC jurisdiction, all commercially non-*de minimis* states will be required to monitor cobia landings in order to maintain sustainable cobia harvest and minimize the potential for overages.

3.1.2 Recreational Catch and Effort Program

3.1.2.1 Recreational Fishery Catch Reporting Process

The Marine Recreational Information Program (MRIP) contains estimated Atlantic cobia catches from 1981-2018. The MRIP evolved from the Marine Recreational Statistics Survey (MRFSS; 1981-2003) and included improvements in survey and estimation methodologies to remove sources of bias. The MRFSS and MRIP programs were simultaneously conducted in 2004-2006 and this information was used to calibrate past MRFSS recreational harvest estimates against MRIP recreational harvest estimates.

The MRIP is a national program that uses several surveys to obtain catch and effort data at a regional level. The Access Point Angler Intercept Survey (APAIS) provides the catch rates and species composition from anglers fishing in estuarine or marine waters (not freshwater). Anglers who have completed a fishing trip are interviewed to gather catch and demographic data. Sampling is separated by fishing mode (charter boat, private/rental boat, beach/bank and man-made structures), area fished, and wave (two-month period).

The MRIP implemented the Fishing Effort Survey (FES) in 2018, an improved methodology to address several concerns with the prior survey (Coastal Household Telephone Survey) including under-coverage of the angling public, declining number of households using landline telephones, reduced response rates, and memory recall issues. The number of fishing households and the numbers of fishing trips taken are determined by FES. The data from the two surveys are combined to provide estimates of the total number of fish caught, released, and harvested. Additionally, information is collected on the weight of the harvest, total number of trips, and the number of people participating in marine recreational fishing. Improvements within APAIS and the adoption of FES have required calibrations of pre-existing data to standardize estimates and as such all recreational data presented herein represent the latest techniques. For additional information on the MRIP see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

Additionally, Virginia has a Cobia Recreational Permit that is required for all recreational fishermen (private and for-hire). Permit holders are required to report all trips, both those that resulted in catches and the zero-catch trips as well. Catch and effort information is captured by the reporting forms. This is permit was created to supplement the MRIP sampling.

3.1.2.1.1 *For Hire Fishery Catch-Reporting Process*

The ACCSP has selected the NOAA Fisheries For-Hire Survey as the preferred methodology for collecting data from charter boats and headboats (partyboats), also called the “for-hire” component. The For-Hire Survey is similar to the MRIP. The independent survey components of the For-Hire Survey include: 1) telephone survey to collect fishing effort data from vessel representatives; 2) an effort validation survey; 3) an access-site intercept survey for catch data; and 4) at-sea samplers on headboats for catch data. Using the data collected through these surveys, NOAA Fisheries generates catch and effort estimates for for-hire fisheries.

The vessel effort survey is a mandatory survey for the for-hire vessels which uses a coastwide directory of such vessels as the sampling frame for for-hire fishing effort. The directory is continually updated as intercept and telephone interviewers identify changes in the fleet. Optimal sampling levels will be determined following evaluation of the Atlantic coast For-Hire Survey results from the first three years. Until optimal sampling levels are determined, a minimum of 10% of for-hire vessels (or three charter boats and three headboats, whichever is greater), will be randomly sampled each week in each state. A vessel representative, usually the captain, is called and asked to provide information on the fishing effort associated with that vessel during the previous week. Vessel representatives are notified in advance that they have been selected for sampling and an example form is provided. To be included in the sample frame for particular wave, a vessel record must include: 1) at least one vessel representative's telephone number; 2) the name of the vessel or a vessel registration number issued by a state or the U.S. Coast Guard; 3) the county the boat operates from during that wave, and 4) designation as either a charter or guide boat (both called "charter") or headboat.

To validate the self-reported effort data collected through the vessel telephone survey, field samplers periodically check access sites used by for-hire vessels to observe vessel effort. Interviewers record the presence or absence of a for-hire vessel from its dock or slip, and if the vessel is absent, they try to ascertain the purpose of the trip. Those observations are compared to telephone data for accuracy and to make any necessary corrections.

3.1.2.1.1.1 Charter Boat Sampling

Vessels that meet the ACCSP definition of a charter boat, "typically hired on a per trip basis," are sampled for catch data through an intercept site survey of anglers similar to the MRIP. The intercept survey has been ongoing since 1981.

Some partners collect for-hire effort data using Vessel Trip Reports (VTR), which are mandatory for some vessels and contain all minimum data elements collected by the For-Hire Survey. In areas where the survey runs concurrently with VTR programs, captains selected for the weekly telephone survey are permitted to fax their VTRs in lieu to being interviewed by phone.

Additionally, South Carolina requires charter boats to submit logbook trip reports to the state on a monthly basis. These logbooks capture catch and effort information. South Carolina is working to develop validation methods for self-reported data.

3.1.2.1.1.2 Headboat Sampling

Catch and effort data for federally permitted headboats operating in the South Atlantic (North Carolina – Georgia) is monitored through the Southeast Region Headboat Survey conducted by the Southeast Fisheries Science Center. Vessel operators are required to file weekly electronic reports for all trips to report catch and effort information. Dockside samplers collect biological samples from the catches, which supplement the samples collected by the at-sea observers.

3.1.2.1.1.3 South Atlantic Mandatory Reporting for Federally-Permitted Charter Vessels

In December 2016, the South Atlantic Fishery Management Council approved an amendment that, if implemented, would require weekly electronic reporting of all charter vessels operating under a South Atlantic federal for-hire permit. The amendment proposes to implement the same reporting requirements for federally-permitted charter vessels in the snapper grouper, dolphin wahoo, and coastal migratory pelagics (mackerel and cobia) fisheries that currently exist for federally-permitted headboats. A federal permit is required for all for-hire vessels (charter and headboats) operating in the exclusive economic zone (federal waters, more than 3 miles offshore). While Atlantic cobia are no longer part of the CMP FMP, they may be caught along with the affected SAFMC-managed fisheries and, thus, reported through this program. Mandatory electronic reporting for charter vessels is expected improve the data available for management and stock assessments, improve the accuracy and timeliness of data collection, and allow fishery managers to better monitor landings and discards, and more accurately assess the impacts of regulations on the for-hire industry fishing in federal waters. Currently, the amendment has been approved by the SAFMC and is under review by NOAA Fisheries and the US Secretary of Commerce.

3.2 BIOLOGICAL INFORMATION

The ACCSP has set standards for how biological data should be collected and managed for commercial, recreational, and for-hire fisheries. Trained field personnel, known as port agents or field samplers, should obtain biological samples. Information should be collected through direct observation or through interviews with fishermen. Detailed fishery statistics and/or biological samples should be collected at docks, unloading sites, and fish houses. Biological sampling includes species identification and disposition; individual lengths and weights; extraction of hard parts including otoliths; and tissue samples such as gonads, stomachs, fin clips, and scales.

Commercial fishery biological samples are collected by federal port agents through the Trip Interview Program (TIP). Some states supplement TIP with state sampling programs; these states are encouraged to continue with these programs.

All states are encouraged to continue sampling programs, such as freezer collection programs, that collect biological information. Information from these programs may be reviewed by the TC and Board on a case-by-case basis for use in management decisions. Examples of current programs include the Virginia Marine Resource Commission's Marine Sportfish Collection Project, North Carolina Division of Marine Fisheries Carcass Collection Program, South Carolina's Freezer Fish Program, and Georgia's Marine Sportfish Carcass Recovery Project.

Additionally, states are encouraged to continue to take biological samples from cobia encountered incidentally during fishery independent sampling to add to information on life history, stock ID, and individual weight.

3.3 SOCIAL AND ECONOMIC INFORMATION

Data on a number of variables relevant to social and economic dimensions of the cobia fishery are collected through existing ACCSP data collection programs and the MRIP; however, no explicit mandates to collect socioeconomic data for cobia currently exist. In addition to pounds landed, commercial cobia harvesters and dealers may report ex-vessel prices or value, fishing and landing locations, landing disposition, and a variety of measures capturing fishing effort. The MRIP regularly collects information on recreational fishing effort and landings, and occasionally gathers socioeconomic data on angler motivations and expenditures.

3.4 OBSERVER PROGRAMS

No specific observer programs are in place to monitor the cobia fishery. Observer programs already in place, whether state or federal, may observe capture of cobia in other monitored fisheries or specific gear types. A review of these programs should take place.

3.5 ASSESSMENT OF STOCK CONDITION

Although management of Atlantic cobia will occur solely through Amendment 1, without any complementary SAFMC FMP, stock assessments will primarily continue to be conducted through the Southeast Data, Assessment, and Review (SEDAR) process. Every five years, the Atlantic cobia stock assessment will be reviewed to determine whether stock assessment or update is necessary. The Commission, through participation in the SEDAR Steering Committee, will coordinate with partnering organizations to schedule SEDAR assessments. This schedule may be modified as needed to incorporate new information and in consideration of the Atlantic cobia stock.

Stock assessments may also be conducted through the Commission's assessment process by the Cobia Stock Assessment Subcommittee (SAS, *Section 4.8.5*). For this process, the TC and Advisory Panel (AP) will meet to review the stock assessment and all other relevant data sources. The stock assessment report shall follow the general outline as approved by the Interstate Fisheries Management Program Policy Board (ISFMP Policy Board) for all Commission-managed species. In addition to the general content of the report as specified in the outline, the stock assessment report may also address the specific topics detailed in the following sections. Specific topics in the stock assessment may change as the SAS continues to provide the best model and metrics possible to assess the Atlantic cobia stock.

3.5.1 Assessment of Annual Recruitment

No programs currently collect data necessary to assess annual recruitment of cobia.

The original FMP (ASMFC, 2017) recommended examination of possible surveys from which Atlantic cobia abundance indices could be developed, as these indices would be valuable for informing future stock assessments. Pre-data workshop calls for SEDAR 58 cobia assessment did not identify any new data sources for recruitment.

3.5.2 Assessment of Spawning Stock Biomass

SEDAR 28 (2013) provides the most current information on spawning stock biomass. While the stock is not currently considered overfished, the 2013 stock assessment does indicate declines in biomass over the last few years of the assessment (terminal year: 2010). New information should be revealed by SEDAR 58, scheduled for completion in early 2020.

3.5.3 Assessment of Fishing Mortality Target and Measurement

SEDAR 28 (2013) provides the most current information on fishing mortality. The stock is not currently considered to be undergoing overfishing. Recent overages of the ACL for both the commercial and recreational sectors have raised concerns. New information should be revealed by SEDAR 58, scheduled for completion in early 2020.

3.6 STOCKING PROGRAM

The Virginia Institute of Marine Science (VIMS) began an experimental stocking program in the Chesapeake Bay in 2003 to explore stock enhancement and study juvenile movement and habitat utilization.[3] Juvenile cobia were tagged and released into the Chesapeake Bay in 2003, 2006, 2007, and 2008, with more than 300 tagged releases occurring in those first two years. Recapture information indicated habitats ranged from 1-4 m in depth and consisting of sandy and grass-bed bottoms. It is unclear whether this program had any effect on the population of cobia in Virginia, although it is assumed to have had minimal impact due to the small number of releases.

South Carolina has an experimental stock enhancement program designed to evaluate the methodology necessary for augmenting wild populations. Experiments have been designed to determine the best size and time of year to stock cobia in coastal rivers focusing on augmentation of the distinct population segment of cobia in South Carolina. Locally-caught brood stock are conditioned to spawn in recirculating seawater systems using temperature and photoperiod conditioning and hormone implantations to facilitate final oocyte maturation.

[3] https://www.vims.edu/research/departments/fisheries/programs/tagging_research/cobia/

Multiple years of spawning and grow out have occurred, and more than 50,000 (60-350 mm TL) cobia have been stocked in the Colleton and Broad rivers of Port Royal Sound. All fish are genetically identifiable to broodstock group and can be identified in the catch and distinguished genetically from wild-spawned fish. Cobia tissue samples collected from charter boat captains and from carcasses collected at tournaments and cooperating recreational anglers show that as much as 50% of the catch from the 2007 year-class were from hatchery releases and that these animals have persisted in the catch each year since release. This research has demonstrated the application of stock enhancement as an additional management tool for cobia. In addition to research on production of animals, the SCDNR has developed predictive individual-based genetic models to determine the appropriate number of cobia that should be produced and stocked each year in order to grow the population while minimizing any negative impact on the genetic health of the wild population.

3.7 BYCATCH REDUCTION PROGRAM

Bycatch is defined as "portion of a non-targeted species catch taken in addition to the targeted species. It may include non-directed, threatened, endangered, or protected species, as well as individuals of the target species below a desired or regulatory size" (ASMFC, 2009). Bycatch can be divided into two components: incidental catch and discarded catch. Incidental catch refers to retained or marketable catch of non-targeted species, while discarded catch is the portion of the catch returned to the sea because of regulatory, economic, or personal considerations.

The recreational cobia fishery is largely a directed fishery with bycatch occurring in fisheries directed towards other species. Mortality associated with regulatory discards of undersized cobia or fish taken after the bag limit is reached is largely unknown but likely varies based on depth caught and methods used to boat the catch. Several ongoing tagging studies will aid in estimating survivability.

The commercial cobia fishery tends to be a bycatch fishery in the hook-and-line and large mesh gill net fisheries. Regulatory discards do occur, but the mortality associated with those discards varies with gear. Juvenile cobia have been documented as bycatch in shrimp trawls off the Atlantic coast, although this is not a frequent occurrence. From 1998-2010, only five cobia were observed from approximately 1,700 shrimp nets and only three of the five were within the stock boundary (SEDAR, 2013). As of Amendment 2 to the federal Shrimp Fishery Management Plan for the South Atlantic Region (SAFMC, 1996), all shrimp trawlers in the South Atlantic are required to use bycatch reduction devices.

3.8 HABITAT PROGRAM

Particular attention should be directed toward cobia habitat utilization and habitat condition (environmental parameters). A list of existing state and federal programs generating environmental data such as sediment characterization, contaminant analysis, and habitat coverage (marsh grass, oyster beds, submerged aquatic vegetation) should also be produced and updated as new information arises. Habitats utilized by cobia range from the middle portions of estuaries and coastal rivers out to and likely beyond, the shelf break. Thus, virtually any study generating environmental data from estuarine or coastal ocean systems could be of value.

4.0 MANAGEMENT PROGRAM

Several aspects of Atlantic cobia management are subject to Board review in this Amendment. Nine issues are specified below to allow for public comment and Board decisions on these issues. Issues are highlighted in this draft for emphasis. Listed options have been developed and recommended to the Board by the Cobia Plan Development Team (PDT), but do not necessarily preclude additional options from being developed or accepted by the Board. Six of these issues include multiple options, while the others (noted with the issue number) include only one option recommended for consideration by the PDT.

4.1 HARVEST SPECIFICATION PROCESS

Issue 1

Options

a. The coastwide total harvest quota, vessel limits, possession or bag limits, minimum size limits, and commercial closure triggering mechanism may be specified by Board action for up to two years. Subsequent harvest specification would occur for implementation after expiration of the previous specification (up to two years apart) or following a completed stock assessment.

b. The coastwide total harvest quota, vessel limits, possession or bag limits, minimum size limits, and commercial closure triggering mechanism may be specified by Board action for up to three years. Subsequent harvest specification would occur for implementation after expiration of the previous specification (up to three years apart) or following a completed stock assessment.

c. The coastwide total harvest quota, vessel limits, possession or bag limits, minimum size limits, and commercial closure triggering mechanism may be specified by Board action for up to four years. Subsequent harvest specification would occur for implementation after expiration of the previous specification (up to four years apart) or following a completed stock assessment.

For all options, in years when harvest specifications are conducted, they will occur no later than the Fall Board Meeting, and resulting measures will be implemented in the following year.

4.2 SECTOR QUOTA ALLOCATION

Issue 2 (No alternatives recommended by the PDT)

The recreational quota will be 92% of the coastwide total harvest quota set through Board specification. The commercial quota will be 8% of the coastwide total harvest quota set through Board specification. These allocation percentages were derived from those previously in place through the CMP FMP. These percentages may be changed in the future through an addendum to this amendment.

4.3 RECREATIONAL FISHERY MANAGEMENT MEASURES

4.3.1 Size Limit

All states shall maintain a recreational minimum size limit of 36 inches FL. A total length equivalent may be considered by the TC and Management Board.

4.3.2 Bag Limit

All states shall maintain a 1 fish per person recreational bag limit.

4.3.3 Vessel Limit

All states shall maintain a recreational daily vessel limit, not to exceed 6 fish per vessel.

4.3.4 Seasons and Allocations

Management of the coastwide recreational quota shall be accomplished by state-specific seasons and allocations. One percent of the recreational quota shall be set aside to account for harvests in *de minimis* states.

State-defined seasons must adhere to state shares (harvest targets) of the coastwide recreational quota. Percentage allocations are based on states' percentages of the coastwide historical landings in numbers of fish, derived as 50% of the 10-year average landings from 2006-2015 and 50% of the 5-year average landings from 2011-2015. Table 9 shows landings used to develop percentage allocations. Numbers of fish are used for allocation percentages to eliminate confusion from differences in average weights applied to numbers data by the MRIP and Southeast Fishery Science Center (SEFSC). Table 10 shows state allocation percentages of the recreational quota, including a one percent set aside that accounts for landings in states with *de minimis* status for their recreational fisheries. These percentages would be used to determine state allocation percentages regardless of whether pounds or numbers of fish are used to evaluate compliance.

Table 9. Average AMG Cobia recreational landings in numbers (n) from Georgia through Virginia for establishing soft recreational harvest targets as an average of the 5-year and 10-year time periods (5-yr/10-yr Average), 2011-2015 and 2006-2015. Data Source: SEFSC (with headboat), queried 2017.

State	5-yr/10-yr Average
Georgia	n = 2,298
South Carolina	n = 2,935
North Carolina	n = 9,273
Virginia	n = 9,589
Total	n = 24,095

Table 10. Allocation percentages for Atlantic cobia by state, with recognition of 1% of the quota being set aside for recreational harvest in *de minimis* states, based on percentages derived from Table 9. State allocation percentages are the same as those found in Table 10 of the Cobia FMP (ASMFC, 2017), except with the inclusion of the 1% *de minimis* set aside from the total recreational quota.

State	Allocation Percentage
GA	9.4%
SC	12.1%
NC	38.1%
VA	39.4%
De Minimis	1.0%
Total	100%

4.3.5 Evaluation of Landings against State Harvest Targets and Overage Response

Issue 3 includes text that more clearly specifies the process of executing landings evaluations and corresponding responses, but follows a similar overall process as that defined in the original FMP. This additional text is shown in bold in this draft and subject to Board review.

Issue 3 (No alternatives recommended by the PDT)

The following language describing the landings evaluation process and response to an overage is similar in concept to what was included in the FMP. However, additional details are included, which further clarify the implementation protocol with consideration of the new harvest specification process (*Section 4.1*).

Recreational landings will be evaluated against state recreational harvest targets at the same time (i.e., in the same meeting) as Board specification of harvest. Recreational landings for each non-*de minimis* state will be evaluated against that state's target as an average of annual landings. **The timeframe for this average will only include years that had the same**

recreational season and vessel limit. The timeframe will include the most recent years with the same season and vessel limit. If the same season and vessel limit have been in place for at least three years, the timeframe will include the three most recent years under these regulations (a rolling average). If the same season and vessel limit have been in place for less than three years, the timeframe will include all years under these regulations.

The terminal year of the evaluated time period will be the year before the evaluation and specification processes are conducted, e.g., 2019 would be the terminal year for data used in an evaluation conducted in 2020, coinciding with a specification of regulations for 2021-2023.

If a state's averaged recreational landings exceed its annual recreational harvest target, that state must adjust its recreational vessel limit or season to reduce harvest, such that its average landings over the following period of specified harvest will achieve the state recreational harvest target.

States reporting a **consistent** under-harvest during an evaluation time period **of at least 3 years** may present a plan to extend seasons or increase vessel limits, if desired, to allow increased harvests that will not exceed the harvest target.

Changes to management measures for states with overages or states that wish to liberalize management measures must be reviewed by the TC and approved by the Management Board prior to implementation. A hypothetical example of several potential evaluation and response scenarios is depicted in Table 11.

Allocation of the recreational quota may be reevaluated by the Management Board if a recreational *de minimis* state exceeds the recreational *de minimis* landings threshold. **Reallocation of the recreational quota among states may be accomplished through an addendum to Amendment 1.**

Table 11. A hypothetical example timeline for a state with a recreational harvest target of 100,000 lb. Evaluation years depict examples of an achieved target (2021), overharvest (2024), short-term underharvest (2027), and long-term underharvest eligible to apply for more liberal measures (2030). Rows with the same shading have the same season and vessel limit regulations. Evaluations occur in August-October, before harvest data for the current year is available.

	Year	Vessel Limit/Season	Harvest	Evaluation Status & Specification
Harvest Target: 100,000 lb	2018	Vessel Limit: 4 fish Season: June 1-Aug. 30	110,000	Not evaluated
	2019	Vessel Limit: 4 fish Season: June 1-Aug. 30	90,000	Not evaluated
	2020	Vessel Limit: 4 fish Season: June 1-Aug. 30	95,000	Not evaluated
	2021	Vessel Limit: 4 fish Season: June 1-Aug. 30	105,000 lb	Evaluated: Achieved target in **2018-2020**. Regulations set for 2022-2024.
	2022	Vessel Limit: 4 fish Season: June 1-Aug. 30	115,000 lb	Not evaluated
	2023	Vessel Limit: 4 fish Season: June 1-Aug. 30	95,000 lb	Not evaluated
	2024	Vessel Limit: 4 fish Season: June 1-Aug. 30	110,000 lb	Evaluated: Over target by average of 5,000 lb per year in **2021-2023**. Required reduction of season or vessel limit. Regulations set for 2025-2027.
	2025	Vessel Limit: 4 fish Season: June 10-Aug. 30	80,000 lb	Not evaluated
	2026	Vessel Limit: 4 fish Season: June 10-Aug. 30	75,000 lb	Not evaluated
	2027	Vessel Limit: 4 fish Season: June 10-Aug. 30	85,000 lb	Evaluated: Achieved target in **2025-2026** (different regulations in 2024). Regulations set for 2028-2030.
	2028	Vessel Limit: 4 fish Season: June 10-Aug. 30	65,000 lb	Not evaluated
	2029	Vessel Limit: 4 fish Season: June 10-Aug. 30	75,000 lb	Not evaluated
	2030	Vessel Limit: 4 fish Season: June 10-Aug. 30	70,000 lb	Evaluated: Achieved target in **2027-2029**. May submit liberalized measures for TC and Board review, for implementation in 2031. Regulations set for 2031-2033.

4.3.6 Units for Recreational Landings, Quotas, and Targets

Issue 4

Options

a. (Status Quo) Recreational landings, quotas, and targets will be evaluated and set in units of pounds.

b. Recreational landings, quotas, and targets will be evaluated and set in units of numbers of fish. The recreational quota and harvest targets will be converted to numbers of fish by dividing poundage amounts by the average of the three most recent annual average weights for cobia landed recreationally, as determined by data from the Marine Recreational Information Program (average weight = recreational pounds/recreational numbers).
   Conversions conducted prior to the availability of average weight data from 2020 will exclude the use of 2016 and 2017, as a portion of the management unit was closed to recreational fishing during those years, and replace them with data from 2014 and 2015, respectively.
   A state may submit alternative data sets that would provide more appropriate estimates of average weight for their state's fishery. Alternative data sets must be evaluated by the TC and approved by the Board before being implemented in converting that state's recreational harvest target from pounds to numbers.

4.4 COMMERCIAL FISHERY MANAGEMENT MEASURES

4.4.1 Size Limit Options

Issue 5

Options

a. (Status Quo) All states shall maintain a minimum size limit of 33 inches fork length or the total length equivalent (37 inches).

b. All states shall maintain a minimum size limit of 36 inches fork length or the total length equivalent (40 inches).

4.4.2 Possession Limit Options

All states shall maintain a commercial possession limit of no more than 2 cobia per person, not to exceed the vessel limit stated in *Section 4.4.3*.

4.4.3 Vessel Limits

Issue 6

Options

a. (Status Quo) All states shall maintain a daily vessel limit, not to exceed 6 fish per vessel.

b. All states shall establish a daily vessel limit, not to exceed 5 fish per vessel.

c. All states shall establish a daily vessel limit, not to exceed 4 fish per vessel.

4.4.4 Quota-based Management

Issue 7 (No alternatives recommended by the PDT)

The commercial fishery shall be managed by a coastwide, commercial quota, set through the harvest specification and sector allocation processes defined in *Sections 4.1* and *4.2*. If commercial *de minimis* states exist, three percent of the commercial quota will be set aside to account for commercial landings in *de minimis* states (qualifications for *de minimis* status are defined in Section 4.5.3).

Commercial landings shall be monitored in-season by non-*de minimis* states and NOAA Fisheries. If reported in-season commercial landings from non-*de minimis* states reach a trigger percentage of the commercial quota, the states will be informed and a future coastwide closure will be scheduled based on that date, after which the commercial fishery will be closed in all state waters within the management unit for the remainder of the calendar year. The Commission will also request through ACFCMA that NOAA Fisheries issue a similar closure in the Exclusive Economic Zone (EEZ).

The trigger percentage and number of following days until a closure occurs will be specified as part of the harvest specification process defined in *Section 4.1*. The number of days past the trigger percentage until a closure occurs will be calculated as the average number of days from the previous three years for commercial landings to go from the trigger percentage to the full commercial quota, less any *de minimis* set aside. The trigger shall be updated as part of the specification process, using similar methodology, to allow the states at least 30 days' notice of an impending commercial closure.

For example, the average number of days for weekly commercial landings in Virginia (VA)-South Carolina (SC) to go from 77% to 97% (accounting for a 3% *de minimis* set aside) of the 2019 commercial quota (50,000 lb) in 2015-17 was 32 days (ACCSP, queried April, 2019). Therefore, a commercial trigger based on these data would initiate a closure 32 days after in-season reported VA-SC landings reach 38,500 lb (77% of the commercial quota).

4.5 ALTERNATIVE STATE MANAGEMENT REGIMES

States are required to obtain prior approval from the Board of any changes to their management program for which a compliance requirement is in effect. Changes to non-compliance measures must be reported to the Board but may be implemented without prior Board approval. A state can request permission to implement an alternative management measure to any mandatory compliance measure only if that state can show, to the Board's satisfaction, that its alternative proposal will have the same or greater conservation value as the measure contained in this amendment or any addenda prepared under Adaptive Management (*Section 4.6*). States submitting alternative proposals must demonstrate that the proposed action will not contribute to overfishing of the resource. All changes to a state's plan must be submitted in writing to the Board and to the Commission as part of their annual compliance report.

4.5.1 General Procedures

A state may submit a proposal for a change to its regulatory program or any mandatory compliance measure under this amendment to the Commission. Such changes shall be submitted to the Chair of the Plan Review Team (PRT), who shall distribute the proposal to appropriate groups, including the Board, the PRT, the TC, and the AP.

The PRT is responsible for gathering the comments of the TC and the AP. The PRT is also responsible for presenting these comments to the Board for decision.

The Board will decide whether to approve the state proposal for an alternative management program if it determines that it is consistent with the goals and objectives of this amendment.

In order to maintain consistency within a fishing season, new rules should be implemented prior to the start of the fishing season. Given the time needed for the TC, AP, and Board to review the proposed regulations, as well as the time required by an individual state to promulgate new regulations, it may not be possible to implement new regulations for the on-going fishing season. In this case, new regulations should be effective at the start of the following season after a determination to do so has been made.

4.5.2 Management Program Equivalency

The TC, under the direction of the PRT, will review any alternative state proposals under this section and provide its evaluation of the adequacy of such proposals to the Board. The PRT can also ask for reviews by the Law Enforcement Committee (LEC) or the AP.

Following the first full year of implementation of an alternate management program, the PRT shall be responsible for evaluating the effects of the program to determine if the measures were equivalent with the standards of the FMP and subsequent amendments or addenda. The PRT will report to the Management Board on the performance of the alternate program.

4.5.3 *De Minimis* Fishery Guidelines

The Commission's Interstate Fisheries Management Program Charter (ISFMP Charter) defines *de minimis* as "a situation in which, under the existing condition of the stock and scope of the fishery, the conservation and enforcement actions taken by an individual state would be expected to contribute insignificantly to a coastwide conservation program required by a Fishery Management Plan or amendment," (ASMFC, 2016).

4.5.3.1 Recreational De Minimis Eligibility

A state can apply annually for *de minimis* status for their recreational fishery. To be eligible for *de minimis* consideration, a state's recreational landings for 2 of the previous 3 years must be less than 1% of the coastwide recreational landings for the same time period. Once *de minimis* status is granted, designated states must submit annual reports including commercial and recreational landings to the Management Board, justifying the continuance of *de minimis* status. States must include *de minimis* requests as part of their annual compliance reports.

4.5.3.1.1 *Procedure to Apply for De Minimis Status*

States must request *de minimis* status each year. Requests for *de minimis* status will be reviewed by the PRT as part of the annual FMP review process (*Section 5.3*). Requests for *de minimis* must be submitted to the Commission's Cobia FMP Coordinator as a part of the state's annual compliance report. The request must contain the following information: all available recreational landings data for the three previous full years of data and the proposed management measures the state plans to implement for the year *de minimis* status is requested. The FMP Coordinator will then forward the information to the PRT.

In determining whether a state meets the *de minimis* criteria, the PRT will consider the information provided with the request, the most recent available coastwide landings data, any information provided by the TC and SASC, and projections of future landings. The PRT will make a recommendation to the Board to either accept or deny the *de minimis* request. The Board will then review the PRT recommendation and either grant or deny the *de minimis* classification.

The Board must make a specific motion to grant a state *de minimis* status. By deeming a given state *de minimis*, the Board is recognizing that: the state has a minimal Atlantic cobia recreational fishery; there is little risk to the health of the Cobia stock if the state does not implement the full suite of management measures; and the overall burden of implementing the complete management and monitoring requirements of the FMP outweigh the conservation benefits of implementing those measures in that particular state.

If the Board denies a state's *de minimis* request, the state will be required to implement all the provisions of the FMP, including adherence to an allocation of the coastwide recreational quota. When a state rescinds or loses its *de minimis* status, the Board will set a compliance date by which the state must implement the required regulations.

4.5.3.2 Plan Requirements if De Minimis Status is Granted

One percent (1%) of the recreational quota shall be set aside to account for harvests in *de minimis* states. If a state qualifies for *de minimis*, the state may choose to match the recreational management measures implemented by an adjacent non-de minimis state (or the nearest non-de minimis state if none are adjacent) or the state may choose to limit its recreational fishery to 1 fish per vessel per trip with a minimum size of 29 inches FL. A total length equivalent may be considered by the TC and Management Board. Should a *de minimis* state choose to match an adjacent (or the nearest) non-*de minimis* state, the *de minimis* state shall be subject to all recreational cobia regulations, including bag, size, vessel, and season restrictions, of their adjacent (or nearest) non-*de minimis* state. *De minimis* states that choose to limit their recreational fisheries to 1 fish per vessel per trip will not be subject to seasonal restrictions for their recreational fishery.

If the coastwide fishery is closed for any reason through Emergency Procedures (*Section 4.7*), *de minimis* states must close their fisheries as well.

Any additional components of the FMP, which the Board determines necessary for a *de minimis* state to implement, can be defined at the time *de minimis* status is granted.

4.5.3.3 Commercial De Minimis Options

Issue 8

Options

a. (Status quo) States may not apply for *de minimis* status for their commercial fishery.

b. States may apply for *de minimis* status for their commercial fishery. To be eligible for commercial *de minimis* consideration, a state's commercial landings for 2 of the previous 3 years must be less than 2% of the coastwide commercial landings for the same time period. States must annually request and prove their eligibility to maintain *de minimis* status. These states would be subject to all coastwide commercial regulations, including minimum size, possession, and vessel limits, as well as closures of the commercial fishery resulting from the commercial quota being reached. States with *de minimis* status for their commercial fishery would not be required to monitor commercial cobia landings for their state within the fishing year. They would still be required to report annual landings through their annual state compliance report. To account for potential, unmonitored landings in these states, 3% percent of the commercial quota would be set aside and not accessible to non-*de minimis* states.

4.6 ADAPTIVE MANAGEMENT

The Board may vary the requirements specified in this FMP as a part of adaptive management in order to conserve the Atlantic cobia resource. Specifically, the Board may change target fishing mortality rates, harvest specifications, or other measures designed to prevent overfishing of the stock complex or any spawning component. Such changes shall be instituted to become effective on the first fishing day of the following year, but may be put in place at an alternative time when deemed necessary by the Board.

4.6.1 General Procedures

The PRT shall monitor the status of the fisheries and the resources and report on that status to the Board annually or when directed to do so by the Board. The PRT shall consult with the TC, SAS, and AP in making such a review and report. The report will contain recommendations concerning proposed adaptive management revisions to the management program.

The Board shall review the report of the PRT, and may consult further with the TC, SAS, or AP. The Board may, based on the PRT Report or on its own discretion, direct the PDT to prepare an addendum to make any changes it deems necessary. An addendum shall contain a schedule for the states to implement its provisions.

The PDT will prepare a draft addendum, as directed by the Board, and distribute it to all states for review and public comment. The document will be released for public comment for a minimum of 30 days. A public hearing will be held in any state that requests one. After the comment period, the PDT will summarize the comments and present them to the Board along with the recommendations of the TC, SAS, LEC, and AP, when applicable. The Board shall then decide whether to adopt or revise and then adopt the addendum.

Upon adoption of an addendum by the Board, states shall prepare plans to carry out the addendum and submit them to the Board for approval, according to the schedule contained in the addendum.

4.6.1 Measures Subject to Change

The following measures are subject to change under adaptive management upon approval by the Management Board:

(1) Fishing year and/or seasons;
(2) Area closures;
(3) Overfishing definition, MSY and OY;
(4) Rebuilding targets and schedules;
(5) Fishery Specifications;
(6) Catch controls, including bag and size limits;
(7) Effort controls;

(8) Bycatch allowance
(9) Reporting requirements;
(10) Gear limitations;
(11) Measures to reduce or monitor bycatch;
(12) Observer requirements;
(13) Management areas;
(14) Recommendations to the Secretaries for complementary actions in federal jurisdictions;
(15) Research or monitoring requirements;
(16) Frequency of stock assessments;
(17) De minimis specifications;
(18) Management unit;
(19) Maintenance of stock structure;
(20) Catch allocation; and
(21) Any other management measures currently included in the Amendment 1.

4.7 EMERGENCY PROCEDURES

Emergency procedures may be used by the Board to require any emergency action that is not covered by or is an exception or change to any provision in Amendment 1. Procedures for implementation are addressed in the Commission's ISFMP Charter, Section Six (c) (10) (ASMFC, 2016).

4.8 MANAGEMENT INSTITUTIONS

The management institution for cobia will be subject to the provisions of the ISFMP Charter (ASMFC, 2016). The following are not intended to replace any or all of the provisions of the ISFMP Charter. All committee roles and responsibilities are included in detail in the ISFMP Charter and are only summarized here.

4.8.1 ASMFC and the ISFMP Policy Board

The Commission and the ISFMP Policy Board are generally responsible for the oversight and management of the Commission's fisheries management activities. The Commission must approve all fishery management plans and amendments, including Amendment 1, and must make all final determinations concerning state compliance or non-compliance. The ISFMP Policy Board reviews any non-compliance recommendations of the various Management Boards and Sections and, if it concurs, forwards them on to the Commission for action.

4.8.2 South Atlantic State/Federal Fisheries Management Board

The South Atlantic State/Federal Fisheries Management Board (Board) was established under the provisions of the Commission's ISFMP Charter (Section Four; ASMFC, 2016) and is responsible for carrying out all activities under this Amendment.

The Management Board establishes and oversees the activities of the PDT, PRT, TC, and SAS, as well as the South Atlantic Species AP. Among other things, the Board makes changes to the management program under adaptive management and approves state programs implementing the amendment and alternative state programs under Sections 4.5 and 4.6. The Management Board reviews the status of state compliance with the management program annually, and if it determines that a state is out of compliance, reports that determination to the ISFMP Policy Board under the terms of the ISFMP Charter.

4.8.3 Plan Development Team / Plan Review Team

The Cobia Plan Development Team (PDT) and Cobia Plan Review Team (PRT) are composed of scientists and/or managers whose responsibility is to provide all of the technical support necessary to carry out and document the decisions of the Board. A Commission FMP Coordinator chairs the PDT and PRT. The PDT and PRT will be directly responsible to the Management Board for providing information and documentation concerning the implementation, review, monitoring and enforcement of the species management plan. The PDT and PRT will be comprised of personnel from state and federal agencies who have scientific and management ability and knowledge of the relevant species. The Cobia PDT is responsible for preparing all documentation necessary for the development of management documents, using the best scientific information available and the most current stock assessment information. The PDT will either disband or assume inactive status upon completion of Amendment 1. Alternatively, the Board may elect to retain PDT members as members of the species-specific PRT, or appoint new members. The PRT provides annual advice concerning the implementation, review, monitoring, and enforcement of the FMP once it has been adopted by the Commission.

4.8.4 Technical Committee

The Cobia Technical Committee (TC) will consist of representatives from state and/or federal agencies, Regional Fishery Management Councils, Commission, university or other specialized personnel with scientific and technical expertise and knowledge of Atlantic cobia. The Management Board will appoint the members of a TC and may authorize additional seats as it sees fit. The role of the TC is to assess the species' population, provide scientific advice concerning the implications of proposed or potential management alternatives, and respond to other scientific questions from the Board, PDT, or PRT. The SAS reports to the TC.

4.8.5 Stock Assessment Subcommittee

Atlantic cobia will be primarily assessed through the Southeast Data, Assessment, and Review (SEDAR) process. However, in addition to SEDAR, the Management Board may appoint members to the Cobia Stock Assessment Subcommittee (SAS). The SAS is approved by the Management Board, with consultation from the TC, and consists of scientists with expertise in the assessment of Atlantic cobia. Its role is to assess the species population and provide scientific advice concerning the implications of proposed or potential management alternatives, or to respond to other scientific questions from the Management Board, TC, PDT or PRT. The SAS reports to the TC.

4.8.6 Advisory Panel

The South Atlantic Species Advisory Panel (AP) was established according to the Commission's Advisory Committee Charter. Members of the AP are citizens who represent a cross-section of commercial and recreational fishing interests and others who are concerned about the conservation and management of cobia, as well as Atlantic croaker, black drum, red drum, Spanish mackerel, spot, and spotted seatrout. The AP provides the Management Board with advice directly concerning the Commission's management programs for these seven species.

4.8.7 Federal Agencies

4.8.7.1 Management in the Exclusive Economic Zone (EEZ)

Management of Atlantic cobia in the EEZ was previously under the jurisdiction of the SAFMC under the Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. 1801 et seq.). However, in the absence of a Council Fishery Management Plan for Atlantic cobia, as is the case under Amendment 31 to the CMP FMP, management of this species is the responsibility of NOAA Fisheries, as mandated by the Atlantic Coastal Fisheries Cooperative Management Act (16 U.S.C. 5105 et seq.). The Commission may recommend regulatory measures to NOAA Fisheries for implementation in the EEZ.

4.8.7.2 Federal Agency Participation in the Management Process

The Commission has accorded the United States Fish and Wildlife Service (USFWS) and NOAA Fisheries voting status on the ISFMP Policy Board and the South Atlantic State/Federal Fisheries Management Board in accordance with the Commission's ISFMP Charter. NOAA Fisheries and the USFWS may also participate on the Management Board's supporting committees described in *Sections 4.8.3-4.8.6*.

4.8.7.3 Consultation with Fishery Management Councils

As of March 21, 2019, Atlantic cobia is no longer included in any SAFMC or other Council FMP. No Regional Fishery Management Councils have indicated an intent to develop a future plan for this stock. However, the SAFMC will continue to have a role in stock assessments for Atlantic cobia by conducting them through the SEDAR process. Additionally, in accordance with the Commission's ISFMP Charter, a representative of the SAFMC shall be invited to participate as a full member of the South Atlantic State/Federal Fisheries Management Board.

4.9 RECOMMENDATION TO THE SECRETARY OF COMMERCE FOR COMPLEMENTARY ACTIONS IN FEDERAL JURISDICTIONS

Through approval of Amendment 31 to the CMP FMP, the SAFMC no longer manages cobia in the EEZ. Therefore, it is necessary for the Commission to recommend measures to be implemented by NOAA Fisheries in the EEZ through authority and process defined in the ACFCMA.

If, for any reason, the coastwide fishery for either the commercial or recreational fishery are closed within state waters, the Commission will request through the ACFCMA that NOAA Fisheries issue a similar closure in the EEZ.

Issue 9

Options

a. Regulations in federal waters will be recommended to correspond to those of the vessel's state of landing.

b. Regulations in federal waters will be recommended to correspond to the location of catch, with regulations persisting along a latitudinal extension of state boundaries into federal waters. This extension for all boundaries would be directly due east, not along any alternative trajectory of these boundaries as they approach the Atlantic coast.

c. Regulations in federal waters will be recommended to correspond to those of the vessel's state of landing, with specified areas of restricted harvest. Regulations and boundaries for these areas of restricted harvest may be requested by a state, but must be approved by the Board.

4.10 COOPERATION WITH OTHER MANAGEMENT INSTITUTIONS

The Board will cooperate with other management institutions during the implementation of this amendment, including NOAA Fisheries and the SAFMC.

5.0 COMPLIANCE

The full implementation of the provisions included in this amendment is necessary for the management program to be equitable, efficient, and effective. States are expected to implement these measures faithfully under state laws. The Commission will continually monitor the effectiveness of state implementation and determine whether states are in compliance with the provisions of this fishery management plan.

The Board sets forth specific elements that the Commission will consider in determining state compliance with Amendment 1, and the procedures that will govern the evaluation of compliance. Additional details of the procedures are found in the Commission's ISFMP Charter

(ASMFC, 2016).

5.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

A state will be determined to be out of compliance with the provisions of this fishery management plan, according to the terms of Section Seven of the ISFMP Charter if:

- Its regulatory and management programs to implement Section 4 have not been approved by the Board; or
- It fails to meet any schedule required by *Section 5.1.2*, or any addendum prepared under Adaptive Management (*Section 4.6*); or
- It has failed to implement a change to its program when determined necessary by the Board; or
- It makes a change to its regulations required under Section 4 or any addendum prepared under Adaptive Management (*Section 4.6*), without prior approval from the Board.

5.1.1 Mandatory Elements of State Programs

To be considered in compliance with this Amendment, all state programs will include harvest controls on cobia fisheries consistent with the requirements of *Sections 4.3, 4.4, 4.5*; except that a state may propose an alternative management program under *Section 4.5*, which, if approved by the Board, may be implemented as an alternative regulatory requirement for compliance.

5.1.1.1 Regulatory Requirements

States may begin to implement Amendment 1 after final approval by the Commission. Each state will be required to submit its Atlantic cobia regulatory program to the Commission through the Commission staff for approval by the Board. During the period between submission and the Board approval of the state's program, a state may not adopt a less protective management program than contained in this Amendment or contained in current state law. The following lists the specific compliance criteria that a state/jurisdiction will be required to implement in order to be in compliance with Amendment 1:

- Recreational fishery management measures as specified in *Section 4.3* including the Size Limit (*Section 4.3.1*), Bag Limit (*Section 4.3.2*), coastwide Vessel Limit (*Section 4.3.3*), and adherence to a state recreational harvest target (*Section 4.3.4*).
- Commercial fishery management measures as specified in *Section 4.4* including the Size Limit (*Section 4.4.1*), Possession Limit (*Section 4.4.2*), coastwide Vessel Limit (*Section*

4.4.3), and closures of the commercial fishery if the commercial quota is met (*Section 4.4.4*).

- Monitoring requirements as specified in *Section 3.1.1*.

- All state programs must include law enforcement capabilities adequate for successful implementation of the compliance measures contained in this Amendment.

- There are no mandatory research requirements at this time; however, research requirements may be added in the future under Adaptive Management, *Section 4.6*.

- There are no mandatory habitat requirements in Amendment 1.

5.2 COMPLIANCE SCHEDULE

States must implement this Amendment according to the following schedule:

Month Day, 201X: Submission of state programs to implement Amendment 1 for approval by the Board. Programs must be implemented upon approval by the Board.

Month Day, 201X: States with approved management programs must implement Amendment 1. States may begin implementing management programs prior to this deadline if approved by the Board.

5.3 COMPLIANCE REPORTS

Each state must submit to the Commission an annual report concerning its Atlantic cobia fisheries and management program for the previous year, no later than July 1st. A standard compliance report format has been prepared and adopted by the ISFMP Policy Board. States should follow this format in completing the annual compliance report.

5.4 PROCEDURES FOR DETERMINING COMPLIANCE

Detailed procedures regarding compliance determinations are contained in the ISFMP Charter, Section Seven (ASMFC, 2016). In brief, all states are responsible for the full and effective implementation and enforcement of fishery management plans in areas subject to their jurisdiction. Written compliance reports as specified in this amendment must be submitted annually by each state with a declared interest. Compliance with Amendment 1 will be reviewed at least annually; however, the Board, ISFMP Policy Board, or the Commission may request the PRT to conduct a review of state's implementation and compliance with Amendment 1 at any time.

The Board will review the written findings of the PRT within 60 days of receipt of a State's compliance report. Should the Board recommend to the Policy Board that a state be determined out of compliance, a rationale for the recommended noncompliance finding will be addressed in a report. The report will include the required measures of Amendment 1 that the state has not implemented or enforced, a statement of how failure to implement or enforce required measures jeopardizes Atlantic cobia conservation, and the actions a state must take in order to comply with Amendment 1 requirements.

The ISFMP Policy Board will review any recommendation of noncompliance from the Board within 30 days. If it concurs with the recommendation, it shall recommend to the Commission that a state be found out of compliance.

The Commission shall consider any noncompliance recommendation from the ISFMP Policy Board within 30 days. Any state that is the subject of a recommendation for a noncompliance finding is given an opportunity to present written and/or oral testimony concerning whether it should be found out of compliance. If the Commission agrees with the recommendation of the ISFMP Policy Board, it may determine that a state is not in compliance with Amendment 1 and specify the actions the state must take to come into compliance.

Any state that has been determined to be out of compliance may request that the Commission rescind its noncompliance findings, provided the state has revised its Atlantic cobia conservation measures.

5.5 ANALYSIS OF THE ENFORCEABILITY OF PROPOSED MEASURES

The Commission's Law Enforcement Committee will, during the implementation of this FMP, analyze the enforceability of new conservation and management measures as they are proposed.

6.0 RESEARCH NEEDS

These management and research needs will be reviewed annually as part of the Commission's FMP Review process. The annual Cobia FMP Review will contain an updated list for future reference.

6.1 STOCK ASSESSMENT AND POPULATION DYNAMICS

An updated stock assessment for the Atlantic cobia has been scheduled for completion in 2019, led by SEFSC Beaufort Lab. The assessment will provide updated status information since the terminal year of the last assessment (2012). Anticipated results will include updated stock status and reference points and contribute to recommendations for additional management needs, if any.

6.2 RESEARCH AND DATA NEEDS

The following research recommendations were developed by the Cobia PDT and are ordered, within each category, from highest to lowest recommended priority.

6.2.1 Biological

1) Obtain more precise and timely estimates of harvest from the cobia recreational fishery.
2) Investigate release mortality and fishing mortality within the commercial and recreational fisheries in along the US Atlantic coast.
3) Continue to collect and analyze current life history data from fishery independent and dependent programs, including full size, age, maturity, histology workups and information on spawning season timing and duration. Any additional data that can be collected on any life stages of cobia would be highly beneficial.
4) Increase spatial and temporal coverage of age samples collected regularly in fishery dependent and independent sources. Prioritize collection of age data from fishery dependent and independent sources in all states.
5) Collect genetic material to continue to assess the stock identification and any Distinct Population Segments that may exist within the management unit relative to recommendations made by the SEDAR 58 Stock ID Process.
6) Conduct a high reward tagging program to obtain improved return rate estimates. Continue and expand current tagging programs to obtain mortality and growth information and movement at size data.
7) Conduct studies to estimate fecundity-at-age coastwide and to estimate batch fecundity.
8) Obtain better estimates of bycatch and mortality of cobia in other fisheries, especially juvenile fish.
9) Obtain estimates of selectivity-at-age for cobia through observer programs or tagging studies.
10) Define, develop, and monitor adult and juvenile abundance estimates through the expansion of current or development of fishery independent surveys.

6.2.2 Social

1) Using social impact analysis approaches such as updating applicable recreational and commercial fisheries community profiles and measures of social vulnerability (See Jepson & Colburn, 2013), evaluate the local and regional dependency on cobia resources managed by the Commission.

6.2.3 Economic

1) Obtain better data (e.g. more comprehensive and timely) to estimate the annual economic impacts, net benefits, and economic contributions of recreational and commercial Atlantic cobia fishing on coastal communities and regions.

2) Obtain cost and expenditure data for recreational fishing trips targeting cobia by fishing mode, for different states, and for anglers returning to private sites, who would not be sampled by the MRIP.
3) Estimate willingness-to-pay associated with recreational cobia angling.

6.2.4 Habitat

1) Expand existing fishery independent surveys in time and space to better define and cover cobia habitats.
2) Conduct otolith microchemistry studies to identify regional recruitment contributions.
3) Conduct new and expand existing satellite tagging programs to help identify spawning and juvenile habitat use and regional recruitment sources.

6.2.5 State-specific

6.2.5.1 Georgia

Little is known regarding cobia stocks off Georgia. It is unclear if Georgia has a unique subpopulation of East-West migration cobia as seen in other nearby states (South Carolina). Currently cobia in Georgia are recognized and managed as part of the Atlantic Migratory Group (AMG). It is possible that some portion of Georgia fish could be mixing more with the Florida East Coast/Gulf stock rather than the AMG. If this is occurring, it could have important management implications for the species. Furthermore, the range of habitat types (inshore vs. nearshore) utilized by cobia in Georgia remains unknown. It would be beneficial to better explain the range of habitats utilized by cobia in Georgia as well as identify overwintering locations for Georgia cobia. This could be easily done through a simple acoustic telemetry study. Identifying these basic life history characteristics for cobia in Georgia will aid in the management of the species both at a state and a regional level. Additionally, better socio-economic estimates of the impact of cobia fishing in Georgia would aid in understanding how regulatory changes may impact the socio-economic benefits of cobia fishing to the State of Georgia and the South Atlantic region.

7.0 PROTECTED SPECIES

In the fall of 1995, Commission member states, the National Marine Fisheries Service (NMFS; now, NOAA Fisheries) and the U.S. Fish and Wildlife Service (USFWS) began discussing ways to improve implementation of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) in state waters. Historically, these policies have been minimally enforced in state waters (0-3 miles). In November 1995, the Commission, through its ISFMP Policy Board, approved amendment of its ISFMP Charter (Section Six (b)(2)) so that interactions between Commission-managed fisheries and species protected under the MMPA, ESA, and other legislation, including the Migratory Bird Treaty Act be addressed in the Commission's fisheries management planning process. Specifically, the Commission's fishery management plans describe impacts of state fisheries on certain marine mammals and endangered species (collectively termed "protected species"), and recommend ways to minimize these impacts. The following section outlines: (1) the federal legislation which guides protection of marine mammals, sea turtles, and marine birds; (2) the protected species with potential fishery interactions; (3) the specific type(s) of fishery interactions; (4) population status of the affected protected species; and (5) potential impacts to Atlantic coastal state and interstate fisheries.

7.1 MARINE MAMMAL PROTECTION ACT (MMPA) REQUIREMENTS

Since its passage in 1972, one of the primary goals of the MMPA has been to reduce the incidental mortality and serious injury of marine mammals permitted in the course of commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate. Under the 1994 Amendments, the MMPA requires the NMFS to develop and implement a take reduction plan to assist in the recovery or prevent the depletion of each strategic stock that interacts with a Category I or II fishery. Specifically, a strategic stock is defined as a stock: (1) for which the level of direct human caused mortality exceeds the potential biological removal (PBR) level; (2) which is declining and is likely to be listed under the Endangered Species Act (ESA) in the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. Category I and II fisheries are those that have frequent or occasional incidental mortality and serious injury of marine mammals, respectively, whereas Category III fisheries have a remote likelihood of incidental mortality and serious injury of marine mammals. Each year, NOAA Fisheries publishes an annual List of Fisheries which classifies commercial fisheries into one of these three categories.

Under the 1994 mandates, the MMPA also requires fishermen participating in Category I and II fisheries to register under the Marine Mammal Authorization Program (MMAP), the purpose of which is to provide an exception for commercial fishermen from the general taking prohibitions of the MMPA for non-ESA listed marine mammals. All fishermen, regardless of the category of fishery they participate in, must report all incidental injuries and mortalities caused by commercial fishing operations within 48 hours.

Section 101(a)(5)(E) of the MMPA allows for the authorization of the incidental taking of individuals from marine mammal stocks listed as threatened or endangered under the ESA in the course of commercial fishing operations if it is determined that: (1) incidental mortality and serious injury will have a negligible impact on the affected species or stock; (2) a recovery plan has been developed or is being developed for such species or stock under the ESA; and (3) where required under Section 118 of the MMPA, a monitoring program has been established, vessels engaged in such fisheries are registered in accordance with Section 118 of the MMPA, and a take reduction plan has been developed or is being developed for such species or stock.

Permits are not required for Category III fisheries; however, any mortality or serious injury of a marine mammal must be reported.

7.2 ENDANGERED SPECIES ACT (ESA) REQUIREMENTS

The taking of endangered sea turtles, fish, seabirds, and marine mammals is prohibited and considered unlawful under Section 9(a)(1) of the ESA. In addition, NOAA Fisheries or the USFWS may issue Section 4(d) protective regulations necessary and advisable to provide for the conservation of threatened species. The ESA defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." There are several mechanisms established in the ESA to allow exceptions to the take prohibition in Section 9(a)(1). Section 10(a)(1)(A) of the ESA authorizes NOAA Fisheries to allow the taking of listed species through the issuance of research permits for scientific purposes or to enhance the propagation or survival of the species. Section 10(a)(1)(B) authorizes NOAA Fisheries to permit, under prescribed terms and conditions, any taking otherwise prohibited by Section 9(a)(1)(B) of the ESA, if the taking is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Finally, Section 7(a)(2) requires federal agencies to consult with NOAA Fisheries to ensure that any action that is authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species. If, following completion of consultation, an action is found to jeopardize the continued existence of any listed species or cause adverse modification to critical habitat of such species, reasonable and prudent alternatives will be identified so that jeopardy or adverse modification to the species is removed and Section

7(a)(2) is met (see Section 7(b)(3)(A)). Alternatively, if, following completion of consultation, an action is not found to jeopardize the continued existence of any listed species or cause adverse modification to critical habitat of such species, reasonable and prudent measures will be identified that minimize the take of listed species or adverse modification of critical habitat of such species (see Section 7(b)(4)). Section (7)(o) provides the actual exemption from the take prohibitions established in Section 9(a)(1), which includes Incidental Take Statements that are provided at the end of consultation via the ESA Section 7 Biological Opinions.

7.3 MIGRATORY BIRD TREATY ACT (MBTA) REQUIREMENTS

Under the Migratory Bird Treaty Act it is unlawful "by any means or in any manner, to pursue, hunt, take, capture, [or] kill" any migratory birds except as permitted by regulation (16 USC. 703). Section 50 CFR 21.11 prohibits the take of migratory birds except under a valid permit or as permitted in the regulations. Many migratory waterbirds occur within the boundaries of cobia fisheries. USFWS Policy on Waterbird Bycatch (2000) states: "It is the policy of the U.S. Fish and Wildlife Service that the Migratory Bird Treaty Act of 1918, as amended, legally mandates the protection and conservation of migratory birds. The USFWS seeks to actively expand partnerships with regional, national, and international organizations, States, tribes, industry, and environmental groups to address seabird bycatch in fisheries, by promoting public awareness of waterbird bycatch issues, and facilitating the collection of scientific information to develop and provide guidelines for management, regulation, and compliance."

Birds of Management Concern are a subset of MBTA-protected species which pose special management challenges because of a variety of factors (e.g., too few, too many, conflicts with human interests, societal demands). These species are of concern because of: documented or apparent population declines; small or restricted populations; dependence on restricted or vulnerable habitats; or overabundant to the point of causing ecological and economic damage.

7.4 PROTECTED SPECIES WITH POTENTIAL FISHERY INTERACTIONS

The management unit of the cobia Atlantic Migratory Group extends from the Georgia/Florida line through New York. There are numerous protected species that inhabit the range of the cobia management unit covered under this FMP. Listed below are ESA and MMPA protected species found in coastal and offshore waters of the Atlantic Ocean within the range of cobia fisheries. USFWS species of management concern that have the potential to interact with cobia fisheries are also listed. Species of management concern are protected under the MBTA, but lack the protections mandated by the ESA.

ESA – Endangered[4]

- Atlantic sturgeon *(Acipenser oxyrinchus oxyrinchus)*, NY Bight, Chesapeake Bay, Carolina, and South Atlantic Distinct Population Segments (DPSs)[5]
- Shorthnose sturgeon (*Acipenser brevirostrum*)
- Smalltooth sawfish (*Pristis pectinata*)
- Blue whale (*Balaenoptera musculus*)
- Fin whale (*Balaenoptera physalus*)
- Humpback whale (*Megaptera novaeangliae*)
- North Atlantic right whale (*Eubalaena glacialis)*
- Sei whale (*Balaenoptera borealis*)
- Sperm whale (*Physeter microcephalus*)
- Hawksbill sea turtle (*Eretmochelys imbricata*)
- Kemp's ridley sea turtle *(Lepidochelys kempii)*
- Leatherback sea turtle (*Dermochelys coriacea)*
- Bermuda petrel (*Pterodroma cahow*)

[4] http://www.nmfs.noaa.gov/pr/species/esa/listed.htm

[5] A distinct population segment (DPS) is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The ESA provides for listing species, subspecies, or DPS of vertebrate species.

- Roseate tern *(Sterna dougallii dougallii*)*,* northeastern U.S. and Nova Scotia breeding population

ESA – Threatened[6]

- Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), Gulf of Maine DPS
- Nassau grouper (*Epinephelus striatus*)
- Green sea turtle (*Chelonia mydas),* North Atlantic and South Atlantic DPSs
- Loggerhead sea turtle *(Caretta caretta)*, Northwest Atlantic Ocean DPS
- Roseate tern *(Sterna dougallii dougallii*)*,* Southeastern U.S. and Caribbean breeding population (FL, GA, NC, SC, Puerto Rico, Virgin Islands)
- Piping plover (*Charadrius melodus*)

MMPA – Protected[7]

Includes all marine mammals above in addition to:

- Atlantic spotted dolphin *(Stenella frontalis)*
- Bottlenose dolphin (*Tursiops truncatus*)
- Atlantic white-sided dolphin *(Lagenorhynchus acutus)*
- Clymene dolphin (*Stenella clymene*)
- Pantropical spotted dolphin *(Stenella attenuata)*
- Risso's dolphin (*Grampus griseus*)
- Rough-toothed dolphin (*Steno bredanensis*)
- Short-beaked common dolphin *(Delphinus delphis)*
- Spinner dolphin (*Stenella longirostris*)
- Striped dolphin (*Stenella coeruleoalba*)
- Gray seal (*Halichoerus grypus*)
- Harbor porpoise (*Phocoena phocoena*)
- Harbor seal (*Phoca vitulina*)
- Minke whale (*Balaenoptera acutorostrata*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Gervais' beaked whale (*Mesoplodon europaeus*)
- True's beaked whale *(Mesoplodon mirus)*
- Bryde's whale (*Balaenoptera edeni*)
- Dwarf sperm whale *(Kogia sima)*
- False killer whale (*Pseudorca crassidens*)
- Killer whale (*Orcinus orca*)
- Long-finned pilot whale *(Globicephala melas)*

---

[6] http://www.nmfs.noaa.gov/pr/species/esa/listed.htm

[7] http://www.nmfs.noaa.gov/pr/species/mammals

- Melon-headed whale (*Peponocephala electra*)
- Pygmy killer whale (*Feresa attenuate*)
- Pygmy sperm whale (*Kogia breviceps*)
- Short-finned pilot whale (*Globicephala macrorhynchus*)

ESA – Species of Concern[8]

- Alewife (*Alosa pseudoharengus*)
- Blueback herring (*Alosa aestivalis*)
- Dusky shark (*Carcharhinus obscures*)
- Porbeagle shark *(Lamna nasus)*
- Rainbow smelt (*Osmerus mordax*)
- Sand tiger shark (*Carcharias taurus*)
- Speckled hind (*Epinephelus drummondhayi*)
- Striped croaker (*Bairdiella sanctaeluciae*)
- Warsaw grouper (*Epinephelus nigritus*)

MBTA—USFWS Species of Management Concern

- Canvasback (*Aythya valisineria*)
- Redhead (*Aythya americana*)
- Greater scaup (*Aythya marila*)
- Lesser scaup (*Aythya affinis*)
- Surf scoter (*Melanitta perspicillata*)
- White-winged scoter (*Melanitta fusca*)
- Black scoter (*Melanitta americana*)
- Long-tailed duck (*Clangula hyemalis*)
- Common goldeneye (*Bucephala clangula*)
- Red-throated loon (*Gavia stellata)*
- Black-capped petrel (*Pterodroma hasitata*)
- Greater shearwater (*Puffinus gravis*)
- Audubon's shearwater (*Puffinus lherminieri*)
- Band-rumped storm-petrel (*Oceanodroma castro*)
- Masked booby (*Sula dactylaria*)
- Brown booby (*Sula leucogaster*)
- Pied-billed grebe (*Podilymbus podiceps*)
- Horned grebe (*Podiceps auritus*)
- Magnificent frigatebird (*Fregata magnificens*)
- Least tern (*Sternula antillarum*), non-listed Atlantic coast subspecies

[8] http://www.nmfs.noaa.gov/pr/species/concern/

- Gull-billed tern (*Gelochelidon nilotica*)

7.5 PROTECTED SPECIES INTERACTIONS WITH EXISTING FISHERIES

7.5.1 Overview of the Cobia Fishery and Gears Used

Recreational fisheries are prosecuted similarly along the coast. The directed cobia fishery is prosecuted in two distinct ways. Bottom fishing with live or dead baits, often while chumming, in estuarine waters or around inlets or offshore around structure, buoys, markers, natural and artificial reefs. More recently, an active method of searching for fish traveling alone or in small groups on the surface or associated with schools of Atlantic menhaden or other bait fishes has grown in popularity. This newer method has resulted in the further development of the for-hire component for cobia, as well as the development of specific artificial baits and boat modifications (e.g., towers) to facilitate spotting and catching the fish. A third method primarily prosecuted in offshore waters is to target large rays, large sharks, sea turtles or floating debris around which cobia congregate. However, the practice of targeting sea turtles while cobia fishing is considered a “take” under the Endangered Species act and is, therefore, unlawful. Additionally, the Atlantic coast of Florida is starting to see more directed spearfishing pressure on cobia. Specifically, spearfishers are chumming for bull shark and then diving/free-diving to spear cobia that associate with them. Spearfishing also occurs off North Carolina, along with a popular pier fishery.

The recreational fishery also takes cobia as bycatch in offshore bottom fisheries such as snapper/grouper, nearshore trolling for king mackerel, bluefish, and dolphin and any other fishery that employs live or dead bait fished on or near the bottom. While the directed fishery appears to focus more on the spring-summer spawning migration, bycatch, especially offshore, can yield cobia virtually year round. The average of recreational Atlantic cobia landings from 2010-2018 is 1.8 million lb (MRIP, queried April, 2019).

The commercial fishery has traditionally been a bycatch in other directed fisheries such as the snapper/grouper hook and line fishery and troll fisheries for various species (e.g., king mackerel, dolphin, wahoo, amberjack). Directed fisheries are generally precluded as a result of the low possession limits, but do occur, specifically Virginia’s commercial hook and line fishery. Cobia from for-hire trips may also be sold commercially, depending on the state’s permit requirements for selling fish. The average of commercial Atlantic cobia landings from 2010-2017 is 62,073 lb (ACCSP, queried April, 2019). In 2017, the predominant gear categories that were used commercially to capture Atlantic cobia were gill nets (33%), hand line (29%), hook and line (20%), and pound nets (11%) (ACCSP, queried April, 2019).

7.5.2 Marine Mammals

NMFS completed a biological opinion on June 18, 2015, evaluating the impacts of the CMP fishery on ESA-listed species. In the biological opinion, NMFS determined that the proposed continued authorization of the CMP Fishery, is not likely to adversely affect any listed whales (i.e., blue, sei, sperm, fin, humpback, or North Atlantic right whales). NMFS also determined that the CMP fishery will have no effect on designated critical habitat for North Atlantic right whale (NMFS, 2015).

The Gulf and South Atlantic CMP hook-and-line fishery (which includes fisheries that capture cobia) is classified in the 2017 MMPA List of Fisheries as a Category III fishery (82 FR 3655; January 12, 2017). This means the annual mortality and serious injury of a marine mammal resulting from the fishery is less than or equal to 1% of PBR, the maximum number of animals, not including natural moralities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. In other words, there is a remote likelihood of or no known incidental mortality and serious injury of marine mammals resulting from these fisheries.

The Gulf and South Atlantic CMP gillnet fishery is classified as Category II fishery in the 2017 MMPA List of Fisheries. This classification indicates an occasional incidental mortality or serious injury of a marine mammal stock resulting from the fishery (1-50% annually of PBR). The fishery has no documented interaction with marine mammals; NMFS classifies this fishery as Category II based on analogy (i.e., similar risk to marine mammals) with other gillnet fisheries.

7.5.3 Sea Turtles

7.5.3.1 Overview

As mentioned above, the NMFS completed a biological opinion on June 18, 2015, evaluating the impacts of the CMP fishery (including king mackerel, Spanish mackerel, and cobia) on ESA-listed species (NMFS, 2015). According to the biological opinion, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all likely to be adversely affected by the CMP fishery. Green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all highly migratory, travel widely throughout the GOM and South Atlantic, and are known to occur in area of the fishery. The biological opinion evaluated the potential for the following gears to interact with protected species: hook-and-line gear, cast net gear, and gill net gear. The biological opinion found that gill net gear is the only gear used in the CMP fisheries that may adversely affect sea turtles. Gill net gear is used to target both Spanish and king mackerel, but not cobia.

7.5.3.2 Hook-and-Line Fishing

The 2015 biological opinion for CMP resources concluded that sea turtles (as well as smalltooth sawfish and Atlantic sturgeon) are not likely to be adversely affected by CMP hook-and-line fishing. The 2015 biological opinion stated: "*The hook-and-line gear used by both commercial and recreational fishers to target CMP species is limited to trolled or, to a much lesser degree (e.g., historically ~2% by landings for king mackerel), jigged handline, bandit, and rod-and-reel gear. Sea turtles, Atlantic sturgeon, and smalltooth sawfish are both vulnerable to capture on hook-and-line gear, but the techniques commonly used to target CMP species makes effects on* *these listed species extremely unlikely and, therefore, discountable. Sea turtles are unlikely to be caught during hook-and-line trolling because of the speed (4-10 kt) at which the lure is pulled through the water. As cedar plugs and spoons are generally used when trolling, it is unlikely that a sea turtle of any size would actively pursue the gear and get hooked. Likewise, we also believe sea turtles would be unlikely to be snagged by jigged gear as it is deployed at or near the surface and constantly reeled and jigged back to the boat. It is possible that a sea turtle could be incidentally snagged if it comes in contact with a trolled or jigged hook, but the chances of this occurring are extremely low… We believe that CMP species caught on bandit gear or standard rod-and-reel gear (i.e., baited and deployed as passive, vertical gear) are largely bycatch when targeting other species closer to the bottom (e.g., snapper and grouper); use of the gear in this method (i.e., mid-water placement) is not effective at catching mackerel based on available information (e.g., landings data). In summary, we believe effects from these gear types on Atlantic sturgeon, smalltooth sawfish, and sea turtles are extremely unlikely to occur, and are therefore discountable"* (NMFS, 2015).

There is limited information about protected species interactions within recreational fisheries.

In 2015, The North Carolina Division of Marine Fisheries conducted a project funded under the ACCSP to examine potential protected species interactions and finfish discards and releases in the recreational cobia hook-and-line fishery. Observations were made via an alternative observer platform, where recreational fishing activity was monitored at close proximity from individuals on state owned vessels. From April 27, 2015, through October 29, 2015, 552 recreational hook-and-line observations (observed fishing trips) were completed over 138 observed fishing days with 16.2% of fishing trips targeting cobia. Observations occurred in inshore (estuarine) and near-shore waters (≤ 3 miles) of Carteret County. No protected species interactions were observed (Boyd, 2016).

7.5.3.3 Gill Net

Cobia are generally considered a bycatch species within gill net fisheries. The 2015 biological opinion for CMP resources concluded that gill net gear used in the federal CMP fisheries of the Atlantic and GOM have adversely affected sea turtles, smalltooth sawfish, and Atlantic sturgeon in the past via entanglement and, in the case of sea turtles, via forced submergence (NMFS, 2015).

7.5.3.4 Targeting of Large Animals

One known method used to prosecute cobia in offshore waters is to target large rays, large sharks, sea turtles, or floating debris around which cobia congregate. However, the practice of targeting sea turtles while cobia fishing is considered a "take" under the Endangered Species act and is, therefore, unlawful. Not much is known about this method or its impacts on protected species.

7.5.4 Sturgeon, Smalltooth Sawfish, Nassau Grouper

The 2015 biological opinion for CMP resources concluded that gill net gear used in the federal CMP fisheries of the Atlantic and GOM have adversely affected smalltooth sawfish[9] and Atlantic sturgeon in the past via entanglement.

The biological opinion also concluded that smalltooth sawfish and Atlantic sturgeon are not likely to be adversely affected by CMP hook-and-line fishing. Fishers who capture smalltooth sawfish most commonly report that they were fishing for snook, redfish, or sharks (Simpfendorfer and Wiley, 2004), not CMP species. Additionally, Atlantic sturgeon and smalltooth sawfish are largely bottom-dwelling species, whereas CMP lures and baits are typically fished near the surface of the water. This also greatly reduces the likelihood of Atlantic sturgeon and smalltooth sawfish interactions with trolling gear (NMFS, 2015).

On June 29, 2016, NMFS published a final rule listing Nassau grouper as threatened under the ESA. Reinitiation of Section 7 consultation on the CMP FMP is needed to address newly listed species. NOAA Fisheries is currently prioritizing completion of the consultation along with other consultations required after recent listings.

7.5.5 Seabirds

The roseate tern, Bermuda petrel, and piping plover are the only ESA listed bird species within the mid-and south-Atlantic maritime regions. The roseate tern and Bermuda petrel are uncommon in inshore and coastal waters of the mid- and south-Atlantic and thus, have relatively low likelihoods of interacting with cobia fisheries. Nevertheless, exceptional efforts to avoid deleterious interactions with these species are warranted as they are rare and highly vulnerable to even minimal levels of mortality. The piping plover could be impacted by shore-based fishing activity if individuals were disturbed or killed by vehicles related to fishing efforts. However, during the nesting season, when plovers are highly vulnerable to beach disturbance, sensitive areas are posted and beach access is often restricted.

Bermuda petrels are occasionally seen in the waters of the Gulf Stream off the coasts of North Carolina and South Carolina during the summer. Sightings are considered rare and only occurring in low numbers. Roseate terns occur widely along the Atlantic coast during the summer but in the southeast region, they are found mainly off the Florida Keys (unpublished USFWS data). Interaction with fisheries has not been reported as a concern for either of these species. Although, the Bermuda petrel and roseate tern occur within the action area, these species are not commonly found and neither has been described as associating with vessels or having had interactions with the CMP fishery. Framework Amendment 4 to the FMP for CMP

[9] Although smalltooth sawfish are typically found in the peninsula of Florida, there have been recent interactions as far north as North Carolina.

resources in the Gulf of Mexico and Atlantic Region concluded that the CMP fishery is not likely to negatively affect the Bermuda petrel and the roseate tern.

7.6 POPULATION STATUS REVIEW OF RELEVANT PROTECTED SPECIES

7.6.1 Marine Mammals

The status review of marine mammal populations inhabiting the Southwest Atlantic are discussed in detail in U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. The most recent assessment was published in 2016 (Waring et al., 2016). The report presents information on stock definition, geographic range, population size, productivity rates, PBR, fishery specific mortality estimates, and compares the PBR to estimated human-caused mortality and serious injury for each stock.

7.6.2 Sea Turtles

All sea turtles that occur in U.S. waters are listed as either endangered or threatened under the ESA. The Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*) are listed as endangered. The Northwest Atlantic Ocean DPS of loggerhead turtles (*Caretta caretta*) and the North Atlantic and South Atlantic DPSs of green turtle (*Chelonia mydas*) are listed as threatened. All five of these species inhabit the waters of the U.S. Atlantic and Gulf of Mexico.

Atlantic coastal waters provide important developmental, migration, and feeding habitat for sea turtles. The distribution and abundance of sea turtles along the Atlantic coast is related to geographic location, reproductive cycles, food availability, and seasonal variations in water temperatures. Water temperatures dictate how early northward migration begins each year and are a useful factor for assessing when turtles will be found in certain areas. Sea turtles can occur in offshore as well as inshore waters, including sounds and embayments. More information about sea turtles can be found here: https://www.fisheries.noaa.gov/sea-turtles.

7.6.3 Sturgeon, Smalltooth Sawfish, and Nassau Grouper

No estimate of the historical population size of shortnose sturgeon is available. While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast, which resulted in a lack of records of shortnose sturgeon. Shortnose sturgeon has been listed as endangered since 1967. A status assessement of shortnose sturgeon was last published in 2010 (SSSRT, 2010).

In 2012, NOAA Fisheries listed four DPSs of Atlantic sturgeon *(Acipenser oxyrinchus oxyrinchus)* as endangered (NY Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs) and one as threatened (Gulf of Maine). More information about Atlantic sturgeon can be found here: https://www.fisheries.noaa.gov/species/atlantic-sturgeon.

The U.S. DPS of smalltooth sawfish was listed as endangered in 2003. No accurate estimates of abundance trends over time are available, but available data, including museum records and anecdotal observations from fishers, indicate that the population has declined dramatically by about 95%. Smallooth sawfish were once common throughout their historic range, but they have declined dramatically in U.S. waters over the last century. Still, there are few reliable data available, and no robust estimates of population size exist.[10]

In 2016, NOA Fisheries listed Nassau grouper as threatened under the ESA (81 FR 42268; June 29, 2016). While the species still occupies its historical range, overutilization through historical harvest has reduced the number of individuals which in turn has reduced the number and size of spawning aggregations. Although harvest of Nassau grouper has diminished due to management measures, the reduced number and size of spawning aggregations and the inadequacy of law enforcement continue to present extinction risk to Nassau grouper. The Nassau grouper's confirmed distribution currently includes Bermuda and Florida (U.S.A.), throughout the Bahamas and Caribbean Sea. Many earlier reports of Nassau grouper up the Atlantic coast to North Carolina have not been confirmed.

7.6.4 Seabirds

The overall population status of the Bermuda Petrel is unknown. The Bermuda Petrel is a pelagic seabird, and its range and distribution at sea make it very difficult to survey. It is known to nest only on five small islets in Bermuda. Surveys are limited to the breeding grounds. The total population of the Bermuda Petrel is estimated as 101 breeding pairs (USFWS, 2013).

The roseate tern is a federally protected and endangered seabird that is mainly found in the Northern Hemisphere on the northeastern coast of North America, extending from Nova Scotia to the southern tip of Florida, as well as several islands in the Caribbean Sea. Populations in the northeastern U.S. greatly declined in the late 19th century due to hunting for the millinery, or hat trade. In the 1930s, protected under the MBTA, the population reached a high of about 8,500, but since then, population numbers have declined and stayed in the low range of 2,500 to 3,300. The species was listed in 1987 as endangered in the northeastern U.S. Populations in Florida, Georgia, North Carolina, Puerto Rico, South Carolina and the Virgin Islands are listed as threatened.[11]

The piping plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina. These birds winter primarily on the Atlantic Coast from North Carolina to Florida, although some migrate to the Bahamas and West Indies. Piping plovers were common along the Atlantic Coast during much of the 19th century, but nearly disappeared due to excessive hunting for the millinery trade. The current population decline is attributed to

[10] https://www.fisheries.noaa.gov/species/smalltooth-sawfish
[11] https://www.fws.gov/northeast/pdf/Roseatetern0511.pdf

increased development and recreational use of beaches. The most recent surveys place the Atlantic population at less than 2000 pairs.[12]

7.7 EXISTING AND PROPOSED FEDERAL REGULATIONS/ACTIONS PERTAINING TO RELEVANT PROTECTED SPECIES

7.7.1 Marine Mammals

Species of large whales protected by the ESA that occur throughout the Atlantic Ocean include the blue whale, humpback whale, fin whale, North Atlantic right whale, sei whale, and the sperm whale. Additionally, the West Indian manatee also occurs in both the Gulf of Mexico and the Atlantic Ocean. These species are also considered depleted under the Marine Mammal Protection Act (MMPA). Depleted and endangered designations afford special protections from captures, and further measures to restore populations to recovery or the optimum sustainable population are identified through required recovery (ESA species) or conservation plans (MMPA depleted species). Numerous other species of marine mammals listed under the MMPA occur throughout the Atlantic Ocean.

The MMPA mandates NOAA Fisheries to develop and implement Take Reduction Plans for preventing the depletion and assisting in the recovery of certain marine mammal stocks that are seriously injured or killed in commercial fisheries. In the Atlantic, the following Take Reduction Plans have been developed, which address in part, gears that have been used to capture cobia (gillnet):

- The Atlantic Large Whale Take Reduction Plan is designed to reduce the risk of mortality and serious injury of large whales (right, fin, humpback) incidental to U.S. commercial trap/pot and gillnet fisheries, including Southeast Atlantic gillnet.
- The Bottlenose Dolphin Take Reduction Plan is designed to reduce the incidental mortality and serious injury of the western North Atlantic coastal bottlenose dolphin stock in several coastal fisheries, including the Southeast Atlantic gillnet fishery.

7.7.2 Sea turtles

Under the ESA, and its implementing regulations, taking sea turtles – even incidentally – is prohibited, with exceptions identified in 50 CFR 223.206. The incidental take of endangered species may only legally be authorized by an incidental take statement or an incidental take permit issued pursuant to Section 7 or 10 of the ESA, respectively. According to the 2015 biological opinion on CMP fisheries, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all likely to be adversely affected by the CMP fishery (NMFS, 2015). Green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all highly

[12] https://www.fws.gov/northeast/pipingplover/overview.html

migratory, travel widely throughout the GOM and South Atlantic, and are known to occur in the area of the fishery. The 2015 biological opinion for CMP established an incidental take statement with reasonable and prudent measures and terms and conditions for incidental take coverage in the federal CMP fisheries for sea turtles takes throughout the action area.

On April 6, 2016, NMFS published a final rule (81 FR 20058) listing 11 distinct population segments (DPSs) for green sea turtles. The listing of the DPSs of green turtles triggers reinitiation of consultation under Section 7 of the ESA because the previous opinion did not consider what effects the CMP fishery is likely to have on this species, therefore NOAA Fisheries must analyze the impacts of these potential interactions. NOAA Fisheries is also in the process of identifying critical habitat, which will be proposed in a future rulemaking.

In 2013, the North Carolina Division of Marine Fisheries was issued a permit for the incidental take of listed sea turtles associated with the otherwise lawful large and small mesh gill net fishing in specified inshore estuarine areas. This permit requires North Carolina to close designated areas to avoid approaching the take limit.

Existing NOAA Fisheries regulations specify procedures that it may use to determine that unauthorized takings of sea turtles occur during fishing activities, and to impose additional restrictions to conserve sea turtles and to prevent unauthorized takings (50 CFR 223.206(d)(4)). Restrictions may be effective for a period of up to 30 days and may be renewed for additional periods of up to 30 days each. In 2007, NMFS issued a regulation (50 CFR 222.402) to establish procedures through which each year NMFS will identify, pursuant to specified criteria and after notice and opportunity for comment, those fisheries in which the agency intends to place observers (72 FR 43176, August 3, 2007). NOAA Fisheries issues a notice or regulation each year maintaining or updating the fisheries listed on the annual determination. The most recent determination was in December 2016 (81 FR 90330, December 14, 2016). NOAA Fisheries may place observers on U.S. fishing vessels, either recreational or commercial, operating in U.S. territorial waters, the U.S. exclusive economic zone (EEZ), or on the high seas, or on vessels that are otherwise subject to the jurisdiction of the U.S. Failure to comply with the requirements under this rule may result in civil or criminal penalties under the ESA.

7.7.3 Sturgeon, smalltooth sawfish, and Nassau grouper

Shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*A. oxyrinchus*) were listed under the ESA in 1967 and 2012, respectively. The Commission and federal government implemented a coastwide moratorium on sturgeon harvest in late 1997 and early 1998. Bycatch remains an important issue in the recovery of Atlantic sturgeon populations throughout their range (ASMFC, 2007). The National Marine Fisheries Service established a recovery plan for shortnose sturgeon in 1998.

In 2013, the Georgia Department of Natural Resources was issued a permit for the incidental take of shortnose and Atlantic sturgeon associated with the otherwise lawful commercial shad fishery in Georgia. In 2014, the North Carolina Division of Marine Fisheries was issued a permit for the incidental take of Atlantic sturgeon DPSs associated with the otherwise lawful commercial inshore gillnet fishery in North Carolina.

The 2015 biological opinion for the Federal CMP fisheries established an incidental take statement with reasonable and prudent measures and terms and conditions for incidental take of Atlantic sturgeon (as well as sea turtles and smalltooth sawfish) throughout the action area (NMFS, 2015). In June 2016, NOAA Fisheries published proposed rules to designate critical habitat for Atlantic sturgeon (81 FR 36077; 6/3/2016 and 81 FR 35701; 6/3/2016).

The U.S. DPS of smalltooth sawfish was listed as endangered in 2003. Critical habitat was designated for it in 2009 (74 FR 45353; 9/2/2009) and a recovery plan was finalized in 2009 as well.

Harvest and possession of Nassau grouper is prohibited in the United States, Puerto Rico, and the U.S. Virgin Islands. NOAA Fisheries is evaluating potential management actions, such as critical habitat or application of the 4(d) rule in the ESA. When NMFS listed Nassau grouper as threatened, it solicited information from the public that may be relevant to the designation of critical habitat for Nassau grouper. A 4(d) rule provides regulations necessary for the conservation of any threatened species

7.7.4 Seabirds

Under the ESA and its regulations, take of Bermuda petrels, roseate terns, and piping plovers, even incidentally, is prohibited. The incidental take of an ESA listed species may only be legally authorized by an incidental take statement or incidental take permit issued pursuant to Section 7 or 10 of the ESA. No incidental takes of ESA listed bird species is currently authorized for cobia fisheries.

Section 316(c) of the Magnuson-Stevens Fishery Conservation and Management Act authorizes the Interior and Commerce Departments to undertake projects, in cooperation with industry, to improve information and technology to reduce seabird-fisheries interactions. USFWS seeks to partner with State, regional, and Federal agencies; industry; tribes; and NGOs to facilitate outreach and improve information and technology to reduce seabird bycatch in fisheries within state and Federal waters. A Memorandum of Understanding between NMFS and the USFWS (2012) describes additional collaborative efforts recommended to better understand and reduce bird bycatch in fisheries.[13]

Most actions to understand and reduce marine bird bycatch in the U.S. have occurred in Pacific waters. However, in 2011, the USFWS issued a business plan for addressing and reducing marine bird bycatch in U.S. Atlantic fisheries. The plan identified priority goals and actions to

[13] https://www.fws.gov/migratorybirds/pdf/management/mounmfs.pdf

target the following marine bird-fisheries interactions: greater shearwaters in the New England groundfish fishery, and red-throated loons in the mid-Atlantic gillnet fisheries.[14]

7.8 POTENTIAL IMPACTS TO ATLANTIC COASTAL STATE AND INTERSTATE FISHERIES

Regulations under the take reduction plans for Atlantic large whales and bottlenose dolphins have the potential to impact gill net fisheries that capture cobia as bycatch.

7.9 IDENTIFICATION OF CURRENT DATA GAPS AND RESEARCH NEEDS

7.9.1 General Bycatch Related Research Needs

The following activities would improve our understanding of bycatch of fish and protected species in the Southeast Region. These activities were identified within NOAA Fisheries' Southeast Regional Office's FY16-20 Strategic Plan[15]:

- In coordination with the Marine Recreational Information Program (MRIP), test and validate the use of on-board recording systems (e.g., electronic logbooks) for capturing information on discarded fishes and bycatch of protected species in the commercial and recreational fisheries including species, length, depth, location, and disposition; priority fisheries include shrimp (including assessing TED compliance), South Atlantic snapper grouper, other Southeast Region recreational hook-and-line fisheries, and fisheries under take reduction teams.
- Enhance existing tools (e.g., observers, logbook requirements, electronic technologies) to collect bycatch data that inform agency bycatch priorities; priority fisheries include shrimp (including assessing TED compliance), South Atlantic snapper-grouper, other Southeast Region recreational hook-and-line fisheries, and fisheries under take reduction teams.
- Invest in new, innovative fishery monitoring techniques, such as electronic fishing logbooks and video monitoring, to provide a cost effective means of producing more information to effectively quantify bycatch; priority fisheries include shrimp (including assessing TED compliance), South Atlantic snapper-grouper, other Southeast Region recreational hook-and-line fisheries, and fisheries under take reduction teams.
- Improve the discard estimates needed for informing snapper-grouper, reef fish, dolphin wahoo, and coastal migratory pelagic SEDAR assessments in the next 3-5 years.

---

[14] https://www.fws.gov/migratorybirds/pdf/management/focal-species/GreaterShearwater.pdf
[15] https://sero.nmfs.noaa.gov/documents/main_articles/pdfs/final_strategic_plan_october_2015.pdf

7.9.2 Marine Mammals

The following bycatch related research needs were identified within NOAA Fisheries' Southeast Regional Office's FY16-20 Strategic Plan[16]:

- Characterize frequency, scope, and scale of bottlenose dolphin interactions with recreational rod/reel fishing gear.
- Enhance and increase observer coverage for gillnet fisheries under the bottlenose dolphin take reduction plans by focusing observer coverage in specific geographic areas and fisheries, improving observer data collection and quality, and measures of fishing effort, as well as coordinating with state observer programs.
- Experimentally investigate possible attractants/deterrents for pilot whale/Risso's dolphins to pelagic longline gear and gear modifications to decrease the likelihood of hooking and/or entanglement.

7.9.3 Sea Turtles

Observer coverage of recreational fisheries has been relatively limited (Boyd, 2016). Expansion of observer programs to recreational hook-and-line fisheries would help determine the level of protected species interactions in those fisheries.

The following bycatch related research needs were identified within NOAA Fisheries' Southeast Regional Office's FY16-20 Strategic Plan[17]:

- Improved methods/models/techniques for estimating sea turtle bycatch in commercial fisheries including accounting for life stage and recovery unit (where applicable) impacts.
- Produce annual bycatch estimates for the shrimp trawl fisheries, pelagic longline, Gulf and South Atlantic reef fish, and Gulf and South Atlantic shark gillnet and bottom longline fisheries.
- Implement monitoring program to assess bycatch of sea turtles in recreational fisheries, including piers, jetties, head boats and FMP covered recreational fisheries.
- Develop tools to reduce recreational fishing bycatch including on piers/jetties.
- Develop and improve analytic methods for sea turtle bycatch estimation and sampling design to optimally allocate observer coverage and identify gaps and recommend improvements/changes to improve sea turtle bycatch information.
- Ensure sea turtle bycatch data collected across fisheries is standardized and contains all necessary elements to assess post interaction mortality and to inform conservation management.

[16] https://sero.nmfs.noaa.gov/documents/main_articles/pdfs/final_strategic_plan_october_2015.pdf
[17] https://sero.nmfs.noaa.gov/documents/main_articles/pdfs/final_strategic_plan_october_2015.pdf

- Conduct gear research and technology transfer to reduce sea turtle interactions and mortalities in both domestic and foreign trawl, longline, and gill net fisheries.
- Develop sea turtle observer programs for commercial fisheries not currently observed but for which data are needed.

7.9.4 Sturgeon

NOAA Fisheries Southeast Regional Office has identified the following research needs for Atlantic sturgeon[18]:

- Identification of spawning and nursery grounds and overwintering areas.
- Long-term population monitoring programs.
- Population genetics.
- Toxic contaminant and biotoxin impacts and thresholds.
- Develop fish passage devices for sturgeon.
- Impacts of dredging.
- Reducing bycatch and bycatch mortality.

Regarding bycatch, very little information is available on current levels of bycatch and bycatch mortality occurring in fisheries in the Southeast. Research is needed to identify the spatial and temporal distribution of bycatch throughout the species range, and to identify measures that can be implemented to reduce bycatch and/or bycatch mortality.

NOAA Fisheries Southeast Regional Office has identified the following research needs for shorthnose sturgeon[19]:

- Genetic assessments.
- Surveys and presence/absence studies.
- Identification of spawning and nursery grounds and overwintering areas.
- Develop fish passage devices for sturgeon.
- Contaminant research.
- Impacts of dredging.

7.9.5 Sawfish

The following research needs were identified within NOAA Fisheries' Southeast Regional Office's FY16-20 Strategic Plan[20]:

---

[18] https://sero.nmfs.noaa.gov/protected_resources/sturgeon/documents/ats_research_priorities.pdf

[19] https://sero.nmfs.noaa.gov/protected_resources/sturgeon/documents/sns_research_priorities.pdf

[20] https://sero.nmfs.noaa.gov/documents/main_articles/pdfs/final_strategic_plan_october_2015.pdf

- Develop a functional assessment model of juvenile sawfish habitat use within the critical habitat units.
- Determine the post-release mortality of sawfish from various types of fishing gear.
- Investigate movements (short-term and seasonal) of adult sawfish to identify aggregation habitats and habitat use patterns.
- Develop habitat models to identify potential sawfish nursery habitats in areas unsurveyed or outside of the currently known habitat areas.
- Continue current sawfish surveys as these will be the basis of monitoring recovery.
- Conduct juvenile sawfish surveys beyond the boundaries of current surveys (e.g., east coast or north of Charlotte Harbor) to refine a baseline abundance estimates and monitor recovery.
- Conduct adult surveys throughout the range of smalltooth sawfish to determine a relative abundance estimate, the distribution of adults, and to identify sawfish mating and pupping habitats.

7.9.6 Seabirds

- Initiate and expand observer coverage/bycatch monitoring and collection and analysis of bird bycatch data to better understand extent of bird bycatch and identify bycaught bird species within the target fisheries (state waters).
- Collaborate with fishermen to develop and test gear and identify deployment practices that reduce bird bycatch within the target fisheries (state waters).
- Conduct outreach activities to facilitate sharing of bird bycatch information in the target fisheries among agencies, industry and the public.

8.0 REFERENCES

Atkinson L.P., D.W. Menzel, and K.A.E. Bush. 1985. *Oceanography of the southeastern U.S. continental shelf*. American Geophysical Union: Washington, DC.

Atlantic States Marine Fisheries Commission (ASMFC). 2002. Amendment 2 to the Red Drum Interstate Fishery Management Plan. ASMFC, Washington, DC. 162 p.

ASMFC. 2007. Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. Special report to the ASMFC Atlantic Sturgeon Fishery Management Board. ASMFC, Washington, DC. 95 p.

ASMFC. 2009. Guide to fisheries science and stock assessments. ASMFC, Washington, DC. 66 p.

ASMFC. 2012. Offshore Wind in My Backyard? Habitat Management Series #11. ASMFC, Arlington, VA. 10 p.

ASMFC. 2013. Harbor Deepening: Potential Habitat and Natural Resources Issues. Habitat Management Series #12. ASMFC, Arlington, VA. 10 p.

ASMFC. 2016. Interstate Fisheries Management Program Charter. ASMFC, Arlington, VA. 29 p.

ASMFC. 2017. Interstate Fishery Management Plan for Atlantic Migratory Group Cobia. ASMFC, Arlington, VA. 85 p.

Benson, N.G. (editor). 1982. Life history requirements of selected finfish and shellfish in Mississippi Sound and adjacent areas. U.S. Fish and Wildlife Service FWS/OBS-81/51: 49-50.

Blanton, J.O., L.P. Atkinson, L.J. Pietrafesa, and T.N. Lee. 1981. The intrusion of Gulf Stream water across the continental shelf due to topographically-induced upwelling. Deep-Sea Research 28: 393-405.

Boyd, J. 2016. North Caroline Division of Marine Fisheries. Final Report to National Marine Fisheries Service and Atlantic Coastal cooperative Statistics Program. Grant Award # NA14NMF47400367. 36 p.

Brooks, D.A., and J.M. Bane. 1978. Gulf Stream deflection by a bottom feature off Charleston, South Carolina. Science 201: 1225-1226.

Brown-Peterson, N.J., J.S. Franks, and K.M. Burns. 2001. Reproductive biology of cobia, *Rachycentron canadum*, from coastal waters of the southern United States. Fishery Bulletin. 99: 15-28.

Burns, K.M., and C.L. Neidig. 1992. Cobia (*Rachycentron canadum*), amberjack (*Seriola dumerili*), and dolphin (*Coryphaena hipurus*) migration and life history study off the southwest coast of

Florida. MARFIN. SEDAR28-RD22. Available at: https://sedarweb.org/docs/wsupp/SEDAR28-RD22%20MARFIN%201992.pdf.

Collette, B., J. L. Russo, and L. A. Zavala-Camin. 1978. *Scomberomorus brasiliensis*, a new species of Spanish mackerel from the western Atlantic. Fish. Bull. 76: 273-280.

Dahl, T.E. 2000. Status and trends of wetlands in the conterminous United States 1986 to 1997. U.S. Dept. of Interior, USFWS, Washington, DC. 81 p.

Darden, T.L., M.J. Walker, K.Brenkert, J.R. Yost, and M.R. Denson. 2014. Population genetics of Cobia (*Rachycentron canadum*): implications form fishery management along thr coast of the southeastern United States. Fish. Bull. 112: 24-35.

Denson, M. 2012. South Carolina experimental stocking of cobia *Rachycentron canadum*. SEDAR28-DW02. https://sedarweb.org/docs/wpapers/SEDAR28-DW02%20v2%20Denson%202012.pdf.

Ditty, J.G., and R.F. Shaw. 1992. Larval development, distribution, and ecology of cobia *Rachycentron canadum* (Family: Rachycentridae) in the northern Gulf of Mexico. Fish. Bull. 90:668-677.

Freeman, B.L., and L.A. Walford. 1976. Angler's Guide to the United States Atlantic coast: Fish, Fishing Grounds & Fishing Facilities. Sect. VII: Altamaha Sound, Georgia to Fort Pierce Inlet, Florida. NOAA – NMFS, Seattle, WA. 21 p.

Gulf of Mexico Fishery Management Council (GMFMC) and South Atlantic Fishery Management Council (SAFMC). 2011. Amendment 18 to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Gulf of Mexico and Atlantic Region. GMFMC, Tampa, FL, and SAFMC, North Charleston, SC. 399 p.

GMFMC and SAFMC. 2014. Amendment 20B to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Gulf of Mexico and Atlantic Region. GMFMC, Tampa, FL, and SAFMC, North Charleston, SC. 258 p.

Hendon, R. and J. Franks. 2010. Sport fish tag and release in Mississippi coastal water and the adjacent Gulf of Mexico. SEDAR28-RD23. https://sedarweb.org/docs/wsupp/SEDAR28-RD23%20Hendon%20and%20Franks%202010.pdf.

Hoese, H.D., and R.H. Moore. 1977. Fishes of the Gulf of Mexico; Texas, Louisiana, and adjacent waters. Texas A&M Univ. Press, College Station, TX. 327 p.

Holland, A.F., G.H.M. Riekerk, S.B. Lerberg, L.E. Zimmerman, D.M. Sanger, G.l. Scott and M.H. Fulton. 1996. Assessment of the impact of watershed development on the nursery functions of tidal creek habitats. ***In:*** G.S. Kleppel and M.R DeVoe (eds.) The South Atlantic Bight land use coastal ecosystems study (LU-CES), p. 28-31. Univ. of Georgia Sea Grant and S.C. Sea Grant Program. Report of a planning workshop.

IMPLAN. 2019. Multi-Regional Input-Output (MRIO) Analysis FAQ, IMPLAN. Available at: www.IMPLAN.com.

Jacob, S., P. Weeks, B. Blount, and M. Jepson. 2013. Development and evaluation of social indicators of vulnerability and resiliency for fishing communities in the Gulf of Mexico. Marine Policy 37: 86-95.

Janowitz, G.S., and L.J. Pietrafesa. 1982. The effects of alongshore variation in bottom topography on a boundary current - topographically-induced upwelling. Continental Shelf Research 1: 123-141.

Jepson, M. and L. L. Colburn. 2013. Development of social indicators of fishing community vulnerability and resilience in the U.S. Southeast and Northeast Regions. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-129. 64 p.

Jepson, M., K. Kitner, A. Pitchon, and W. Perry. 2005. Fishing Communities in the Carolinas, Georgia and Florida: An Effort at Baseline Profiling and Mapping. SAFMC, Charleston, SC.

Lee, T.N., C. Rooth, E. Williams, M.F. McGowan, A.F. Szmant, and M.E. Clarke. 1992. Influence of Florida Current, gyres and wind-driven circulation on transport of larvae and recruitment in the Florida Keys coral reefs. Continental Shelf Research 12: 971-1002.

Lee, T.N., M.E. Clarke, E. Williams, A.F. Szmant, and T. Berger. 1994. Evolution of the Tortugas Gyre. Bulletin of Marine Science 54(3): 621-646.

Lefebvre, L.S., and M.R. Denson. 2012. Inshore spawning of cobia (*Rachycentron canadum*) in South Carolina. Fish. Bull. 110: 397-412.

Leis, J.M. 1991. The pelagic stage of Reef Fishes, p. 182-229. In: The Ecology of Fishes on Coral Reefs. P. Sale (ed.). Academic Press, Inc., San Diego, CA.

Manooch, Charles S. 1984. Fisherman's guide to fishes of the Southeastern United States. North Carolina Museum of Natural History. Raleigh, North Carolina. 362 p.

McClane, A.J. 1974. McClane's new standard fishing encyclopedia and international angling guide. Holt, Rinehart & Winston, NY. 1156 p.

Menzel, D.W., editor. 1993. Ocean processes: U.S. southeast continental shelf. DOE/OSTI -- 11674. U.S. Department of Energy.

Miller, J.M. 1988. Physical processes and the mechanisms of coastal migrations of immature marine fishes. In: M.P. Weinstein (ed.) Larval fish and shellfish transport through inlets, p. 68-76. American Fisheries Society, Bethesda, MD.

Miller, J. M., J. P. Read and L. J. Pietrafesa. 1984. Pattern, mechanisms and approaches to the study of migrations of estuarine-dependent fish larvae and juveniles. In: McCleave, J. D., G. P. Arnold, J. J. Dodson and W. H. Neill (eds). Mechanisms of Migrations in Fishes. Plenum Press, NY.

National Marine Fisheries Service (NMFS). 2015. Endangered Species Act - Section 7 Consultation Biological Opinion. 2015 Reinitiation of Endangered Species Act (ESA) Section 7 Consultation on the Continued Authorization of the Fishery Management Plan (FMP) for Coastal Migratory Pelagic (CMP) Resources in the Atlantic and Gulf of Mexico under the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA). Available at: http://sero.nmfs.noaa.gov/protected_resources/section_7/freq_biop/documents/fisheries_bo/2015_cmp_opinion.pdf.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2017. Fisheries Economics of the United States, 2015. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-170. 245p. Available at: http://www.st.nmfs.noaa.gov/economics/publications/feus/fisheries_economics_2015/index.

NOAA Fisheries. 2019. NOAA Fisheries Announces Changes to Management of Cobia in Federal Waters of the Atlantic, FB19-008 South Atlantic Fishery Bulletin (Final Rule: 84 FR 4733). Available at: https://www.fisheries.noaa.gov/action/coastal-migratory-pelagics-amendment-31-management-atlantic-migratory-group-cobia.

Orbesen, Eric. 2012. Constituent based tagging of cobia in the Atlantic and Gulf of Mexico waters. SEDAR28-DW13. Available at: https://sedarweb.org/docs/wpapers/SEDAR28-DW13%20Orbesen%202012.pdf.

Perkinson, M. and M. Denson. 2012. Evaluation of cobia movements and distribution using tagging data from the Gulf of Mexico and South Atlantic coast of the United States. SEDAR28-DW05. Available at: https://sedarweb.org/docs/wpapers/SEDAR28-DW05%20v2%20Perkinson%20and%20Denson%202012.pdf.

Robins, C.R., and G.C. Ray. 1986. Field Guide to Atlantic Coast Fishes of North America. Houghton Mifflin Co., Boston, MA. 354 p.

Schwartz, F. J. 1989. Zoogeography and ecology of fishes inhabiting North Carolina's marine waters to depths of 600 meters. Pages 335-374 *In* R. Y. George, and A. W. Hulbert, editors. North Carolina Coastal Oceanography Symposium. U.S. Dep. Commerce, NOAANURP Rep. 89-2.

Serafy, J.E., K.C. Lindeman, T.E Hopkins and J.S. Ault. 1997. Effects of freshwater canal discharges on subtropical marine fish assemblages: field and laboratory observations. Mar. Ecol. Prog. Ser. 160: 161-172.

Shortnose Sturgeon Status Review Team (SSSRT). 2010. A Biological Assessment of shortnose sturgeon (Acipenser brevirostrum). Report to National Marine Fisheries Service, Northeast Regional Office. November 1, 2010. 417 p.

Simpfendorfer, C.A., and T.R., Wiley. 2004. Determination of the distribution of Florida's remnant sawfish population, and identification of areas critical to their conservation. Mote Marine Laboratory, Technical Report July 2, 2004. 37 p.

Smith, N.P. 1994. Long-term Gulf-to-Atlantic transport through tidal channels in the Florida Keys. Bulletin of Marine Science 54:602-609.

Smith, J.W. 1995. Life history of cobia *Rachycentron canadum* (Osteichthyes: Rachycentridae), in North Carolina Waters. Brimleyana 23:1-23.

SAFMC. 1996. Final Amendment 2 (Bycatch Reduction) to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region. NOAA Award # NA67FC0003. Charleston, SC. 227 p.

SAFMC. 1998. Habitat plan for the South Atlantic region: essential fish habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. SAFMC, Charleston, SC. 457 p.

SAFMC. 2011. Amendment 18 to the Fishery Management Plan for Coastal Migratory Pelagics Resources in the Gulf of Mexico and Atlantic Region. NOAA Award # FNA05NMF4410004. Charleston, SC. 399 p.

SAFMC. 2018a. Amendment 31 to the Fishery Management Plan for Coastal Migratory Pelagics Resources in the Gulf of Mexico and Atlantic Region. NOAA Award # FNA10NMF441001. Charleston, SC. 209 pp.

SAFMC. 2018b. The Economic Contribution of Fisheries for Species Managed by the South Atlantic Fishery Management Council, Report May, 2018. Charleston, SC. 23 pp.

SEDAR. 2013. SEDAR 28 – South Atlantic Cobia Stock Assessment Report. SEDAR, North Charleston, SC. 420 p. Available at: https://sedarweb.org/sedar-28.

SEDAR. 2018. SEDAR 58 – Cobia Stock ID Process Report Compilation. SEDAR, North Charleston, SC. 116 p. Available at: http://sedarweb.org/sedar-58-stock-id-process.

Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Wilhelm, J. McCarthy, and M. Pentony. 2004. Characterization of the fishing practices and marine benthic ecosystems of the Northeast U.S.

Shelf, and an evaluation of the potential effects of fishing on essential fish habitat. Woods Hole (MA): National Marine Fisheries Service, Northeast Fisheries Science Center, NOAA Technical Memorandum NMFS-NE-181. 179 p.

Swingle, H.A. 1971. Biology of Alabama estuarine areas – Cooperative Gulf of Mexico Estuarine Inventory. Alabama Marine Resources Bulletin 5, 123 p.

U.S. Fish and Wildlife Service. 2013. Cahow of Bermuda Petrel (*Pterodroma cahow*). 5-year review: Summary and Evaluation. https://ecos.fws.gov/docs/five_year_review/doc4326.pdf.

Wang, J.D., J. van de Kreeke, N. Krishnan, and D. Smith. 1994. Wind and tide response in Florida Bay. Bulletin of Marine Science 54:579-601.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, editors. 2016. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2015. NOAA Technical Memorandum NMFS-NE-238.

Wiggers, R.K. 2010. South Carolina marine game fish tagging program 1978-2009. SEDAR28-RD21. https://sedarweb.org/docs/wsupp/SEDAR28-RD21%20Wiggers%202010.pdf.

Yeung, C., and M.F. McGowan. 1991. Differences in inshore-offshore and vertical distribution of phyllosoma larvae of *Panulirus, Scyllarus, and Scyllarides* in the Florida Keys in May-June, 1989. Bulletin of Marine Science 49: 699-714.

APPENDIX I

Table A1. Commercial landings by state, in pounds, 1981-2018. 2018 data is preliminary and provided by individual states. * indicates confidential data. Source: ACCSP, queried April, 2019.

Year	NY	NJ	DE	MD	VA	NC	SC	GA	Total
1981					1,400	5,260	10,137	1,126	17,923
1982				100	2,000	10,574	16,286	2,304	31,264
1983					900	4,279	11,357	1,497	18,033
1984					1,900	6,701	2,523	2,570	13,694
1985				100	2,300	6,640	1,464	611	11,115
1986					1,200	18,303	3,690	2,561	25,754
1987	100				300	32,672	4,718	2,705	40,495
1988		100			5,700	15,690	5,224	1,924	28,638
1989		200		300	10,600	14,898	6,835	440	33,273
1990	17	1,649		431	16,532	21,938	1,802	1,367	43,736
1991		1,155		2,045	11,743	23,217	3,005	2,651	43,816
1992		1,037		1,882	6,110	18,534	6,925	2,187	36,675
1993		792		471	5,986	20,431	9,092	2,730	39,502
1994	165	483		*	7,817	30,586	5,488	2,483	47,022
1995	411	1,736		*	22,011	35,143	6,133	1,543	66,977
1996	*	2,295		*	*	33,404	4,483	675	40,857
1997	89	3,989		377	11,710	42,063	3,513	1,742	63,484
1998	60	2,853		*	13,419	22,197	3,481	*	42,010
1999	46	1,432		*	5,808	15,491	2,568	*	25,345
2000	101	1,762		*	7,525	28,754	2,974	*	41,116
2001	252	683		*	*	24,718	4,395	*	30,048
2002	70	2,086		*	11,445	21,058	5,007	*	39,666
2003	84	621	*	*	7,387	21,313	4,746	*	34,151
2004	758	576		211	6,143	20,162	4,459	705	33,014
2005	*	329		*	6,108	17,886	4,192	*	28,515
2006	*	*	*	398	6,369	20,270	2,672	*	29,709
2007	*	1,650		*	6,086	19,005	3,786	245	30,771
2008	*	*		*	6,978	22,047	3,464	*	32,488
2009	*	1,134		196	6,197	31,898	2,275	*	41,701
2010	*	270		*	8,852	43,715	2,749	*	55,586
2011	408	*		*	8,522	19,924	4,466	*	33,320
2012	152	701		*	5,389	31,972	3,731		41,945
2013	841	885	*	*	11,073	35,456	4,254	*	52,509
2014	311	366		*	22,345	41,798	3,880	*	68,701
2015	235	226		*	27,722	52,684	2,763	*	83,631
2016	129	312	*	*	36,460	48,244	4,532	*	89,677
2017	81	*	*	*	36,384	20,842	4,590	*	61,898
2018**					25,194	20,447			

Table A2. Cobia recreational harvest (A + B1) by state, in pounds, 1981-2018, with effort estimated by or calibrated to the Coastal Household Telephone Survey (CHTS). 2018 data is preliminary. Source: MRIP, queried April, 2019.

Year	NY	NJ	DE	MD	VA	NC	SC	GA	TOTAL
1981					4,705	6,484			11,189
1982						66,342	22,215	24,997	113,554
1983				0				20,894	20,894
1984						191,237	125,332	78,428	394,997
1985	0			49,528	103,391	20,985	104,178	17,817	295,899
1986		108,701		4,416	77,695	178,128	145,843	15,252	530,035
1987					24,956	79,944	44,033	17,994	166,927
1988						106,749	42,133	3,927	152,809
1989				65	105,819	115,373	60,962	38,687	320,905
1990					86,345	118,387	16,923	16,677	238,331
1991				23,667	412,996	128,710	123,868		689,241
1992					159,502	120,261	40,285	24,977	345,025
1993					93,858	94,990			188,848
1994	0				159,460	94,394	31,994		285,848
1995					200,794	144,757	16,629		362,180
1996					152,759	99,867	82,476	9,347	344,449
1997					358,225	154,862	28,916	1,555	543,558
1998					141,566	125,545	35,561		302,673
1999				6,787	101,308	47,477	178,753	5,192	339,517
2000					324,562	118,349	763		443,674
2001					367,003	74,757		10,074	451,834
2002					75,489	209,043	10,691	1,172	296,395
2003				0	37,213	84,773	425,939	342	548,266
2004					35,189	294,042	649,803	44,045	1,023,079
2005			818		516,764	239,195	3,130	774	760,680
2006		17,035			898,542	184,300	53,634	1,733	1,155,244
2007					352,071	106,213	271,431	46,729	776,444
2008					116,420	82,566	32,497	320,174	551,657
2009					445,993	166,195	62,332	2,009	676,530
2010				1,069	254,414	498,581	67,946	89,840	911,850
2011					107,424	145,796		74,651	327,871
2012		6,796			26,537	104,106	201,223	97,766	436,427
2013					224,442	506,067	9,873	25,183	765,565
2014					173,772	247,386	26,439	19,079	466,677
2015					882,022	695,842	124,933	26,499	1,729,296
2016				193	915,151	298,090	76,754		1,290,187
2017					252,683	259,737		328	512,748
2018			4,840	3,254	843,994	364,810	36,683	6,226	1,259,807

Table A3. Cobia recreational harvest (A + B1) by state, in pounds, 1981-2018, with effort estimated by or calibrated to the mail-based Fishing Effort Survey. 2018 data is preliminary. Source: MRIP, queried April, 2019.

Year	NY	NJ	DE	MD	VA	NC	SC	GA	Total
1981					5,788	3,726			9,514
1982						8,430	9,991	26,075	44,496
1983				0		0		73,504	73,504
1984						259,354	194,569	130,102	584,025
1985	0	0		63,281	78,704	2,720	193,778	47,167	385,650
1986		48,781		20,807	134,568	533,982	76,547	5,633	820,318
1987					21,167	81,833	4,477	9,989	117,466
1988						103,975	62,918	2,434	169,327
1989				25	262,795	208,259	91,078	50,169	612,326
1990					86,491	188,539	22,471	37,195	334,696
1991				2,095	118,737	266,633	477,604		865,069
1992					229,977	317,628	53,255	47,111	647,971
1993					113,636	168,142			281,778
1994	0		0		196,525	169,168	26,051		391,744
1995					637,842	302,745	20,718		961,305
1996					1,287,826	102,899	821,361	11,902	2,223,988
1997					516,108	129,299	90,931	1,498	737,836
1998					379,056	117,754	18,991		515,801
1999				1,387	164,817	101,465	100,955	3,446	372,070
2000					383,077	91,143	1,267	0	475,487
2001					283,256	121,751		8,354	413,361
2002					242,697	319,178	3,446	3,557	568,878
2003				98,524	120,097	223,508	940,447	459	1,383,035
2004		0			76,408	420,684	426,301	106,405	1,029,798
2005			5,044		792,006	401,557	1,549	899	1,201,055
2006		6,768			1,596,234	196,330	148,146	1,918	1,949,396
2007					499,736	218,447	538,625	63,024	1,319,832
2008		0			182,451	167,463	37,124	499,198	886,236
2009					855,629	320,075	94,996	1,831	1,272,531
2010		0		1,179	557,907	808,227	100,614	230,865	1,698,792
2011					341,751	399,192	0	182,799	923,742
2012		60,473		0	47,547	102,077	214,512	512,499	937,108
2013					488,181	980,541	24,005	43,915	1,536,642
2014					499,218	645,427	79,171	42,481	1,266,297
2015		0			1,166,000	1,925,762	434,899	102,917	3,629,578
2016				307	1,505,528	838,363	159,345	0	2,503,543
2017					488,287	872,861	0	390	1,361,538
2018		0	9,664	3,254	1,936,274	561,526	160,191	6,226	2,677,135

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

January 18, 2018

To: **South Atlantic State/Federal Fisheries Management Board**

From: **Atlantic Croaker Technical Committee and Spot Plan Review Team**

Subject: **Recommended Updates to the Annual Traffic Light Analyses for Atlantic Croaker and Spot**

In 2017, benchmark stock assessments were completed for Atlantic croaker and spot. Neither of these assessments were recommended for management use due in part to conflicting signals from abundance and harvest time series. To improve the annual Traffic Light Analyses (TLA) conducted for these species, which monitor these fisheries using abundance and harvest time series, the South Atlantic State/Federal Fisheries Management Board (Board) tasked the Atlantic Croaker Technical Committee (TC) and Spot Plan Review Team (PRT) with exploring potential updates to the TLAs for both species.

The TC and PRT recommend the following changes to the annual Atlantic croaker TLA:

1. Incorporation of indices from the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) and the South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey into the adult composite characteristic index, in addition to the currently used indices from the Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey and Southeast Area Monitoring and Assessment Program (SEAMAP).
2. Use of revised adult abundance indices from the surveys mentioned above, in which age-length keys and length composition information are used to estimate the number of adult (age 2+) individuals caught by each survey.
3. Use of regional metrics to characterize the fisheries north and south of the Virginia-North Carolina state border. The ChesMMAP and NEFSC surveys would be used to characterize abundance north of the border, and the SCDNR Trammel Net and SEAMAP surveys would be used to characterize abundance south of the border.
4. Change/establish the reference time period for all surveys to be 2002-2012.
5. Change the triggering mechanism to the following: Management action will be triggered according to the current 30% red and 60% red thresholds if both the abundance and harvest thresholds are exceeded in any 3 of the 4 terminal years.

The TC and PRT recommend the following changes to the annual spot TLA:

1. Incorporation of indices from ChesMMAP and the North Carolina Division of Marine Fisheries (NCDMF) Pamlico Sound Survey, Program 195, into the adult composite characteristic index, in addition to the currently used NEFSC and SEAMAP indices.
2. Use of revised adult abundance indices from the surveys mentioned above, in which age-length keys and length composition information are used to estimate the number of adult (age 1+) individuals caught by each survey.
3. Use of regional metrics to characterize the fisheries north and south of the Virginia-North Carolina state border. The ChesMMAP and NEFSC surveys would be used to characterize abundance north of the border, and the NCDMF Program 195 and SEAMAP surveys would be used to characterize abundance south of the border.
4. Change/establish the reference time period for all surveys to be 2002-2012.
5. Change the triggering mechanism to the following: Management action will be triggered according to the current 30% red and 60% red thresholds if both the abundance and harvest thresholds are exceeded in any 2 of the 3 terminal years.

In addition to the above changes to the TLA triggering mechanisms, the TC/PRT recommend annual PRT review of juvenile abundance indices and shrimp trawl discards for both species. The TC/PRT recommend these data be used regularly only as supplemental information, but with the potential for PRT recommendation of management action if these or other data indicate action is warranted, even in years when management action is not required by the triggering mechanisms.

A summary of the call on January 16, 2018, on which the TC and PRT discussed and decided upon these changes is attached for your reference.

Enc: Atlantic Croaker TC/Spot PRT Jan 16, 2018, Call Summary

Atlantic States Marine Fisheries Commission

Atlantic Croaker Technical Committee and Spot Plan Review Team

Call Summary

January 16, 2018
10:00 a.m.-12:00 p.m.

Attendees

Technical Committee/Plan Review Team: Tim Daniels (NJ), Michael Grego (DE), Harry Rickabaugh (MD), Ryan Jiorle (VA), Dan Zapf (NC), Chris McDonough (TC Chair, SC), Dawn Franco (GA), Joseph Munyandorero (FL)

ASMFC Staff: Jeff Kipp, Michael Schmidtke

Summary

A conference call was held on January 16, 2018 to review potential changes to the Traffic Light Analysis (TLA) for both spot and Atlantic croaker. Jeff Kipp gave an update of the work done by the sub-group analyzing the available data and exploring alternative configurations of the TLA to improve its utility in informing the board on current stock status. The use of Relative Exploitation along with the TLA was also presented and discussed. The TLA and indices used for both species are very similar. Therefore spot was reviewed and discussed in detail first, including working through a decision tree to provide a recommended TLA configuration to the board. Once this was completed croaker was reviewed with some discussion where there were differences compared to spot, and the same decision tree was used to develop a recommended Atlantic croaker TLA. The discussion points below apply to both species unless otherwise noted.

Jeff presented a background of the current TLAs and how the signals given by the Harvest metric (commercial and recreational landings) and the Adult Abundance metric (independent offshore trawl surveys) do not agree, particularly a continued decline in harvest in recent years, with generally increasing or stable index values. Closer examination of the data indicated the indices were being influenced by age zero fish, particularly in years with strong recruitment. Indices were split into adult and juvenile components. The SEAMAP spring index was determined to be a better indicator of adult abundance, and the fall index better indexes juveniles. Inclusion of additional indices including ChesMMAP for spot and croaker, the South Carolina trammel net survey for croaker and the NC DMF program 195 for spot were also explored, since they have adequate time series and provide information on adult abundance in inshore waters. The SC trammel net survey also provides a wider range of adults. Unlike SEAMAP and NMFS, the NC DMF P195 and ChesMMAP are showing a steady decline in abundance in recent years. There was also evidence of differences in the Mid-Atlantic and South Atlantic trends, suggesting a regional split may be appropriate. The working group also suggesting moving to a two out of three years trip mechanism for spot (as compared to the current 2 consecutive years) and 3 out of 4 years for croaker instead of the current 3 consecutive years.

A question was raised as to why juvenile indices are only used as informative and not as a trigger mechanism. The reason for this is the lack of a significant stock recruit relationship for either species, leading to environmental factors having a stronger influence on recruitment than adult abundance.

The use of relative exploitation in place of the TLA was discussed. The effects of the shrimp trawl fishery would not be incorporated in the annual trigger exercise, potentially affecting results, but would be considered as an informative index in a similar manner to the juvenile indices. The group felt the TLA was more familiar and easier to understand for the board and the general public. The relative exploitation methods presented were also very conservative, and likely would need more work on determining the appropriate reference points. For these reasons the consensus was to continue with the TLA.

In discussing which indices to include, there was some concern raised that the offshore indices, particularly the NMFS trawl survey, may not be accurately tracking adult abundance of these species, even when split out by age. This would be due to timing of the migration of fish offshore compared to the timing of the survey, in some years these two events may occur at the same time, but in others they may not. Changes in habitat use from inshore to offshore may also be occurring, so the consensus was to continue using these surveys and to add in the inshore surveys as well (2 inshore and 2 offshore for each species). The group also agreed to use the age 1+ indices for spot, and the age 2+ indices for croaker.

Whether to split the TLAs regionally into Mid-Atlantic (VA north) and South Atlantic (NC south) was discussed in detail. Clarification was made that the split would be due to fishery differences and not because the biology of the species suggested it was needed. Recruitment indices tend to track across regions, but landings and index values show more continuity within region than across. It was also pointed out that the shrimp trawl fishery occurs primarily in the south Atlantic, and the dynamics of Chesapeake Bay likely differ from southern estuaries. Including ChesMMAP in the Mid-Atlantic region requires changing the reference time period to begin in 2002 as this was the first year for the ChesMMAP survey. By using regional TLAs the south Atlantic could keep a longer time series, although the same TLA reference time period would be used for both regions. Consensus was reached that the TLAs should be split by region due to differences in the fishery trends and characteristics.

Based on the decisions above the reference period for both species needed to be changed to accommodate the shorter time series of the ChesMMAP survey. The group discussed whether to have different reference periods for each region, and whether the 2002-2012 time frame was appropriate for both species. The consensus was to maintain consistency between regions, and that the 2012 cutoff was appropriate to avoid including several very low harvest years in the recent time frame, but still include variability within the data sets.

Clarification was given as to how the current 30%/60% red thresholds were selected, and consensus was to continue using those values.

The tripping mechanism was discussed for each species. The current requirement of two (spot) or three (croaker) consecutive years of red above either of the thresholds to trigger management may be too stringent. Since recruitment is not strongly tied to abundance, a single strong year-class from a low adult abundance could potentially provide a value of red below 30%, requiring two or three more very poor years before management would be considered. If this occurred more than once, with a continued decline in long term adult abundance, this could lead to recruitment failure, particularly in spot. Group consensus was for a two out of three years above a red threshold occurring for spot and three out of four years for croaker, and both metrics would need to trip in the same three (spot) or four (croaker) year time frame.

There also was a discussion on the inclusion of effort data for either the recreational or commercial fishery. Primarily revolving around the reliability of effort data that could be produced for these species. It was generally agreed upon that including that information would be ideal, but developing a reliable effort data stream would be a very large undertaking, that may not prove successful.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

July 31, 2018

To: **South Atlantic State/Federal Fisheries Management Board**

From: **Atlantic Croaker and Spot Plan Development Team**

Subject: **Recommendations for Management Response to Triggers from Updated Traffic Light Analyses**

At the May 2018 meeting, the South Atlantic State/Federal Fisheries Management Board (Board) tasked the Atlantic Croaker and Spot Plan Development Team (PDT) with exploring potential responses to management triggers that would result from incorporation of TC-recommended updates to the annual Traffic Light Analyses (TLA) for Atlantic croaker and spot. The Board provided guidance on a goal of management measures that would achieve a red level of 35% or less within a two-year timeframe. This goal would only apply to the abundance metric, as the harvest metric would need to be re-evaluated under a new management regime.

The PDT met twice via conference call to address this task. Abundance of Atlantic croaker is strongly associated with environmental variables (Hare and Able 2007, Norcross and Austin 1981), historically expressed through a cyclical pattern in commercial landings. Additionally, the impetus for revision to the TLA was a lack of correlation between current harvest and abundance metrics. Thus, a reduction in harvest would not necessarily be expected to result in a proportional increase in abundance. Atlantic croaker are currently in a low period for commercial harvest, similar to what was previously observed during the early 1980s and followed by an increase into a high period in the late 1990s to early 2000s. Relationships between spot abundance or harvest and environmental variables are not as well-studied as Atlantic croaker, and spot do not exhibit a similar cyclical landings pattern.

Therefore, rather than focusing on a specific numeric goal for percentage red that may not be realistically attainable through management alone, the PDT recommends an alternative goal of initially establishing management measures for both the Atlantic croaker and spot fisheries, which currently have no coastwide management requirements in their respective Fishery Management Plans (FMP). These measures would ideally be suited for long-term management of these species, with the ability for them to be altered in reaction to management triggers from the TLAs. If management action is triggered, as is the case for both species in the Mid-Atlantic region under the updated TLAs, the PDT recommends that measures put in place be re-evaluated as defined in Addendum II to the Atlantic Croaker FMP (after 3 years) and Addendum I to the Spot FMP (after 2 years) to determine if they are eliciting the desired response and evaluate if adjustments should be made. For both Atlantic croaker and spot, the PDT recommends commercial and recreational

M18-073

management measures in the form of seasons and trip limits (vessel or bag). Given the close association of Atlantic croaker and spot fisheries, management through an aggregate bag or vessel limit could also be considered. State-level minimum size limits are currently used for commercial and recreational Atlantic croaker fisheries in Delaware and Maryland. Size limits can be a more reliable way to restrict harvest than seasons or an aggregate bag limit due to annual variations in migration timing and masked changes in aggregate bag composition. Determination of whether a coastwide minimum size limit would be useful and an appropriate minimum size would require further discussion and evaluation of size selectivity by gears used for Atlantic croaker throughout the management unit relative to biological information on growth and maturity. Minimum size limits have not been applied to spot at the state level, and may be less useful due to the species' fast growth and early maturity.

The PDT also reviewed literature on movement and connectivity of Atlantic croaker and spot between regions specified by the updated TLA as Mid-Atlantic (New Jersey-Virginia) and South Atlantic (North Carolina-Florida). Although movement literature was sparse, genetic and life history studies, as well as commercial landings trends, suggest connectivity across the VA-NC border. The PDT recognizes that Mid- and South Atlantic regions were designated in the TC's recommendations due to the incorporation of regional abundance indices – such as indices from the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP), the South Carolina Department of Natural Resources Trammel Net Survey, and North Carolina Division of Marine Fisheries Program 195 survey – rather than any stock distinction between these regions. Additionally, the 2010 (ASMFC 2010) and 2017 (unpublished) stock assessments for Atlantic croaker and the 2017 (unpublished) stock assessment for spot were conducted for single, coastwide stocks spanning the entire management units (both New Jersey-Florida). Given the connectivity of fish north and south of the VA-NC border, the PDT recommends that any management response to the updated, regional TLA triggers be executed on a coastwide basis. This could be accomplished through an equal response throughout the management unit, or through a form of apportioned response in which all states take on restricted measures, but states of the triggering region enact stricter measures than those of the non-triggering region. For example, if the whole coast were to implement a 100-pound trip limit and the Mid-Atlantic TLA triggers under that management regime, a response could be an 80-pound trip limit in the Mid-Atlantic and a 90-pound trip limit in the South Atlantic.

To summarize, in response to management triggers from the TC-recommended TLA updates, the PDT recommends that long-term commercial and recreational coastwide management measures be established for each species in the form of seasons and/or trip (vessel or bag/possession) limits. These measures should be re-evaluated in three years for Atlantic croaker and two years for spot to determine if they are eliciting the desired response and evaluate if any adjustments should be made. Use of coastwide or area- or gear-specific minimum size limits for Atlantic croaker could be further evaluated if deemed potentially useful from a management perspective.

References

ASMFC. 2010. Atlantic Croaker 2010 Benchmark Stock Assessment. Washington (DC): ASMFC. 366 p.

Hare, JA and KW Able. 2007. Mechanistic links between climate and fisheries along the east coast of the United States: explaining population outbursts of Atlantic croaker (*Micropogonias undulatus*). Fisheries Oceanography 16(1): 31-45.

Norcross, BL and HM Austin. 1981. Climate scale environmental factors affecting year class fluctuations of Chesapeake Bay Croaker, *Micropogonias undulatus*. Special Scientific Report No. 110: Gloucester Point, Virginia: Virginia Institute of Marine Science, 78 pp.

Virginia Summary on Atlantic Croaker and Spot Issues
Presented to the VMRC Finfish Management Advisory Committee Meeting 1/9/19
Attendance: General Public 15. FMAC Members 7 of 14. VMRC Staff: 7

Comments from Meeting

Size Limits:
- Most spoke against size limits.
- It would eliminate bait in recreational fisheries and increase culling and dead discards in commercial fisheries.
- There was a question on how Maryland utilizes their 9" minimum size limit to manage their croaker fishery.
- Need to mirror NC regulations or it won't work.
- A commercial haul seiner supported methods to avoid catching small fish since they have little value and increase cull time.
- 3 committee members spoke against, 2 from the general public spoke against - all on the basis that it would limit bait options.

Possession Limits
- Both the committee and the general public would support a recreational bag limit if it was high enough. Suggested ranges were from 30 to 50 fish per person per day.
- Members of the public, both private anglers and headboat captains, admitted that the average angler is presently catching less than 15 fish per trip.
- The higher bag limits would be there to allow the use of the fish as bait for offshore species.
- 2 committee members spoke in favor, one with a limit of 15-30 and one with a limit of 50.
- 3 general public in favor, two in favor of 25-30 fish and one in favor of 50 fish.
- 1 Committee member spoke against, needing more than 50 for bait for a full day of fishing.

Seasonal Closures
- No opinions regarding recreational fishing
- No support commercially. Those that spoke claimed the season is highly variable and they need the opportunity to fish when the croaker/spot are available.

General
- A commercial fisherman commented that we a protecting large predators like spiny dogfish that consume large numbers of spots and croakers
- Several committee members and those in the general public expressed concern that abundance of these species is cyclic and driven by environmental conditions. They wanted assurance that any regulation would have to be easily removable when abundance increases again.
- The NC shrimp trawl fishery makes a vastly larger contribution to removals than all Virginia fisheries combined.

Items for further consider
- A recreational bag limit, or aggregate bag limit (spot and croaker) for the recreational fishery.
- A commercial season restriction. A similar percent reduction (as a result of the recreational bag limit) should be applied to the major sectors of the commercial fishery (haul seine, pound net, and gill net).
- Develop protocols for observer coverage for the commercial haul seine fishery.
- Develop a workgroup from membership of FMAC and members of the various fishing sectors to explore and vet potential options. This workgroup will have its first meeting April 22nd.

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

March 29, 2019

MEMORANDUM

TO: ASMFC South Atlantic State/Federal Fisheries Management Board

FROM: Daniel Zapf and Chris Batsavage, NC Division of Marine Fisheries

SUBJECT: Public input on potential Atlantic States Marine Fisheries Commission management measures for spot and Atlantic croaker

---

The South Atlantic State/Federal Fisheries Management Board (Board) requested member states seek public comment regarding potential management measures for spot and Atlantic croaker that could be considered in response to declining trends in harvest and abundance prior to taking action on approval of the Traffic Light Analysis (TLA) revisions. The North Carolina Division of Marine Fisheries (Division) accepted written comments and held three in person public comment meetings. Below is a summary of the input the Division received.

Public Meeting Attendance

There were 23 attendees from the public at the public meeting in Manteo and Division staff included Chris Batsavage, Daniel Zapf and Odell Williams. A total of six members of the public attended the Morehead City public meeting, and Division staff included Chris Batsavage, Daniel Zapf, Tina Moore and Brian Gupton. At the Wilmington public meeting there were 19 attendees from the public, and Division staff included Chris Batsavage, Daniel Zapf, Chris Stewart and Anne Markwith. Attendance almost entirely consisted of individuals affiliated with the commercial fishing industry at all of the public meetings.

Summary of In-Person Public Comment

The Division sought public comment on potential Atlantic States Marine Fisheries Commission (ASMFC) management measures for spot and Atlantic croaker in Manteo at the Dare County Commissioners Office on February 25th, in Morehead City at the N.C. Division of Marine Fisheries' Central District Office on February 26th and in Wilmington at the N.C. Department of Environmental Quality's Wilmington Regional Office on February 27th. The Division presented information about current management of spot and Atlantic croaker, the ASMFC proposal to revise the TLA used to monitor the spot and Atlantic croaker stocks, and an overview of the spot and Atlantic croaker fisheries in North Carolina. After background information was presented, the floor was opened for questions and comments from the public.

Public comments were overwhelmingly in favor of no new management measures for spot or Atlantic croaker. The public suggested declines in spot and Atlantic croaker commercial landings were the result of increased commercial fishing regulations causing less fishing effort. In Manteo and Morehead City the public commented that management measures for weakfish led to effort declines in multiple fisheries (gill nets, long haul seines, sciaenid pound nets) that also catch Atlantic croaker and spot, and these measures did not recover the weakfish stock. In Morehead City and Wilmington there was discussion of the small mesh gill net prohibition within 100 yards from shore in the ocean to reduce bottlenose dolphin takes essentially eliminating the spot fishery. In the southern areas there was also concern that changes to minimum gill net mesh size regulations would have negative consequences on the sea mullet (*Menticirrhus sp.*) fishery. There was also concern that the harvest component of the TLA might not adequately monitor the stock or the fishery because there is no effort data included.

Much of the in-person public comment focused on natural processes and how they affect these species. The cyclical nature of Atlantic croaker abundance was mentioned by several people. The public indicated strongly that changes in the environment, including climate change and declining water quality and habitat in the sounds and nearshore ocean waters, are causing these species to move further north and/or farther offshore. In addition, the public felt that increased predation on these species by red drum, striped bass and cormorants were causing declines in the populations.

The public asked questions about specific management measures that have been considered and Division staff indicated that at this point in the process nothing specific has been discussed. Public input did suggest that any new management measures would likely just increase dead discards and minimum size limits would not be appropriate because they would cause targeting of female fish and would cause issues with fisheries that use spot and Atlantic croaker as bait. There were also suggestions that more should be done to understand how the environment impacts stock dynamics of these species and attempt to incorporate that into monitoring.

Summary of Written Comments

The Division accepted written public comments from February 14 through March 15, and received online written comments from 18 individuals (20 comments) and written comments via email from two individuals.

Most of the written comments stated there had been declines in the spot and Atlantic croaker populations and nearly all (19 of 22) mentioned shrimp trawl bycatch as the primary source of population declines for these species. The preferred management action expressed in most written comments was to ban or limit trawling in at least some portion of the state, though there were also suggestions to increase minimum mesh sizes in gill nets, ban gill nets, ban haul seines, implement a creel limit in the recreational fishery, and eliminate the use of nets for recreational purposes with the exception of cast nets.

Very few written comments addressed management measures included as potential management options in informational material provided by the Division on this topic (i.e., trip/creel limits, season, size limits). Size limits were not supported as a management measure in two written comments with one comment stating that all measures would be supported, with the exception of size limits, if they are done in conjunction with limits to or a ban on trawling in inshore waters.

There was one comment supporting the implementation of a larval stocking program for both spot and Atlantic croaker and one comment that stated management decisions should not be made during hurricane years because of the potential for false data.

State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021