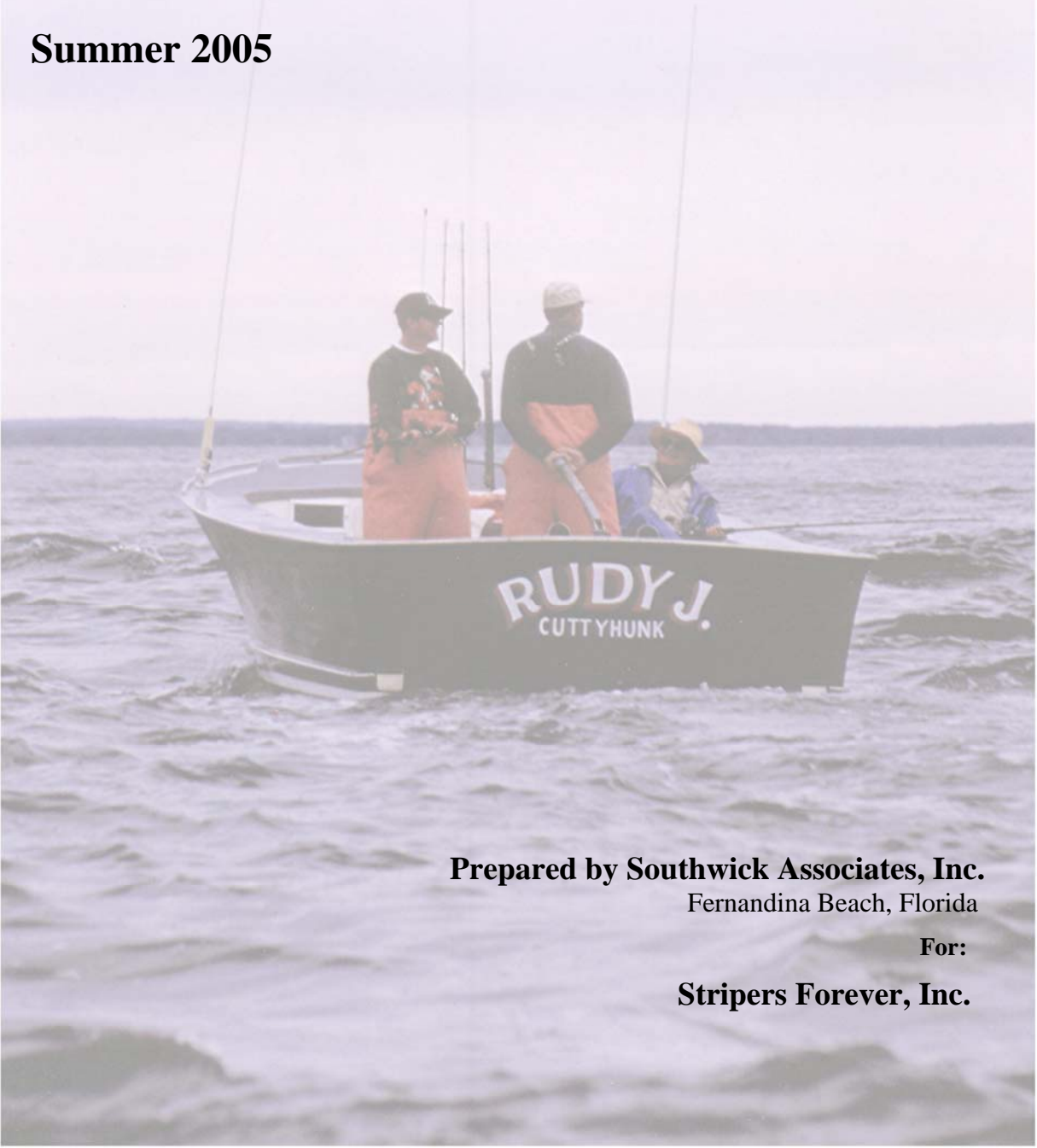


The Economics of Recreational and Commercial Striped Bass Fishing in Massachusetts

Summer 2005



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Fernandina Beach, Florida

For:
Stripers Forever, Inc.

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On The Cover: Capt. Jim Nunes and sports off Cuttyhunk. Photo by Dick White.

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Executive Summary

Economic Impacts:

This report assesses the economic contributions of commercial and recreational marine striped bass fishing in the estuarine and marine waters of Massachusetts, and aquaculture's potential as a substitute for wild fish. The contents were adapted from an Atlantic coast-wide study on the same topic (*The Economics of Recreational and Commercial Striped Bass Fishing*, March, 2005). This report presents results specific to Massachusetts while the original report contained results for all the Atlantic states from Maine to North Carolina.

The mission of Stripers Forever is as follows:

“Stripers Forever advocates eliminating all commercial fishing for wild striped bass, setting aside as much of the commercial quota as necessary to create and maintain healthier fish stocks, and allocating the rest to improve personal-use fishing for recreational anglers.”

If the striped bass fishery were so managed, any future harvest levels would produce greater returns for coastal economies and the national economy, because as this report explains, striped bass captured by the recreational sector are far more valuable on a per pound basis than those harvested commercially.

The purpose of this report is to help readers understand the greater economic returns from recreational fishing compared to commercial harvests, even when overall harvests are reduced. This report is based on data from existing sources and includes details regarding methods, limitations and results.

Currently, given state-specific allocations of striped bass between the commercial and recreational sectors, recreational anglers harvest 4.6 times more fish, yet produce nearly 50 times more economic activity than commercial fishermen as a result (see Table E-1, page v). The commercial impacts in Table E-1 considered the value-added and additional impacts created as raw striped bass move through processors and distributors on the way to the final restaurant or retail consumer. Detailed, state-specific impacts for the recreational and commercial fisheries are presented later in this report.

Table E-1: Impacts of Recreationally Harvested Striped Bass Compared to Commercially Harvested Striped Bass in Massachusetts

	Commercial	Recreational	Recreational Impacts Are:
<u>Total:</u>			
Pounds Harvested	1,055,496	4,889,036	4.6 times greater
Retail Sales (seafood retail and restaurants / angler expenditures)	\$6,156,450	\$649,742,549	105.5 times greater
Total Multiplier Effect (output, or ripple effect)	\$24,242,457	\$1,158,014,659	47.8 times greater
Jobs	524	10,986	21.0 times greater
<u>Per Pound:</u>			
Retail Sales (angler expenditures; seafood retail and restaurants)	\$5.83	\$132.90	22.8 times greater
Total Multiplier Effect (output, or ripple effect)	\$22.97	\$236.86	10.3 times greater
Jobs	.00050	.00225	4.5 times greater

The state economy will benefit by maximizing the percentage of fish caught by the recreational sector (harvested fish plus catch-and-release fishing). This is demonstrated in Table E-2, which presents the actual economic impacts from all striped bass activity in 2003, plus a hypothetical scenario based on all harvests occurring in the recreational sector.

Table E-2: Actual and Hypothetical Economic Impacts of Massachusetts Striped Bass Harvests

<u>Current 2003 Scenario:</u>	Commercial	Recreational	Total
Pounds Harvested	1,055,496	4,889,036	5,944,532
Retail Sales	\$6,156,450	\$649,742,549	\$655,898,999
Total Multiplier Effect	\$24,242,457	\$1,158,014,659	\$1,182,257,116
Jobs	524	10,986	11,510
<u>If Stripers Fully Allocated to Recreation:</u>			
Pounds Harvested	0	5,944,532	5,944,532
Retail Sales	\$0	\$850,512,997	\$850,512,997
Total Multiplier Effect	\$0	\$1,515,841,189	\$1,515,841,189
Jobs	0	14,381	14,381
<u>Net Increase in Impacts:</u>			
Pounds Harvested	-1,055,496	1,055,496	0
Retail Sales	-\$6,156,450	\$200,770,448	\$194,613,998
Total Multiplier Effect	-\$24,242,457	\$357,826,530	\$333,584,073
Jobs	-524	3,395	2,871

Economic Values:

A full economic examination of a fishery should include economic values, when possible. Economic values examine economic efficiency, and look at changes in consumer surplus and producer surplus. Consumer surplus is the value of a good or service beyond what the customer

actually paid, and can be viewed as the satisfaction received after using a specific good or service. In the case of recreational fishing, consumer surplus is a dollar measure of the benefit an angler receives from the enjoyment of going fishing. Producer surplus is defined as the difference between what producers actually receive when selling a product and the minimum amount they would be willing to accept for that product. For a seafood processor, producer surplus would be equal to the value of the price of a pound of fish minus the opportunity cost, or the amount they could have received, in their next most productive activity. These concepts are explained in greater detail within the report.

Massachusetts-specific valuation data were not possible. However, by adapting results from an existing study produced by the Virginia Institute of Marine Sciences (Kirkley et al. 2000), rough estimates of the economic value of the striped bass fishery to the Atlantic coast were possible. A 100 percent allocation to the recreational fishery produces the greatest societal benefit among various management scenarios. However, without a detailed analysis of economic value, which was beyond the scope of this study, interpretation of results should be cautioned. Nevertheless, based on these best available data, a hypothetical 100% allocation to the recreational sector would produce nearly 11.5 times as much value compared to a complete allocation to the commercial sector, and about 1.3 times as much value compared to current harvest allocations (or approximately \$50 million). With 64 percent of marine recreational fishing trips in Massachusetts targeting striped bass, compared to 20 percent in Virginia, it is reasonable to expect that any economic valuation procedures applied in Massachusetts will show maximum value is derived from recreational fisheries.

Aquaculture as a Substitute:

Estimates on the Massachusetts-specific effects of substituting wild-caught striped bass for striped bass raised through aquaculture were not possible. However, the effects expected in-state from substituting fish are not expected to be substantially different from the expected national effects. In 2003, aquaculture produced 11.447 million pounds of striped bass, which is 61.6 percent greater than the 7.085 million pounds harvested in the same year by the commercial sector. These fish currently enter the commercial market at the distribution level, such as the Fulton Fish Market and other similar points. The per-pound prices in 2003 for striped bass aquaculture and wild striped bass were basically the same, averaging \$2.78 in 2003 for aquaculture fish and \$2.75 for wild fish. The price similarity reflects the market's lack of distinction between the two products. If wild fish were considered superior, a higher price would reflect their extra desirability.

Once aquaculture fish enter the seafood processing and distribution chain, their economic impacts are expected to be similar to wild striped bass. Starting with the major fish auctions and distributors, many of the same businesses that currently handle farmed striped bass or could do so in the future are likely handling wild striped bass. Therefore, any dislocation in the overall U.S. economy would be very minimal if wild fish are replaced by farm-raised fish. The economic impacts at these levels need not be considered when looking at trade-offs between wild harvests and aquaculture. However, economic changes will occur in the production sector,

with dollars and economic impacts lost to commercial fishermen offset by gains in the aquaculture sector. The estimated trade-offs between the economic impacts of producing striped bass are presented in Table E-3.

Table E-3: Comparing the Economics of Obtaining Striped Bass for Human Consumption from Aquaculture Sources and Wild Sources in the U.S., 2003

	Dockside Value	Total Multiplier Effect	Salaries and Wages	Jobs
Aquaculture (farm activities only, does not include processing, wholesale, retail, restaurants, etc.)	\$12,741,553	\$48,458,674.3 7	\$9,021,019.52	349
Commercial Fisheries (wild harvest only, does not include processing, wholesale, retail, restaurants, etc.)	\$12,741,553	\$34,288,983.9 6	\$11,674,958.1 5	342
Difference:		41.3%	-22.7%	1.9%

The impacts in Table E-3 must be considered estimates only, based on the differing data sources used for the aquaculture and commercial fisheries analyses. However, Table E-3 is the best approximation possible of the economic impacts created by each source of raw product, and expresses the point that a shift in striped bass production from wild harvests to aquaculture will result in minimal net economic losses. While local disruptions will occur, as they do whenever an industry experiences shifts in manufacturing sources, the net effects on the U.S. economy would be minimal.

U.S. striped bass production on farms already exceeds wild production, 11.447 million pounds in 2003 versus 7.085 million pounds. Annual aquaculture production would need to increase an additional 38 percent to produce the 7.085 million pounds of wild striped bass harvested in 2003. However, in the past three years alone, the annual production of striped bass by fish farms has grown 21.9 percent, and over the past 10 years the total growth was 222 percent, indicating that the ability to expand production exists.

1.0 Introduction

This report assesses the economic contributions of commercial and recreational marine striped bass fishing in Massachusetts, and the potential of aquaculture as an alternate source for wild fish to be sold in the marketplace. The purpose is to help readers understand the relative difference in economic activity resulting from recreational and commercial striped bass fishing. The information in this report was extracted from a study released by Stripers Forever titled “*The Economics of Recreational and Commercial Striped Bass Fishing*” (March, 2005). The latter report is based on data from existing scientific publications, reports and other data sources. Data limitations encountered are described in this report.

This report reviews the economics of striped bass harvests using two principal measures: economic impacts (jobs, expenditures, tax revenues, etc.) and economic value (quality of life measures and consumer and producer surpluses). Both measures are valid and have a role in fisheries management decisions. Many people prefer economic value measures because economic impacts do not reflect the full intrinsic and financial values individuals receive from either catching fish recreationally and eating them, or consuming fish purchased at a seafood store or restaurant. However, it is important to recognize the value of various fisheries to equipment dealers, seafood processors, coastal communities and others who are personally impacted by fishery management decisions. Recognizing the different ways people measure and debate fishery management issues, this report includes both economic impact and value measures.

2.0 Definitions

Recreational fishing means all types of fishing, including catch-and-release fishing, that ultimately involves people pursuing fish as a recreational activity. This includes fishing guides, charter boats and party boats (head boats) that exist for the purpose of taking people fishing as a recreational activity. All measures of recreational fishing in this report include guides and charter boats. **Commercial** fishing includes all type of harvests made for the primary purpose of selling fish as a means of income.

Economic impacts measure the changes within an economy, and are usually expressed in jobs, income, retail sales (expenditures) and tax revenues. Economic impacts, for the purpose of economic modeling, can be divided into three standard components: direct, indirect and induced impacts. Each of these is considered by most economic models when estimating the overall impacts of any activity on the economy. A **direct impact** is defined as the economic result impact of the initial purchase made by the consumer. For example, when a person buys fishing tackle or a fish to eat for \$10, there is a direct impact for the retailer, and the economy, of \$10. **Indirect impacts** measure how sales in one industry affect the various other industries providing supplies and support. For example, the retailer must purchase additional rods or fish, plus pay costs such as power, rent, etc.; the tackle manufacturer must purchase more plastics production; plastics manufacturers must buy resins, fish retailers must buy more fish, wholesalers must buy more products and supplies, and so on. Therefore, the original expenditure of \$10 benefits many other industries. An **induced impact** results from the wages and salaries paid by the directly and indirectly impacted industries. The employees of these industries then spend their incomes. These expenditures are induced impacts which, in turn, create a continual cycle of indirect and induced effects.

The sum of the direct, indirect and induced effects is the **total economic impact**. As the original retail purchase (direct impact) goes through round after round of indirect and induced effects, the economic impact of the original purchase is multiplied, benefiting many industries and individuals. Likewise, the reverse is true. If a particular item or industry is removed, the economic loss is greater than the original retail sale. Once the original retail purchase is made, each successive round of spending is smaller than the previous round. When the economic benefits are no longer measurable, the economic examination ends.

Economic value goes beyond the impacts created by dollars changing hands. Economic value measures the surplus left to the consumer or producer after all sales are complete. Economic value measures the intrinsic well-being people are left with after completing an activity or consuming a product and all dollars or other expenses are spent. Economic value can be considered a quality of life measure. For example, a person who buys a boat for \$20,000 expects the value or enjoyment the boat brings back to be worth more than \$20,000. Another example: when a consumer buys a fish to eat for \$10, but would have paid \$15, the consumer is better off by \$5. Economic value measures should be considered along with economic impacts and other issues involved with fishery management efforts.

There are different perspectives how *recreational economic impacts* should be applied in fishery management decisions. Some people focus on the “new” dollars brought into a region by outside visitors or businesses and do not consider the dollars and business associated with purchases made by local residents. Others may argue that equipment and resident expenditures are relevant because, in the absence of striper fishing, the dollars spent on that activity may be taken out of the local community or spent on other industries besides fishing. The proper application of economic impacts depends on the situation. The perspective of this study is the overall economic activity created per state by striper fishing, for fish landed, eaten or released, regardless of where. Therefore, resident and non-resident distinctions are not considered. Since many businesses impacted by striped bass stock fluctuations sell equipment such as tackle and boats, recreational impacts are presented that include equipment sales as well as estimates that do not.

Many theoretical discussions of fishery economics include both together, with economic value equating to the surpluses earned after impacts are considered. In this report, economic impacts and economic value are considered separately based on available data and literature. If resources allow, future examinations of the trade-offs between recreational and commercial fisheries would benefit from detailed examinations of net economic impacts and consumer and producer surpluses.

3.0 Economic Impacts

3.1 Recreational Harvest

The data and information in this report were extracted from a similar report that covered the Atlantic coast from Maine to North Carolina. The methods used in that report are separated here into three stages:

- 1) Listing the number of recreational trips taken in 2003 in Massachusetts that primarily targeted striped bass (the year 2003 is the latest for which data were available, and presents the best current picture.
- 2) Estimating the expenditures made by striped bass anglers per trip and in total.
- 3) Estimating economic impacts by matching the dollars spent with economic multipliers.

This report measures the economic impact of recreational trips that *targeted* striped bass, versus those trips that were in pursuit of any species or those that caught striped bass incidentally while pursuing other species. The other alternative was to consider the economic impact of trips where at least one striped bass was *caught*, whether or not striped bass were the primary target for those trips. However, one can assume that many of those trips would have been made even in the absence of striped bass, though the exact percentage is unknown. Anglers who intentionally targeted striped bass and spent dollars pursuing them most accurately reflect the economic effects of the striped bass fishery.

The methodology used here includes expenditures made for travel *and* equipment expenditures. Recognizing this study measures the total impacts of trips that targeted striper, it is correct to include equipment purchases made by striper anglers. Likewise, the effects of resident striped bass angling expenditures should be considered. In the absence of striped bass, anglers may not necessarily spend their dollars in a manner benefiting the state or the same industries at the same level. A disruption in resident striped bass angling may displace many businesses and employees and should be considered in striped bass management plans. Therefore, it can be prudent to use the economic importance measure (resident and non-resident effects) rather than just economic impacts (non-residents only).

Trip Data:

The number of all marine fishing trips for each state, including Massachusetts, and the number of trips targeting striped bass were obtained directly from NOAA Fisheries' Marine Recreational Fisheries Statistics Survey (MRFSS).¹ The MRFSS is a combination phone and in-person, on-site survey conducted annually. The MRFSS reports angler trips taken for specific species, the number of anglers, and total fish caught, and also provides annual trip data. SAS software was

¹ While subject to criticism about its reliability, better data sources for striped bass-specific trips were not available.

used to analyze the MRFSS data to calculate the total number of marine recreational fishing trips taken and the number of trips for striped bass. Table 1 presents estimates of trips taken.

Table 1: Number of Trips Targeting Any Species and Striped Bass, by Mode and State, 2003

	Mode: ²	Estimated Total Fishing Trips	Trips Targeting Striped Bass	% of All Trips Targeting Striped Bass
Massachusetts	Shore	1,610,570	1,013,660	62.9%
	Party/Charter Boat	145,303	38,069	26.2%
	Private/Rental Boat	2,329,167	1,580,206	67.8%
	Total	4,085,040	2,631,935	64.4%
Atlantic Coast, Maine to North Carolina (including Massachusetts)	Shore	14,766,485	4,460,461	30.2%
	Party/Charter Boat	1,726,271	377,104	21.8%
	Private/Rental Boat	19,462,694	6,295,711	32.3%
	Total	35,955,450	11,133,276	30.96%

Source: Personal communication from NOAA Fisheries, Fisheries Statistics and Economics Division.

Expenditures:

Expenditures made to pursue striped bass in Massachusetts were based on the average expenditures made *regionally* for striped bass. This was a necessary step in the larger Atlantic-coast wide report as the number of people per state in the MRFSS survey who reported fishing for striped bass was often too low to reliably develop state-specific expenditure profiles. Using small samples to develop expenditure profiles would possibly have resulted in wide differences and lower reliability in many state-specific results. Recognizing that the types of expenditures made by striper anglers will vary little from state to state, regional profiles of striped bass anglers were developed. The regions were adopted from previous NOAA Fisheries angler expenditure studies in the northeast (ME to VA) and southeast (NC to FL) regions (Steinback and Gentner, 2001; and Gentner et al, 2001). With this approach, all expenditure items reported have large sample sizes, ranging from a minimum of 67 up to 652, depending on the mode of fishing and region. The regional expenditure profiles are presented in Tables 2a and 2b. Massachusetts was one of the few states with large, relatively reliable survey sample sizes. *To ensure the results reported here remain consistent with the national report, the methods used in the national report are carried over without substituting state-specific data for the regional data.*

Angler expenditures were obtained directly from the NOAA Fisheries' MRFSS (personal communications, NOAA Fisheries Statistics and Economic Division). Expenditure data were produced by NOAA Fisheries via several add-on economic components to MRFSS. The analysis only included expenditures made by striped bass anglers. The original dataset contained responses from 2,025 anglers. "Outliers," or unreasonable responses, were removed, for a total 1,920 useable responses. All analyses were conducted using SAS software. Regional profiles

² Shore fishing = fishing from a beach, bank or man-made structure; party/charter boat fishing includes guides. Private or rental boat refers to operating a boat without a hired captain or crew. These classifications are the standard method of categorizing anglers in NOAA Fisheries surveys.

were developed, with the Northeast profile representing all striper anglers from Virginia to Maine.

Both trip and equipment expenditures are included in the analysis. Massachusetts’ annual trip expenditures were relatively simple to calculate. The average amount reported spent per trip by striped bass anglers, as provided by the regional expenditure profiles and reported in Table 2, was multiplied by the total number of reported trips (Table 3). The equipment expenditures in the regional profiles report the amount spent annually for specific services and durable goods (boats, reels, etc.) that are used for many fishing trips, including those not targeting striped bass. To estimate the percentage consumed by striped bass angling, these services and durable goods expenditures were multiplied by the percent of *all* marine fishing trips targeting striped bass. This procedure suffices in meeting the goal of this project, which is to estimate the economic impacts of striped bass angling, versus projecting the losses to regional economies should striped bass angling cease. The latter would require estimating how much angling activity and dollars would be shifted to other species, a step not required when projecting current economic impacts.

Table 2: Average Costs Per Angler

Table 2a: Average Cost Per Angler/Trip^{3,4}

		<u>\$ Per Trip:</u> <u>(Maine to Virginia)</u>
Private Transportation	Charter	\$6.68
	Private/Rental	\$5.45
	Shore	\$7.68
Food	Charter	\$22.21
	Private/Rental	\$15.02
	Shore	\$16.83
Lodging	Charter	\$15.00
	Private/Rental	\$2.45
	Shore	\$5.91
Public Transportation	Charter	\$3.90
	Private/Rental	\$1.86
	Shore	\$1.87
Boat Fuel	Private/Rental	\$12.07
Charter Fees	Charter	\$107.08
Access/Boat Launching	Charter	\$0.15
	Private/Rental	\$2.68
	Shore	\$0.30
Equipment Rental	Charter	\$2.22
	Private/Rental	\$0.08
	Shore	\$0.09
Bait	Charter	\$1.89

³ Charter fishing includes party boats (or head boats) and guides. Shore fishing includes beaches, bank fishing, docks, piers and other man-made structures.

⁴ The data in this table comes directly from MRFSS, the best source available. As with any survey, there is an element of error that may account for any unusual figures, such as dollars reported for boat purchases by charter customers, and boat expenses reported by shore anglers.

	Private/Rental	\$4.37
	Shore	\$5.78
Ice	Charter	\$2.65
	Private/Rental	\$0.99
	Shore	\$0.73
<i>Travel Costs Sub-Total:</i>	Charter	\$161.78
	Private/Rental	\$44.96
	Shore	\$39.20

Table 2b: Average Annual Equipment Expense per Angler Targeting Striped Bass

		<u>Maine to Virginia</u>
Rods and Reels	Charter	\$18.49
	Private/Rental	\$84.03
	Shore	\$74.99
Other Tackle	Charter	\$18.76
	Private/Rental	\$34.40
	Shore	\$29.20
Camping Equipment	Charter	\$27.97
	Private/Rental	\$2.95
	Shore	\$3.77
Binoculars	Charter	\$2.40
	Private/Rental	\$3.05
	Shore	\$0.83
Clothing	Charter	\$4.31
	Private/Rental	\$6.31
	Shore	\$2.32
Processing/Taxidermy	Charter	-
	Private/Rental	-
	Shore	\$0.00
Magazines	Charter	\$3.23
	Private/Rental	\$2.97
	Shore	\$1.92
Club Dues	Charter	\$5.19
	Private/Rental	\$3.24
	Shore	\$8.29
Miscellaneous	Charter	\$0.00
	Private/Rental	\$1.90
	Shore	\$4.40
Boat Expenses	Charter	\$227.29
	Private/Rental	\$347.10
	Shore	\$113.29
Power Boat Purchases	Charter	\$15.51
	Private/Rental	\$1,818.68
	Shore	\$818.71
Non-Power Boat Purchases	Charter	\$47.71
	Private/Rental	\$4.94
	Shore	\$5.72
Electronics	Charter	\$13.72
	Private/Rental	\$37.40
	Shore	\$9.02
Fishing Vehicle	Charter	\$0.00
	Private/Rental	\$404.50
	Shore	\$211.43
Vacation Home	Charter	\$0.00
	Private/Rental	\$5.48
	Shore	\$2.50
<i>Equipment Sub-Total:</i>	Charter	\$384.57
	Private/Rental	\$2,756.96
	Shore	\$1,286.39

Table 3: Number of Trips Targeting Any Species and Striped Bass, by Mode, 2003

Mode: ⁵		Estimated Total Fishing Trips	Trips Targeting Striped Bass	% of Marine Trips Targeting Striped Bass
Massachusetts	Shore	1,610,570	1,013,660	62.9%
	Party/Charter Boat	145,303	38,069	26.2%
	Private/Rental Boat	<u>2,329,167</u>	<u>1,580,206</u>	<u>67.8%</u>
	Total	4,085,040	2,631,935	64.4%
<hr/>				
Total, Atlantic Coast (Maine to North Carolina)	Shore	14,766,485	4,460,461	30.2%
	Party/Charter Boat	1,726,271	377,104	21.8%
	Private/Rental Boat	19,462,694	6,295,711	32.3%
	Total	35,955,450	11,133,276	30.96%

Source: Personal communication from NOAA Fisheries, Fisheries Statistics and Economics Division.

Corrections were made to the expenditures to update them to 2003 levels. This was done by applying the Consumer Price Index to adjust data from 1998 levels, which was the date for the Northeast expenditure data. According to the Department of Commerce (U.S. Department of Commerce, 2004), the inflation adjustment factors were 1.13 (+13%) for the Northeast U.S. Table 4 presents the expenditure estimates for Massachusetts.

Table 4: Estimated Expenditures for Striped Bass Fishing in Massachusetts

<u>Trip Expenditures:</u>	<u>MODE:</u>	<u>Per Mode</u>	<u>\$ Per Item:</u>
Private Transportation	Charter	\$254,305	16,649,696
	Private/Rental	\$8,608,962	
	Shore	\$7,786,429	
Food	Charter	\$845,676	41,638,297
	Private/Rental	\$23,729,479	
	Shore	\$17,063,142	
Lodging	Charter	\$571,035	10,435,345
	Private/Rental	\$3,872,769	
	Shore	\$5,991,542	
Public Transportation	Charter	\$148,357	4,981,197
	Private/Rental	\$2,936,039	
	Shore	\$1,896,801	
Boat Fuel	Private/Rental	\$19,069,136	19,069,136
	Charter	\$4,076,276	
Charter Fees	Charter	\$5,598	4,546,917
	Private/Rental	\$4,233,957	
	Shore	\$307,362	
Equipment Rental	Charter	\$84,536	311,319
	Private/Rental	\$130,699	
	Shore	\$96,085	
Bait	Charter	\$71,969	12,828,708
	Private/Rental	\$6,899,811	
	Shore	\$5,856,927	

⁵ Shore fishing = fishing from a beach, bank or man-made structure; Party/Charter boat fishing includes guides. Private or rental boat refers to operating a boat without a hired captain or crew. These classifications are the standard method of categorizing anglers in NOAA Fisheries surveys.

Table 4 Continued

Ice	Charter	\$100,957	2,403,155	
	Private/Rental	\$1,562,682		
	Shore	\$739,516		
<i>Trip Sub-Total:</i>	Charter	6,158,710		
	Private/Rental	71,043,533		
	Shore	39,737,803		
	<i>Total:</i>	<u>116,940,047</u>	116,940,047	
x CPI adjustment to 2003 (13%):		132,142,253		
	<u>Resident</u>	<u>Non-resident</u>	<u>Total:</u>	
Rods and Reels	\$73,339,000.00	\$24,943,000.00	\$98,282,000.00	
Other Tackle	\$33,438,000.00	\$6,443,000.00	\$39,881,000.00	
Camping Equipment	\$6,520,000.00		\$6,520,000.00	
Binoculars	\$1,612,000.00		\$1,612,000.00	
Clothing	\$6,814,000.00		\$6,814,000.00	
Processing/Taxidermy	\$211,000.00		\$211,000.00	
Magazines	\$3,265,000.00		\$3,265,000.00	
Club Dues	\$3,616,000.00		\$3,616,000.00	
Miscellaneous	\$2,672,000.00		\$2,672,000.00	
Boat Expenses	\$4,340,000.00		\$4,340,000.00	
Power Boat Purchases	\$361,455,000.00		\$361,455,000.00	
Non-Power Boat Purchases	\$2,672,000.00		\$2,672,000.00	
Electronics	\$6,228,000.00		\$6,228,000.00	
Licenses	n/a		n/a	
Fishing Vehicle	\$173,055,000.00		\$173,055,000.00	
Vacation Home	\$324,000.00		\$324,000.00	
<u>Equipment Total, ALL FISHING:</u>			<u>\$710,947,000.00</u>	
Durable \$\$ assigned to striped bass:			\$458,053,358.71	
TOTAL STRIPED BASS EXPENDITURES, 1998			\$574,993,406	
x CPI Adjustment to 2003: + 13%				
TOTAL 2003 EST. STRIPED BASS \$:			\$649,742,549	

Economic Impact Per Dollar Spent by Marine Recreational Anglers

Economic multipliers explaining the total jobs, earnings (salaries and wages), total economic impact (output), and tax revenues for Massachusetts were derived from American Sportfishing Association data (ASA 2002). This study calculated the economic impact from marine recreational fishing per state based on data from the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (U.S. Fish and Wildlife Service 2002) and RIMS-II input-output multipliers (Bureau of Economic Analysis 1997). This source was chosen for use over other sources such as NOAA Fisheries regional economic analyses of sport fishing because it provides a better “apples-to-apples” comparison to the multipliers derived in this report for the commercial fishing analysis. The resources available for this report did not allow for the development of economic models unique to striped bass. Simple multipliers were obtained by dividing the total output, jobs and earnings estimates by total expenditures. The resulting ratios were then used as multipliers and are listed in Table 5. The expenditures were multiplied by the respective multipliers to derive the final economic impact estimates.

Table 5: Recreational Multipliers Used in This Analysis (Impacts Per Dollar Spent)

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	1	1.782266933	0.453533969	0.000016908	0.060186976	0.021231887	0.076958074
United States	1	2.746529311	0.71905113	0.000026232	0.043581188	0.007550318	0.119978368

Source: Sport Fishing in America, Values of Our Traditional Pastime, American Sportfishing Association, 2003.

The multiplier data were for 2001, not 2003, which is the time frame of this report. However, without updated models showing any increases or decreases in the impact effects between 2001 and 2003, adjustments were not possible. Given the nature of the general economy to evolve slowly over time, economic multipliers would generally experience small changes from year to year. The U.S. Department of Commerce, reflecting the slowly evolving nature of the economy, only updates the data used to produce its RIMS-II economic multipliers every five years. Regardless, the economy does change gradually. Therefore, the multipliers used in this report are considered closely, but not perfectly, representative to 2003. The estimated economic effects of striped bass angler expenditures on travel-related expenses and equipment sales is presented in Table 6. The effects from only travel-related expenses are presented in Table 7 and explain the importance of striped bass angling to coastal-related tourism. Appendix I presents rough estimates of the number of striped bass anglers per state.

Table 6: Estimated Economic Impacts, All Recreational Travel and Equipment Expenditures Combined

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$649,742,549	\$1,158,014,659	\$294,680,317	10,986	\$39,106,039	\$13,795,261	\$50,002,935
Atlantic Coast, Maine to North Carolina (including Massachusetts)	\$2,412,284,999	\$6,625,411,457	\$1,734,556,255	63,278	\$105,130,245	\$18,213,520	\$289,422,017
Per lb harvested in Massachusetts:	\$132.90	\$236.86	\$60.27	0.00225	\$8.00	\$2.82	\$10.23
Per fish caught and kept in Massachusetts:	\$1,596.03	\$2,844.55	\$723.85	0.02698	\$96.06	\$33.89	\$122.83
Per trip in Massachusetts:	\$246.87	\$439.99	\$111.96	0.00417	\$14.86	\$5.24	\$19.00

Table 7: Estimated Economic Impacts from Recreational Travel Expenditures Only

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$132,142,253	\$235,512,768	\$59,931,001	2,234	\$7,953,243	\$2,805,629	\$10,169,413
Atlantic Coast, Maine to North Carolina (including Massachusetts)	\$645,816,927	\$1,773,755,120	\$464,375,391	16,941	\$28,145,469	\$4,876,123	\$77,484,061
Per lb harvested in Massachusetts:	\$27.03	\$48.17	\$12.26	0.00046	\$1.63	\$0.57	\$2.08
Per fish caught and kept in Massachusetts:	\$324.59	\$578.51	\$147.21	0.00549	\$19.54	\$6.89	\$24.98
Per trip in Massachusetts:	\$50.21	\$89.48	\$22.77	0.00085	\$3.02	\$1.07	\$3.86

3.2 Commercial Harvest

All analyses in this report, including those used to determine commercial harvests, were obtained from a study released by Stripers Forever titled “*The Economics of Recreational and Commercial Striped Bass Fishing*” (March, 2005). The methods used to generate the economic impact estimates of Massachusetts and Atlantic coast commercial striped bass landings are separated into two basic stages:

- 1) Obtain NOAA Fisheries data regarding the value of fish landed in Massachusetts and for the coast as a whole, and
- 2) Combine landings value data, also known as dockside prices, with economic multipliers that describe the economic activity stimulated as the raw product is processed, distributed and ultimately consumed.

Commercial Landings Value Data

Data regarding the 2003 Atlantic striped bass harvest in Massachusetts and all states was obtained from NOAA Fisheries. Data were retrieved for pounds harvested and dollars earned by harvesters.

Commercial Harvest Multiplier Data

Only a few sources of multiplier data for Massachusetts and Atlantic commercial finfish harvest were found. The most recent and directly applicable source was from the Virginia Institute of

Marine Science (Kirkley et al, 2000). The multipliers in this report, while detailed and considered very reliable, reported only the economic effects of commercial fishery activities in Virginia. No other source of adequate and more recent multipliers was available for Massachusetts or any other states that covered all major commercial fishery sectors (harvesting, processing, distribution and retail and restaurants/food service). Therefore, the Virginia multipliers were adapted for use in the other Atlantic coast states. Recognizing the competitive nature of the seafood industry along the Atlantic coast, commercial fishery multipliers for Massachusetts and Virginia are not expected to have major differences.

The Virginia multipliers consider the expenditures and impacts generated as striped bass move through the processing, distribution and retail/food service levels. The commercial fishery multipliers used in this study, and the adaptations made to these multipliers, are presented in Appendix II. Please note that all adjustments were made in a manner where any possible error was skewed towards maximizing estimates of commercial harvest data. The economic results reported herein are considered to be at the high end of their possible range.

Applying the Multipliers

The multipliers explain the relationship between the value of commercial striper landings and their cumulative economic impacts. In this study, for every \$1 of fish landed, the multipliers report the level of economic activity created, the number of jobs supported, and income (salaries, wages, and business profits) produced. To determine the economic impacts for Atlantic coast striped bass commercial harvests, the total dock-side values of all 2003 landings in Massachusetts and for all states from Maine to North Carolina were applied to their appropriate multipliers. Landing values and the resulting economic impact estimates are reported in Table 8.

Table 8: Estimated Economic Impacts of Commercial Striped Bass Landings, 2003¹

Region:	Landings	Consumer Level Retail Sales ³	Total Multiplier Effect (Output)	Income (salaries, wages, business profits)	Jobs (Full-time equivalent)
Massachusetts	\$1,819,354	\$6,156,450	\$24,242,457	\$17,844,542	524
U.S. ²	\$12,741,553	\$43,115,704	\$250,079,578	\$188,542,356	5,023
Pounds Harvested, in Massachusetts:	1,055,496				
Per lb harvested, in Massachusetts:	\$1.72	\$5.83	\$22.97	\$16.91	.000496

¹ Blank cells ("\$ - ") are states that do not permit commercial striped bass harvests or reported zero harvest

² The sum of the impacts per state will not equal the U.S. estimate. See Appendix II.

³ These figures reflect the weighted average amount paid at the seafood retail and restaurant level.

4.0 Economic Impacts from Reallocating Striped Bass

NOTE: The mission of Stripers Forever is as follows: "Stripers Forever advocates eliminating all commercial fishing for wild striped bass, setting aside as much of the commercial quota as necessary to create and maintain healthier fish stocks, and allocating the rest to improve personal-use fishing for recreational anglers." The information presented in this section is *only* intended to demonstrate the greater economic returns produced by recreational fishing, even when fish are released, compared to commercial landings.

This section looks at the differences in retail sales, jobs and overall economic activity stimulated by recreational and commercial harvests. Recognizing that boat, tackle and other equipment dealers have been vocal about the importance of striped bass management to their livelihoods, the recreational dollars analyzed here are based on Table 4, which includes travel and equipment expenditures.

Based on NOAA landings data, and matched with the economic impact information presented on the preceding pages, the respective impacts per pound of fish *landed* (versus caught and released) are presented in Table 9. Please note that these numbers do not reflect the fish allocated by government to the commercial and recreational sectors. Instead, they reflect actual fish caught as reported by NOAA Fisheries. Overall, on a per-pound basis, the recreational sector in Massachusetts generates greater impacts for the coastal economy, with over 22 times more in retail sales value per pound landed, over 10 times more economic activity across the state economy, and 4.5 times as many jobs.

Table 9. Recreational Landings Compared to Commercial Harvests, 2003:

	Commercial	Recreational	Recreational Impacts Are:
Total:			
Pounds Harvested	1,055,496	4,889,036	4.6 times greater
Retail Sales (angler expenditures; seafood retail and restaurants)	\$6,156,450	\$649,742,549	105.5 times greater
Total Multiplier Effect (or new economic activity)	\$24,242,457	\$1,158,014,659	47.8 times greater
Jobs	524	10,986	21.0 times greater
Per Pound:			
Retail Sales (angler expenditures; seafood retail and restaurants)	\$5.83	\$132.90	22.8 times greater
Total Multiplier Effect (or new economic activity)	\$22.97	\$236.86	10.3 times greater
Jobs	.00050	.00225	4.5 times greater

One goal of this study is to demonstrate the greater returns to coastal economies from recreational fishing for striped bass compared to commercial harvests. The greater returns from recreational activities are demonstrated next by comparing current economic impacts of striped bass harvests to a hypothetical scenario where fishing is limited to recreational anglers only.

The first step is to estimate the level of economic impacts that might occur if commercial harvesting ceased. Two different approaches, each differing slightly but based on a similar approach, were tested to estimate the economic returns from such a scenario and are presented here. The first approach is slightly more complex, but both yield the same general results. These approaches were developed and reported in the *Stripers Forever* report titled “The Economics of Recreational and Commercial Striped Bass Fishing” (March, 2005).

4.1 Approach #1:

Total allowable striped bass harvests, as set by the Atlantic States Marine Fisheries Commission (ASMFC), are based on overall mortality on fish stocks. If the 7.1 million fish currently harvested along the Atlantic coast by commercial fishermen were reallocated to the recreational sector, state authorities would be able to adjust seasons and bag and size limits in a way that permits the harvest of the additional fish.⁶ Do not mistake this as recognition that anglers are compelled to harvest all the fish they catch. The changes in recreational fishing levels brought on by changes to seasons include both fish landed by anglers and catch-and-release activity. Even though this approach is based on total fish harvested, it automatically includes catch-and-release angling. Catch-and-release angling is increasingly popular, and to a degree even sustained the recreational fishery for striped bass during the harvest moratoriums of the late 1980’s and early 1990’s.

Without being able to accurately predict how Massachusetts or any other state would ultimately adjust their regulations, estimates are made here based on the regulations as they existed in 2003, the latest year when data was available. The following process was used:

- 1) In 2003, according to NOAA Fisheries, 2,503,800 striped bass weighing 22,952,673 pounds were landed or discarded by anglers from Maine through the Carolinas. Therefore, the average weight of a striper landed in 2003 was 9.17 pounds. Please note this figure represents only fish *landed* or *discarded*, and does not include fish released alive. This figure includes all striped bass -- those caught in inshore waters which are typically populated with smaller fish, and those caught in deeper waters and areas populated by large, fully mature fish.
- 2) In 2003, a total of 35,955,450 marine recreational fishing trips were made in the same states, for all types of fish, in all types of water (inshore, offshore, etc.) by all modes (boat, shore, etc.); of these, 11,133,276 trips were made specifically targeting striped bass (see Table 1).
- 3) Based on the above, in 2003, the average recreational fishing trip landed an average of 0.07 striped bass/trip ($2,503,800 \text{ fish} / 35,955,450 \text{ trips} = .0696 \text{ fish}$, rounded to 0.07 fish).

⁶ *Stripers Forever*, Inc. emphasizes it does not seek to simply reallocate commercial harvests to recreational anglers. Instead, the goal is to create healthier fish stocks, and therefore better catch-and-release fishing and some limited harvests by reducing *overall* landings and mortality as necessary to achieve this goal.

- 4) Therefore, the average weight of striped bass harvested per trip was 0.6419 pounds per trip (9.17 pounds per fish x .07 fish per trip = 0.6419 pounds per trip).
- 5) Hypothetically, if the total commercial allocation was assigned to the recreational sector, the 7,085,427 pounds taken in 2003 could be harvested by a maximum of 11,038,210 additional targeted and non-targeted trips (7,085,427 lbs / .6419 = 11,038,210 fishing trips, assuming striped bass populations remain steady at 2003 levels). Increases in striped bass populations could result in more recreational fishing trips, with increased harvest limits; this is further discussed in the next section. The trips discussed include both those that harvested fish and catch-and-release trips. The above hypothetical scenario helps to highlight the greater economic returns of recreational striped bass fishing, but is not meant to advocate for assigning the total commercial harvest to the recreational sector. This scenario also assumes that demand for fishing would remain static at 2003 levels. Demand for striped bass fishing varies each year based on anglers' expectations of catching fish, weather, economic variables, and other factors not fully understood nor available for use in estimating the effects of harvest shifts between recreational and commercial harvests.
- 6) Based on Table 1, approximately 30.9 percent of *all* 2003 marine recreational fishing trips targeted striped bass. Therefore, of the 11,038,210 new trips that could be created, an estimated 3,417,881 trips may specifically target striped bass. We estimate that only targeted trips for striped bass will increase as a result of reallocated fish, and that the 7,616,365 non-targeted trips would remain at the same level and not grow as a result of the increased striper opportunities. The additional 3,417,881 trips would equate to an approximate 30.9 percent increase in trips targeting striped bass.

Without the means to estimate marginal changes in economic impacts per dollar spent by anglers, we must assume economic impacts from striped bass would also increase approximately 30.9 percent. We acknowledge that for many anglers, equipment expenditures for items like boats and tackle made for fishing at lower harvest levels would suffice for their additional fishing activities. By the same token, some anglers may make such expenditures if the fishing were to improve. In addition, increased fishing activity can increase wear on existing equipment, thus increasing anglers' average annual equipment expenditures. With no information available on the marginal changes in anglers' expenditures based on changes in expected fishing activity, we have made the assumption that economic impacts will increase linearly with fish populations. This assumption is partially supported by Table 15, which shows that angling activity increased in near-linear fashion as striped bass stocks grew in the 1980's and 1990's. To an unknown extent, it is reasonable to assume angler expenditures grew as well. Tables 10 and 11 present the additional economic impacts reallocation could produce, and Tables 12 and 13 present the overall impacts that could result.

Table 10: Estimated Additional Economic Impacts from Reallocating Striped Bass 100 Percent to Recreational Fishing, Based on Travel and Equipment Expenditures Combined

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$199,470,962	\$355,510,500	\$90,466,857	3,373	\$12,005,554	\$4,235,145	\$15,350,901
United States	<u>\$740,571,495</u>	<u>\$2,034,001,317</u>	<u>\$532,508,770</u>	<u>19,426</u>	<u>\$32,274,985</u>	<u>\$5,591,551</u>	<u>\$88,852,559</u>
Per lb harvested in Massachusetts:	\$40.80	\$72.72	\$18.50	0.00069	\$2.46	\$0.87	\$3.14
Per fish caught and kept in Massachusetts:	\$489.98	\$873.28	\$222.22	0.00828	\$29.49	\$10.40	\$37.71
Per trip in Massachusetts:	\$75.79	\$135.08	\$34.37	0.00128	\$4.56	\$1.61	\$5.83

Table 11: Estimated Additional Economic Impacts from Reallocating Striped Bass, Based on Travel Expenditures Only

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$40,567,672	\$72,302,420	\$18,398,817	686	\$2,441,645	\$861,328	\$3,122,010
United States	<u>\$198,265,797</u>	<u>\$544,542,822</u>	<u>\$142,563,245</u>	<u>5,201</u>	<u>\$8,640,659</u>	<u>\$1,496,970</u>	<u>\$23,787,607</u>
Per lb harvested in Massachusetts:	\$8.30	\$14.79	\$3.76	0.00014	\$0.50	\$0.18	\$0.64
Per fish caught and kept in Massachusetts:	\$99.65	\$177.60	\$45.19	0.00169	\$6.00	\$2.12	\$7.67
Per trip in Massachusetts:	\$15.41	\$27.47	\$6.99	0.00026	\$0.93	\$0.33	\$1.19

Table 12: Estimated TOTAL Economic Impacts from Reallocating Striped Bass 100 Percent to Recreational Fishing, Based on Travel and Equipment Expenditures Combined

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$849,213,511	\$1,513,525,160	\$385,147,174	14,358	\$51,111,593	\$18,030,406	\$65,353,836
United States	<u>\$3,152,856,494</u>	<u>\$8,659,412,775</u>	<u>\$2,267,065,025</u>	<u>82,705</u>	<u>\$137,405,231</u>	<u>\$23,805,071</u>	<u>\$378,274,577</u>
Per lb harvested in Massachusetts:	\$173.70	\$309.58	\$78.78	0.00294	\$10.45	\$3.69	\$13.37
Per fish caught and kept in Massachusetts:	\$2,086.01	\$3,717.82	\$946.08	0.03527	\$125.55	\$44.29	\$160.54
Per trip in Massachusetts:	\$322.66	\$575.06	\$146.34	0.00546	\$19.42	\$6.85	\$24.83

Table 13: Estimated TOTAL Additional Economic Impacts from Reallocating Striped Bass 100 Percent to Recreational Fishing, Based on Travel Expenditures Only

	Retail Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs	Sales and Motor Fuel Taxes	State Income Taxes	Federal Income Taxes
Massachusetts	\$172,709,925	\$307,815,188	\$78,329,818	2,920	\$10,394,888	\$3,666,958	\$13,291,423
United States	<u>\$844,082,724</u>	<u>\$2,318,297,942</u>	<u>\$606,938,636</u>	<u>22,142</u>	<u>\$36,786,128</u>	<u>\$6,373,093</u>	<u>\$101,271,668</u>
Per lb harvested in Massachusetts:	\$35.33	\$62.96	\$16.02	\$0.00	\$2.13	\$0.75	\$2.72
Per fish caught and kept in Massachusetts:	\$424.24	\$756.12	\$192.41	\$0.01	\$25.53	\$9.01	\$32.65
Per trip in Massachusetts:	\$65.62	\$116.95	\$29.76	\$0.00	\$3.95	\$1.39	\$5.05

The estimated increase in economic impacts can be considered conservative. The average weight of a fish harvested by recreational anglers, calculated in this analysis to be 9.17 pounds, was determined using the total weight of fish landed as reported by NOAA Fisheries. However, NOAA’s weight estimates do not include the weight of fish discarded (fish released alive that did not survive.) Typically, such fish will be smaller because anglers are more likely to keep the larger fish. But the average weight of fish brought home is used by NOAA to estimate the average weight of fish discarded, for lack of better data. Therefore, we assume the weight of discarded fish is likely lower than the estimates used in this report. If we used a lower average weight for fish caught, our calculations of additional trips taken would be larger, and the estimated economic impacts would also be higher.

The additional economic impacts from reallocating the Atlantic coast commercial harvest of 7.1 million pounds to the recreational sector are much greater than the impacts these fish currently generate as a commercial fishery. Economic activity from the 7.1 million pounds would be over seven times greater, and nearly three times more jobs would be created. Table 14 presents a comparison of the two allocation alternatives specific to Massachusetts.

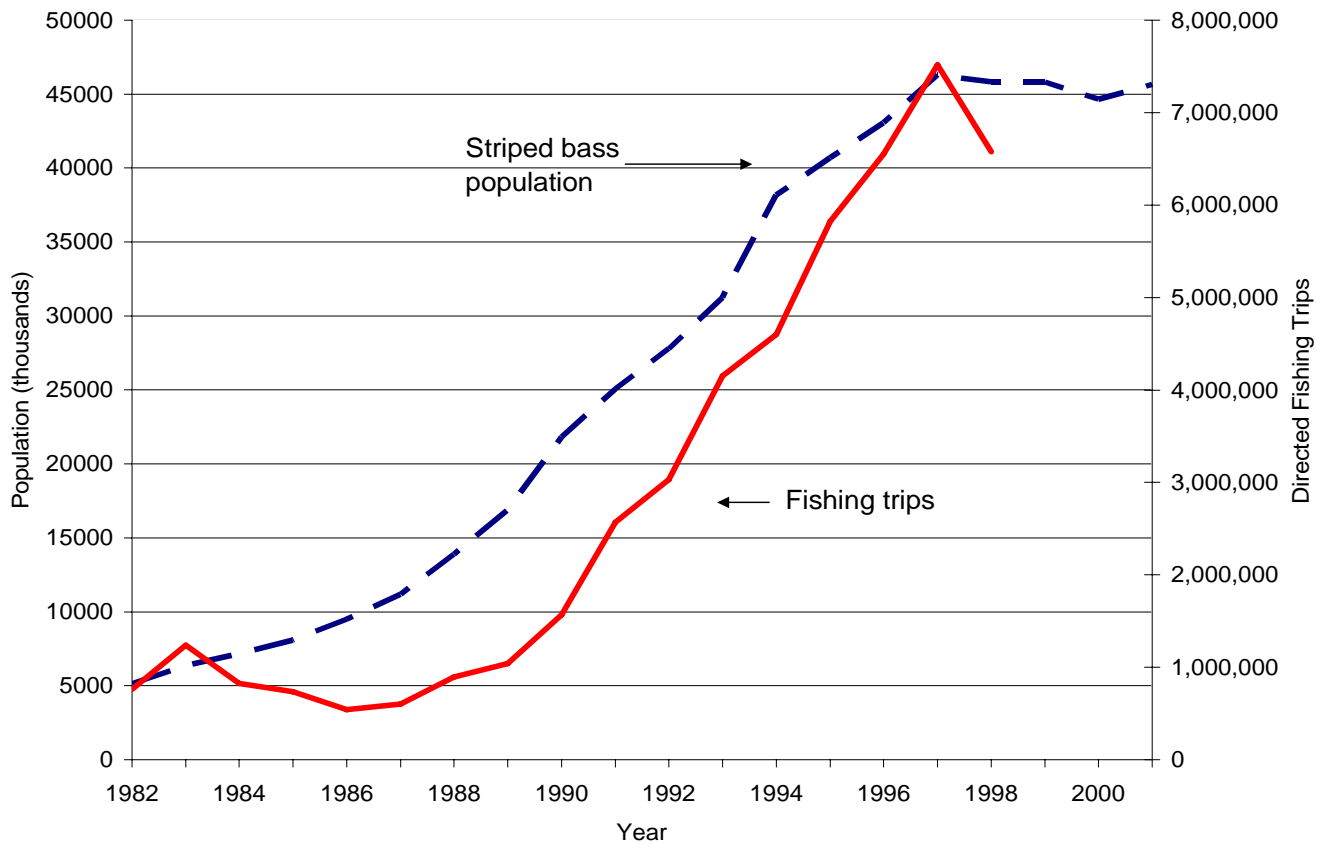
Table 14. Estimated Recreational Impacts if Stripers Were Fully Allocated to Recreational Harvest

<u>I. Current 2003 Scenario:</u>	Commercial	Recreational	Total
Pounds Harvested	1,055,496	4,889,036	5,944,532
Retail Sales	\$6,156,450	\$649,742,549	\$655,898,999
State Fuel & Sales Tax Revenues	n/a	\$39,106,039	n/a
State Income Tax Revenues	n/a	\$13,795,261	n/a
		\$1,158,014,65	\$1,182,257,11
Total Multiplier Effect	\$24,242,457	9	6
Jobs	524	10,986	\$11,510
<u>II. If Stripers Fully Allocated to Recreation:</u>			
Pounds Harvested	0	5,944,532	5,944,532
Retail Sales	\$0	\$849,213,511	\$849,213,511
State Fuel & Sales Tax Revenues	\$0	\$51,111,593	\$51,111,593
State Income Tax Revenues	\$0	\$18,030,406	\$18,030,406
		\$1,513,525,16	\$1,513,525,16
Total Multiplier Effect	\$0	0	0
Jobs	0	14,358	14,358
<u>III. Net Increase in Impacts (I – II):</u>			
Pounds Harvested	(1,055,496)	1,055,496	0
Retail Sales	(\$6,156,450)	\$199,470,962	\$193,314,512
State Fuel & Sales Tax Revenues	n/a	\$12,005,554	n/a
State Income Tax Revenues	n/a	\$4,235,145	n/a
	(\$24,242,457)	\$355,510,500
Total Multiplier Effect)	\$355,510,500	\$331,268,043
Jobs	-524	3,373	2,849

4.2 Approach #2:

This approach only examines the reallocation effects along the Atlantic coast from Maine to North Carolina; state-specific results were not produced. Thus, this approach is different from the basic method presented in Section 4.1 when estimating the economic effects of reallocation. Evidence indicates that an increase in the availability of striped bass may increase angling effort, even if harvest restrictions are tightened. Table 15 (next page) presents the increase in striped bass stocks in the 1980's and 1990's and the corresponding increase in angler trips. According to more recent NOAA Fisheries (MRFSS) data released since the production of Table 15, the increasing trend in targeted striped bass trips has continued through 2003, while the striper population has held steady at 45 million, thus indicating a relative continuation of the long-term trend seen since the mid-1980's when recreational fishing trips increased at the same basic pace as fish populations, with a slightly faster growth rate in the last several years. This was also clearly the case with Florida snook. As stock sizes increased over recent years, so has fishing activity, as measured by the sales of snook stamps by the Florida Fish and Wildlife Conservation Commission (personal communication, Dr. Russell Nelson). Table 16, using data provided by the Gulf States Marine Fisheries Commission for angling in all Gulf states except Texas, shows how red drum, commercially fished and over-exploited in the early 1980's, experienced a rapid increase in angling participation once commercial harvests were stopped and recreational limits tightened in the mid-1980's, even while the average number of fish harvested per trip fell. Since 1988 or 1989, the average fish kept per trip has remained stable while the overall recreational fishery has increased, generating significant new economic impacts. Simultaneously, the snook fishery, also protected, grew significantly while the number of fish harvested per trip mostly held steady. Both fisheries saw harvest restrictions increase during this time. Together, tables 15 and 16 indicate that angling trips can increase even when bag limits and harvest restrictions are tightened, as long as quality fishing opportunities exist.

Table 15. Trends in Striped Bass Stocks and Recreational Trips



Data Sources: 2001 ASMFC Stock Assessment and National Marine Fisheries Service Marine Recreational Fisheries Statistics Survey. Graphic provided by Loftus Consulting.

Table 16. Trends in Gulf of Mexico Trips and Harvests

Year:	Red Drum Trips:	Reds Harvested/Trip :	Snook Trips:	Snook Harvested/Trip :
1982	1,756,690	1.43	133,957	0.04
1983	3,121,894	1.24	179,568	0.03
1984	2,629,398	1.09	158,792	0.21
1985	2,109,603	0.94	92,807	0.06
1986	2,519,744	0.96	224,162	0.05
1987	2,068,807	0.85	57,261	0.49
1988	1,170,916	0.77	295,903	0.11
1989	2,292,576	0.58	417,085	0.03
1990	1,835,229	0.44	184,084	0.06
1991	2,962,393	0.41	718,523	0.04
1992	3,485,479	0.64	942,162	0.03
1993	3,511,795	0.63	797,162	0.03
1994	3,470,940	0.49	757,649	0.07
1995	4,051,196	0.71	840,017	0.05

1996	3,725,091	0.67	908,434	0.07
1997	4,094,260	0.56	1,161,813	0.06
1998	3,485,233	0.53	935,167	0.04
1999	3,191,360	0.67	714,013	0.05
2000	4,466,200	0.73	1,032,578	0.03
2001	4,814,350	0.65	1,108,312	0.03
2002	4,252,717	0.58	1,169,459	0.02
2003	5,480,232	0.49	1,409,284	0.03

Past increases in striped bass fishing activity may not have necessarily resulted solely from changes in government allocations; they may have been influenced by increased angler expectations of catching fish. For example, even though there was a moratorium on fishing for striped bass in Maryland and Delaware from 1985-1990, combined with increased restrictions in other states, the number of recreational fishing trips targeting striped bass increased during that period. The growth in trips after this time may likely be a combination of relaxed restrictions, healthier stocks and socio-economic changes. Angler expectations may have changed in response to increased fish stocks, longer seasons and more liberal rules, etc. Catch-and-release fishing is a factor too, as many anglers do not necessarily have to keep fish as a requirement for taking more trips; people fish for more reasons than just bringing home fish. Relaxation, socializing with family and friends, the challenge, etc., are among the many reasons why people fish (Knopf et al. 1973; Driver and Cooksey 1977; Fedler and Ditton 1994).

Due to the complex methods used to allocate annual harvests, it is not possible to fully estimate the additional pounds of striped bass that would be made available to recreational anglers if reallocation occurred. Instead, a proxy estimate is used. In 2003, commercial anglers landed 7.1 million pounds, an amount equal to 30.9 percent of the recreational harvest. If recreational anglers were permitted to harvest these fish and managed to do so, the total recreational harvest could increase 30.9 percent, as could the overall level of striper fishing and related economic activity, based on the trends seen in Table 15.⁷ Several assumptions are incorporated here:

1. Increases in fish stocks do not necessarily result in linear increases in angling activity. However, with no information available regarding how anglers would respond to increases in fish available for harvest, the assumption that economic impacts will increase linearly with fish populations is made. This assumption is partially supported by Table 15, which shows that angling activity increased in near-linear fashion as striped bass stocks grew in the 1980's and 1990's. To an unknown extent, it is reasonable to assume angler expenditures grew as well. The limitations are explained in more detail in step # 6 in section 4.1. It is unknown how future changes in fish stocks would affect annual angling days and dollars spent by anglers. Using historical data about increases in fish stocks and fishing is regarded as the most reasonable approach.
2. There would be no marginal increases in fishing days or dollars required to harvest the additional pounds. For example, if it took one million angler-days to harvest one million fish, it will require another one million angler-days to take the next one million fish. This assumption may minimize the estimated increase in angling days and dollars. With most

⁷ Stripers Forever, Inc. emphasizes its goal is to create healthier fish stocks, and therefore better catch-and-release fishing and some limited harvests by adjusting overall landings and mortality as necessary.

activities, the cost to harvest or acquire each additional unit is greater than the previous unit, a theory known as “diminishing returns.” More trips would likely be needed to produce an increase in the harvest.

3. Fishermen would increase fishing activity to a level where the additional fish will be taken. Recognizing the severe size and bag limits needed to maintain recreational harvests at current levels, an increase in the recreational allocation might be consumed if size, bag or season limits are adjusted accordingly by state fishery officials. This assumption recognizes the difficulty states might have addressing and developing size, bag and season limits that would allow anglers to harvest additional fish.

Table 17 presents the economic impacts that could result in Massachusetts with a 30.9 percent increase in recreational striper angling.

Please note that the impact of sport fishing economics results from anglers increasing their fishing participation rates, not by increasing the number of fish landed. Unlike commercial fisheries, the harvest or landing of fish is not a primary factor in generating additional economic impacts from recreational fishing. Increases in striper populations present greater catch-and-release opportunities as demonstrated in Table 15, and may be enough to stimulate greater fishing and economic impacts without a concurrent increase in recreational allocations. The calculations presented in this chapter are only intended to help demonstrate the greater economic returns from recreational catches compared to the commercial harvest of striped bass.

Table 17. Potential Recreational Impacts in Massachusetts if Stripers Were Fully Allocated to the Recreational Sector

<u>Current 2003 Scenario:</u>	Commercial	Recreational	Total
Pounds Harvested	1,055,496	4,889,036	5,944,532
Retail Sales	\$6,156,450	649,742,549	655,898,999
Total Multiplier Effect	\$24,242,457	1,158,014,659	1,182,257,116
Jobs	524	10,986	11,510
<u>If Stripers Fully Allocated to Recreation:</u>			
Pounds Harvested	0	5,944,532	5,944,532
Retail Sales	\$0	\$850,512,997	\$850,512,997
Total Multiplier Effect	\$0	\$1,515,841,189	\$1,515,841,189
Jobs	0	14,381	14,381
<u>Net Increase in Impacts:</u>			
Pounds Harvested	-1,055,496	1,055,496	0
Retail Sales	-\$6,156,450	\$200,770,448	\$194,613,998
Total Multiplier Effect	-\$24,242,457	\$357,826,530	\$333,584,073
Jobs	-524	3,395	2,871

The two approaches, differing slightly, produce the same basic result: if all striped bass harvests had been made by recreational anglers only, the Massachusetts economy would have been increased by approximately \$334 million and have supported nearly 2,900 additional jobs. The goal of Stripers Forever is to eliminate all commercial fishing for wild striped bass and to set aside as much of the commercial quota as necessary to reduce overall mortality, increase the health of striped bass stocks, and improve recreational fishing. The arguments presented here state that the economic returns from striped bass stocks can be maximized through recreational angling, even when overall mortality is reduced.

Potential Striper Management Revenue:

To help offset the revenues lost from lower sales of commercial licenses, and to boost striped bass management activities, a stamp could be required for recreational anglers who wish to keep any stripers to eat. Considering the estimated number of striped bass anglers in Massachusetts, and three proposed price points for a striped bass stamp, the potential revenues that could be earned for striper management are presented below. (Please note that this table assumes all striped bass anglers would purchase a stamp, and does not exclude seniors or youth who might be exempted from purchasing a striped bass stamp).

Massachusetts Striped Bass Anglers:	548,691
Potential Revenues from a Massachusetts Striper Stamp:	
	\$2,743,45
@ \$5 annually:	5
	\$5,486,91
@ \$10 annually:	0
	\$8,230,36
@ \$15 annually:	5

5.0 Economic Value

Rather than rely solely on economic impacts, managers have to understand the value of a fishery to optimize allocation among competing interests. There are several reasons why economic impacts alone cannot be used to make the best choice when allocating scarce resources, including the degree to which anglers and fish consumers can substitute striped bass for other species, and the net benefits received by each via substitute species. Realizing this, Kirkley et al. (2000) sought to understand the economic value associated with the Virginia striped bass fishery. The following discussion is a synopsis of that report and the shortcomings of exclusively relying on economic impacts when allocating resources.

The work of Edwards (1990) and that of Kirkley et al. (2000), outline several shortcomings of economic impact analysis as the primary method for allocation decisions. One reason is economic impact analysis does not assess changes in net economic value (the changes in the personal, or intrinsic, values held or received by individuals from a fishery). Also, relying on economic impacts alone does not provide sufficient information about producer surplus. Producer surplus is defined as the difference between what producers actually receive when selling a product and the amount they would be willing to accept for a unit of the goods for sale (Bade and Parkin 2003). For a seafood processor, producer surplus would be equal to the value of the price of a pound of fish minus the opportunity cost, or the productivity of the resources in their next most productive application. Consumer surplus is the value of a good or service beyond what the customer actually paid. In the case of recreational fishing, consumer surplus is a dollar measure of the benefit an angler receives from the enjoyment of going fishing. For example, an angler may pay \$500 for a day of fishing, but would have been willing to pay \$750 for the same trip. The consumer surplus for the trip would be \$250.

Rather than simply presenting an economic impact analysis of different allocation scenarios, Kirkley et al. (2000) also use benefit-cost analysis or economic valuation to estimate net economic value of various allocation scenarios. The scenarios used in the analysis were the status quo (approximately 54 percent to the commercial sector, based on 1998 harvest), zero percent to the commercial sector (i.e., 100 percent to the recreation sector), 25 percent, 50 percent, 75 percent, and 100 percent.

Estimates of consumer surplus for all commercial sectors (harvesting, processing, distributing, food service, and retail) were derived from survey data. Consumer surplus was estimated for the recreational sector via a trip demand model for angling trips based upon surveys of striped bass anglers. Producer surplus was estimated for the commercial sector using survey data; it was not included for the recreational sector due to lack of data availability. The analysis focused on the estimates that likely overstated the value of the commercial fishery and underestimated the value of the recreational fishery. This method provided the most defensible results.

When examining the economic impacts of the various management scenarios, the allocation of 100 percent to the recreational sector produced the greatest economic impacts. Under the status quo (i.e., their estimate of economic impacts under the current system), the commercial and recreational sectors produce approximately \$166 million in total output, \$95 million in income,

and 3,427 jobs. Even if the allocation were shifted entirely to the recreational sector, the total output grows to approximately \$181 million, with \$101 million in income generated, and 3,738 jobs. Under no other allocation scenario would the impacts be as great. When catch-and-release trips were excluded, the same pattern emerges. The 100 percent allocation to the recreational sector produces the greatest economic impact among all of the scenarios (Table 18).

The net economic value of the commercial and recreational striped bass fisheries are presented in Table 19. Again, the results show that a 100 percent allocation to the recreational sector would produce the greatest value to the people of Virginia. Under the current management scenario, Kirkley et al. (2000) report that the 3,436,615 pounds of striped bass harvested in 1998 were valued at approximately \$24 million (with catch-and-release trips included). If the entire catch was allocated to the recreational sector, the value would increase to \$27 million.

Although both the analyses of the economic impacts and the net economic value indicated that a 100 percent allocation to the recreational sector would produce the greatest economic and societal benefit from the striped bass fishery, the authors outline several shortcomings of their work. First, they were not able to quantify the social impacts of a closure to the commercial striped bass fishery. These impacts have been examined in other areas (e.g., Florida) when certain commercial fisheries were closed (Thunberg et al. 1994; Smith 1995). While not readily quantifiable for inclusion into mathematical and statistical models, these impacts should not be overlooked in allocation decisions. Second, the authors did not examine the costs of purchasing tags from commercial fishers who hold them under the individual transferable tag program that Virginia had for regulating the commercial fishery. Also, the authors assumed that anglers would still fish for striped bass if the recreational striped bass fishery was closed to harvest (i.e., catch and release only) in the same proportion of trips in which all of their fish are released.. While this may be a valid assumption, closures of harvest to recreational fisheries elsewhere have met with significant opposition from recreational anglers (Matlock et al. 1988; Ditton and Fedler 1989).

The authors also understood the importance of their estimates of commercial and recreational expenses, and the associated models they produced to estimate economic impact and net economic value. Using Monte Carlo analysis, a widely accepted statistical technique to determine precision of model parameters (Metropolis and Ulam 1949; Mooney 1997), the authors concluded that there was a 0.03 percent chance that the commercial fishery would generate higher consumer surplus than the recreation fishery. For the commercial fishery to produce a greater economic impact and net economic value, the price of a pound of striped bass would have to exceed \$29, a highly unlikely scenario given the availability of other wild and aquaculture fish. The authors also recognize that the data on which their results were based may have been anomalous. Given the highly restrictive striped bass fishery in the late 1980s and early 1990s, the commercial demand for striped bass had declined and, as the authors state, it is difficult to restore lost markets for fishery products. In addition, the data for the recreational sector may be inflated due to “pent-up demand” for recreational striped bass fishing. In order to test the validity of the results, the authors subjected their estimates to an analysis of how “wrong” they

Table 18. Economic Impacts of 1998 Commercial and Recreational Striped Bass Fisheries and Alternative Resource Allocations in Virginia (Source: Kirkley et al. 2000)

Allocation		Sales—Total Output 2000 Dollars			Total Income 2000 Dollars			Total Employment Full-Time Equivalent		
<u>Commercial</u>	<u>Recreational</u>	<u>Commercial</u>	<u>Recreational</u>	<u>Total</u>	<u>Commercial</u>	<u>Recreational</u>	<u>Total</u>	<u>Commercial</u>	<u>Recreational</u>	<u>Total</u>
Includes All Angler Trips: Harvest and Catch-and-Release Trips:										
Status Quo	Status Quo	13,638,527	152,006,719	165,645,246	10,039,134	85,176,392	95,216,066	295	3,132	3,427
100%	0%	23,939,202	67,886,898	91,826,100	17,592,173	38,055,991	55,648,164	517	1,398	1,915
75%	25%	18,470,940	138,481,523	156,952,463	13,580,307	77,591,265	91,171,572	399	2,854	3,253
50%	50%	12,699,009	155,395,297	168,094,306	9,350,222	87,061,590	96,411,812	275	3,203	3,478
25%	75%	6,624,277	167,004,479	173,628,756	4,895,831	93,515,118	98,410,949	144	3,445	3,589
0%	100%	0	181,071,669	181,071,669	0	101,337,066	101,337,066	0	3,738	3,738
Excludes Catch-and-Release Trips: Harvest or Retention Only:										
Status Quo	Status Quo	13,638,527	84,119,821	97,758,348	10,039,134	47,120,941	57,160,075	295	1,734	2,029
100%	0%	23,939,202	0	23,939,202	17,592,173	0	17,592,173	517	0	517
75%	25%	18,470,940	70,594,625	89,065,565	13,580,307	39,535,274	53,115,581	399	1,456	1,855
50%	50%	12,699,009	87,508,399	100,207,408	9,350,222	49,005,599	58,355,821	275	1,805	2,080
25%	75%	6,624,277	99,117,581	105,741,858	4,895,831	55,459,127	60,354,958	144	2,047	2,191
0%	100%	0	113,184,770	113,184,770	0	63,281,075	63,281,075	0	2,340	2,340

Table 19. Net Economic Values of Commercial and Recreational Striped Bass Fisheries in Virginia, 1998 Reference Year^a
 (Source: Kirkley et al. 2000)

Allocation				Economic Value			Consumers' and Producers' Surplus	
Commercial		Recreational		Commercial	Recreational ^b	Recreational ^c	Total ^b	Total ^c
Percent	Pounds	Percent	Pounds	Year 2000 Dollars			Year 2000 Dollars	
Status Quo	1,855,055	Status Quo	1,581,560	\$2,533,988	\$21,615,794	\$12,085,143	\$24,149,782	\$14,619,131
100%	3,436,615	0%	0	5,626,841	9,530,651	0	15,157,492	5,626,841
75%	2,577,461	25%	859,154	3,847,994	19,824,693	10,294,041	23,672,687	14,142,035
50%	1,718,308	50%	1,718,308	2,318,496	22,316,503	12,785,852	24,634,999	15,104,348
25%	859,154	75%	2,577,461	1,041,691	24,711,242	15,180,591	25,752,933	16,222,282
0.0%	0	100%	3,436,615	0	27,619,605	18,088,954	27,619,605	18,088,954

^a Net Economic value equals sum of consumer and producer surpluses. Allocations assessed relative to observed harvests in 1998. Economic values are presented in terms of 2000 dollars. Assessment based on 49.4 percent consumption away-from-home, 50.6 percent consumption at-home, and producers' surplus for the commercial sector estimated from survey data. The economic values for the recreational sector does not include producers' surplus for commercial-recreational activities.

^b Consumers' surplus with catch-and-release trips included.

^c Consumers' surplus with catch-and-release trips excluded.

would have to be to produce different results. Only when their estimates were off by 40 percent did their results change to show that a 100 percent allocation to the recreational sector was erroneous (i.e., they would have underestimated the economic value of the commercial sector by 40 percent and overestimated the value of the recreational fishery by 40 percent). Again, this is an unlikely scenario.

Although the aforementioned study concentrated on striped bass fishing in Virginia, some interesting comparisons can be made for Massachusetts and the entire Atlantic coast striped bass fishery. In 1998 (the year of the study), commercial fishers harvested 1,855,055 lbs. of striped bass in Virginia, which is about 28 percent of the entire commercial harvest for the Atlantic coast (6,713,764 lbs. of striped bass were harvested in the Atlantic in 1998). Likewise, recreational anglers caught 1,581,560 lbs. of striped bass in Virginia in 1998, which represents 12 percent of the entire catch of striped bass on the Atlantic coast (12,918,833 lbs). If we assume that the net economic values of the commercial and recreational fisheries in Virginia are representative of the total economic value of the fishery for the entire Atlantic coast, we can estimate the economic value of the fishery to the Atlantic coast. For example, since the pounds of fish harvested by commercial fishers represents 28 percent of the entire harvest for the Atlantic coast, the economic value of the Virginia commercial fishery (\$2,533,988, Table 16) is 28 percent of a total economic value of \$9,049,957 for the entire Atlantic coast (under the status quo). Under a 100 percent allocation scenario to the commercial fishery, the \$5,626,841 in economic value would represent 28 percent of \$20,095,861 of total economic value to the Atlantic coast. Using the same reasoning for the recreational fishery produces \$180,131,617 of total economic value under the status quo for the entire Atlantic coast, and \$230,163,375 in economic value for a 100 percent allocation to the recreational sector.

Based on these rough estimates of the total economic value of the striped bass fishery to the Atlantic coast, it is apparent that the 100 percent allocation to the recreational fishery produces the greatest societal benefit among the management scenarios. However, without a detailed analysis of economic value, which was beyond the scope of this study, interpretation of the results should be cautious. Nevertheless, based on these best available data, a 100 percent allocation to the recreational sector would produce nearly 11.5 times as much value compared to a complete allocation to the commercial sector, and about 1.3 times as much value compared to the status quo (or approximately \$50 million). Anglers in Massachusetts place a high value on striped bass. With 64 percent of marine recreational fishing trips in Massachusetts targeting striped bass, compared to 20 percent in Virginia and 31 percent of all marine recreational fishing trips from Maine to North Carolina, it is certainly reasonable to expect that any economic valuation procedures applied in Massachusetts will show that maximum value is derived from recreational fisheries.

6.0. Substitute Sources for Wild Striped Bass for the Commercial Market

Substitute sources for wild striped bass for public consumption already exist. In 2003, aquaculture nationally produced 11.447 million pounds of striped bass, which is 61.6 percent greater than the 7.085 million pounds of wild fish harvested along the Atlantic coast in the same year by the commercial sector (personal communications, Striped Bass Growers Association, 2004; Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division). These fish currently enter the commercial market at the distribution level, i.e.: the Fulton Fish Market and other similar points. By using existing distribution and sales channels, striped bass raised through aquaculture provide product and income opportunity to many of the same businesses now handling wild striped bass.

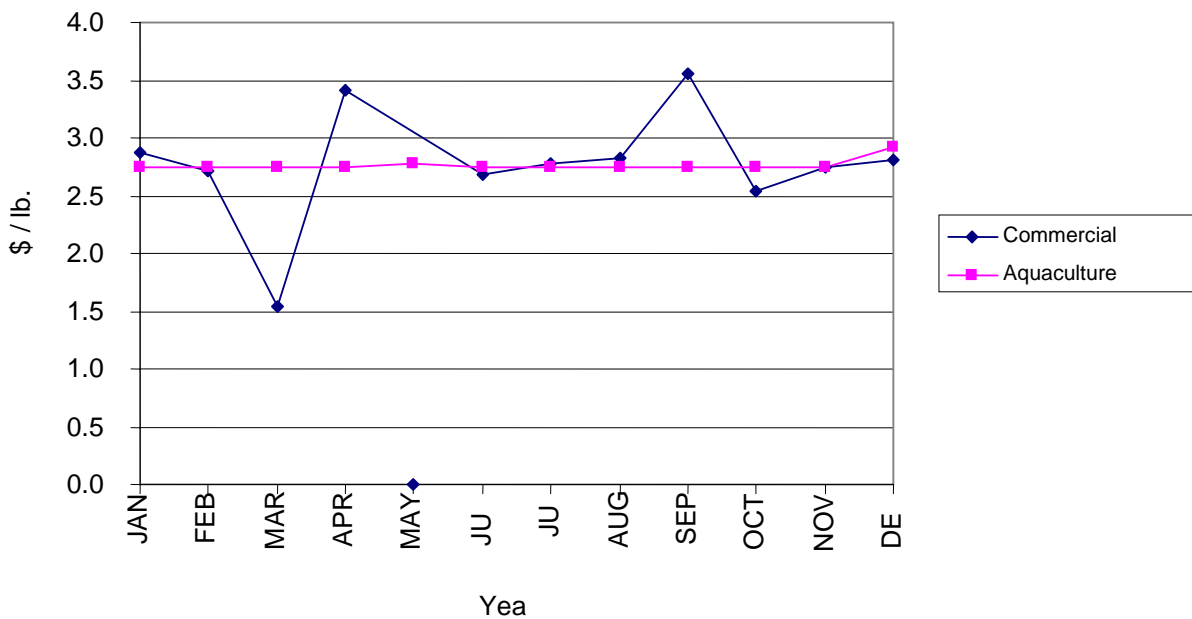
Farm production of striped bass (aquaculture) has been growing rapidly over the past decade. Table 20 shows the increase in production and capacity. Aquaculture operations are able to control when fish are harvested and enter the market, thus providing a reliable year-round source of fresh fish. Queried as part of this project, leading aquaculture producers reported the ability to continue increasing capacity further as demand increases (Personal communications, Striped Bass Growers Association, 2004). Currently, producers report that their sales drop in the major months for wild fish harvests, but sales are strong for the remaining months.

Table 20. Yearly U.S. Production of Aquaculture Produced Striped Bass by Method of Production (lbs)

Year	Tanks	Ponds	Cages	Total	Increase Over 1987 Levels
1987	395,000	10,000	0	406,987	-
1988	800,000	80,000	0	881,988	116.7%
1989	870,000	150,000	0	1,021,989	151.1%
1990	1,220,000	370,000	0	1,591,990	291.2%
1991	1,520,000	730,000	0	2,251,991	453.3%
1992	1,520,000	730,000	0	2,251,992	453.3%
1993	2,600,000	950,000	0	3,551,993	772.8%
1994	4,350,000	1,525,000	75,000	5,951,994	1,362.5%
1995	5,175,000	2,325,000	125,000	7,626,995	1,774.0%
1996	3,870,000	3,730,000	250,000	7,851,996	1,829.3%
1997	4,722,000	3,615,000	100,000	8,438,997	1,973.5%
1998	4,260,000	5,075,000	50,000	9,386,998	2,206.5%
1999	4,378,000	5,317,750	38,000	9,735,749	2,292.2%
2000	4,364,000	6,822,000	51,000	11,239,000	2,661.5%
2001	4,383,000	6,500,000	20,000	10,905,001	2,579.4%
2002	4,479,000	5,988,000	22,500	10,491,502	2,477.8%
2003	4,848,000	6,509,000	90,000	11,447,003	2,713.1%

Prices for striped bass raised through aquaculture and wild fish are comparable. Farmed fish enter the market at a major distribution level. As of 2003, prices for farmed striped bass (reported as hybrid striped bass) have been stable at approximately \$2.78 per pound at New York’s Fulton Fish Market. Wild striped bass prices tend to experience greater price fluctuations during the year depending on the volume landed (Figure 1). It should be noted that for the month of May, the price of \$0 indicates that no wild fish were available. The average price in 2003 for wild fish was \$2.75 per pound, which reflects the amount received by commercial fishermen (\$1.80 in 2003) plus the mark-up to the buyers who bring the fish to New York’s Fulton Fish Market. When averaged by year, the prices for wild and aquaculture fish going into the next levels of the seafood industry are basically the same (Figure 2). Fish raised through aquaculture offer advantages by providing restaurants and retailers with steady and reliable supplies. The end result for the consumer is a consistently priced and available product with consistent quality.

Figure 1. 2003 Prices for Commercially Caught Striped Bass and Striped Bass Produced Through Aquaculture by Month^{8,9}

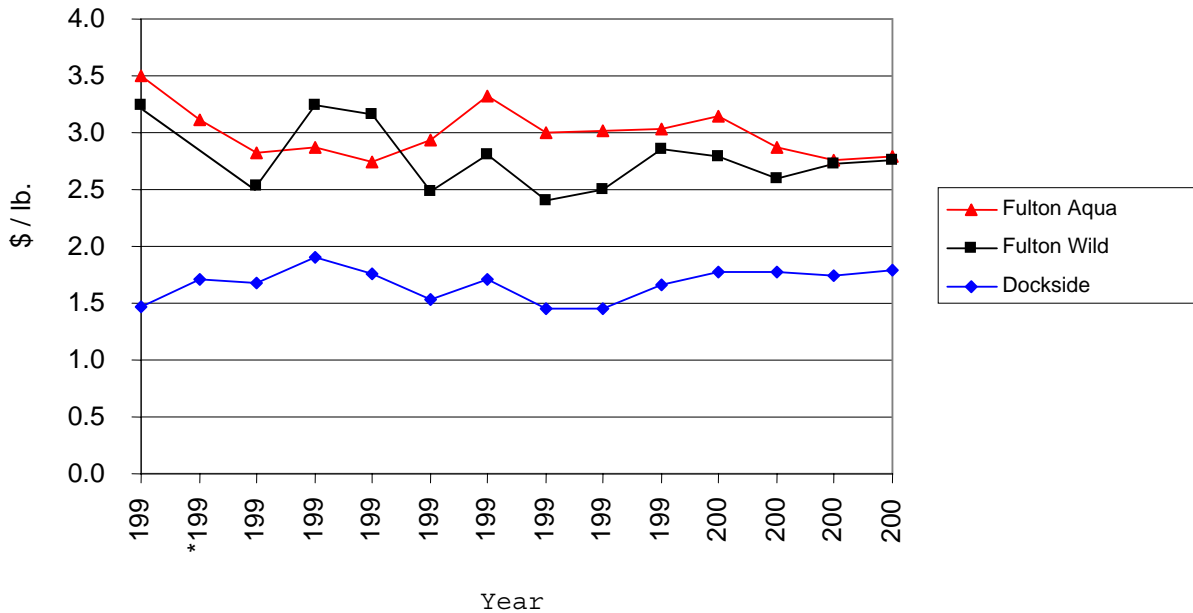


Source: NOAA Fisheries; Fulton’s Fish Market.

⁸ The \$0 value for striped bass sales in May was recorded at the Fulton Fish Market. Sales may have been transacted in other markets, and wild striper harvests or demand may slacken in May. Aquaculture data indicates relatively stable demand and availability for striped bass in May.

⁹ Fish sold at Fulton and any other major fish market come from many states. No attempt is made, or is possible, to separate Massachusetts fish from fish harvested elsewhere.

Figure 2. Average Price for Striped Bass Produced Through Aquaculture, Commercially Caught Striped Bass, and the Dockside Value of Commercially Caught Striped Bass by Year



* No data were available for commercially caught fish in 1991
 Source: NOAA Fisheries; Fulton’s Fish Market

Estimated Economic Impacts of Striped Bass Aquaculture

Per the Fulton Fish Market, in 2003, striped bass farms shipped \$31.8 million in hybrid bass raised through aquaculture. Using economic multipliers produced by the U.S. Department of Commerce, Bureau of Economic Analysis¹⁰, a better understanding is gained of the national economic impact created by U.S. striped bass farmers. Table 21 presents the impacts created from the production of whole, raw fish (no processing or distribution effects are added, except those conducted directly on fish farms):

Table 21: U.S Economic Impacts of Striped Bass Aquaculture Production

2003 Industry Sales	Total Multiplier Effect (output)	Salaries and Wages	Jobs
\$31,828,220	\$121,049,086	\$85,702,753	2,348

¹⁰ Regional Input-Output Multipliers System (RIMS-II). Impacts reflect striped bass producers across the U.S., with impacts accruing to the U.S. as a whole.

Once these fish enter the seafood processing and distribution chain, their impacts are expected to grow similarly to wild striped bass as the final product makes its way to restaurant or home consumers. Starting with the major fish auctions and distributors, many of the same businesses that currently handle (or could handle) farmed striped bass already work with wild striped bass. It is expected that any economic dislocation to these sectors will be minimal by substituting farm-raised fish for wild fish. Changes will occur in the production sector, with lost impacts from the wild harvest sector (i.e. commercial fishermen) offset by gains in the aquaculture sector. The estimated U.S.-wide losses and gains are presented in Table 22. Please note that given current data, it is not possible to separate the effects of aquaculture substitutes for Massachusetts alone. A coast-wide analysis provides a better estimation as the effects of trade policies in one state upon another need not be considered.

Table 22: Comparing the Economic Impacts of Obtaining Striped Bass for Human Consumption from Aquaculture Sources versus Wild Sources, 2003

	Dockside Value	Total Multiplier Effect	Salaries and Wages	Jobs
Aquaculture (farm activities only, does not include processing, wholesale, retail, restaurants, etc.)	\$12,741,553	\$48,458,674.3 7	\$9,021,019.52	349
Commercial Fisheries (wild harvest only, does not include processing, wholesale, retail, restaurants, etc.)	\$12,741,553	\$34,288,983.9 6	\$11,674,958.1 5	342
Difference:		41.3%	-22.7%	1.9%

The impacts in Table 22 are based on the economic multipliers for aquaculture presented previously (Section 3.2 Commercial Harvests). The economic impact estimates for the commercial sector were derived from a 1997 Virginia Institute of Marine Science (VIMS) study (Kirkley 1997) that reported economic impacts for moderate to high-value finfish fisheries, including striped bass. Using the same methods employed in Section 3.2, the commercial fishery multipliers were adjusted to better reflect national impacts because the data from the VIMS study only reported impacts at the state level.

Recognizing the different sources of the multipliers used for aquaculture and for the commercial fishery as per Table 22, and the adjustments made to the commercial multipliers to equate them in the best possible way to national level impacts, the economic estimates above cannot be considered scientific. Comparing the two directly is basically an “apples and oranges” comparison. Instead, Table 22 approximates the economic impacts created by each source of raw product. The table is intended to express the point that a shift in striped bass production from wild harvests to aquaculture will result in minimal net economic losses for the U.S. economy. While local disruptions will occur, as they do whenever an industry experiences shifts in manufacturing sources, the overall effects on the U.S. economy are limited.

Capacity

U.S. striped bass production on farms already exceeds wild production, 11.447 million pounds versus 7.085 million pounds in 2003. Annual aquaculture production would need to increase 38 percent to fully accommodate the additional 7.085 million pounds of wild striped bass harvested in 2003. In the past three years alone, the annual production of striped bass by fish farms has increased 21.9 percent, and over the past 10 years it has grown by 222 percent. So the capacity to expand production is in place.

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Appendix I

Estimated Number of Striped Bass Anglers Per State

To assist in discussions about marine striped bass angling, estimates were developed regarding the number of striped bass anglers per state. The results are presented below. These numbers were estimated by assuming the percentage of marine fishing trips made for striped bass is approximate to the percentage of anglers who fished for striped bass. There are certainly errors in this assumption, but better data were not located. Only the overall number of anglers, regardless of species caught or pursued, is reported per state by NOAA Fisheries. By applying the percentage of trips targeting striped bass (as reported in Table 1) to the total number of anglers reported by NOAA Fisheries (personal communications, NOAA Fisheries Statistics and Economics Division), rough approximations can be made. Recognizing that many people will fish in more than one state each year, summing the number of anglers per state will likely overestimate the total number of striped bass anglers, so the number of striped bass anglers for other states had to be included as well. The available source of necessary information was from the membership list of Strippers Forever. This list indicates that eight percent of the organization's members reside in states not listed below. Eight percent is then used as a proxy estimate for striped bass anglers in other states. Note that the results below indicate Massachusetts has the highest number of striped bass anglers.

	% of Marine Fishing Trips Targeting Striped Bass (from Table 1)	Number of Marine Anglers	Estimated Number of Striped Bass Anglers
Connecticut	44.90%	472,750	212,265
Delaware	21.30%	326,105	69,460
Maine	70.90%	358,103	253,895
Maryland	39.10%	997,421	389,992
Massachusetts	64.40%	852,004	548,691
New Hampshire	59.00%	182,419	107,627
New Jersey	25.50%	1,074,006	273,872
New York	24.80%	699,844	173,561
North Carolina	21.20%	2,102,925	445,820
Rhode Island	44.00%	400,374	176,164
Virginia	19.80%	724,398	143,431
Subtotal:			2,794,778
Other states		8%	223,582

TOTAL:

3,018,361

Appendix II: Commercial Fishery Multipliers

	Landings Value	Output/Total Economic Activity	Income	Jobs (FTE)
Reported by Kirkley et al (2000)	\$2,558,869	\$13,638,527	\$10,039,134	295
Resulting Multiplier (Impact divided by Landings Value:)		5.329904344	3.923270007	0.000115
1. (see below) Adjustment to account for 60% of fish processed out of state (divided by .4):		13.32476086	9.808175018	0.00028821
2. (see below) Adjustment made to account for national level multipliers:		19.6270877	14.79743918	0.00039426

The multipliers used in this report were derived from Kirkley, et al (2000). The bases of the multipliers were the 1998 landings value for striped bass divided into the total output, income and jobs figures produced in this report. Several key adjustments were made to adapt the results to this study, and care was made to ensure all adaptations were done in the favor of commercial interests:

1. The multipliers provided in the report are based on the economic impacts created by commercial striped bass landed in Virginia. The report states that 60 percent of stripers caught by Virginia watermen are either sold or processed in other states. We do not know the percentage of the reported \$2.6 million in landings sold in Virginia, then processed outside of the state. If these fish remained in Virginia, then the effect on the state economy would have been proportionally larger, and the multipliers would likewise have been higher. Recognizing the Virginia multipliers were to be used to estimate the typical economic impacts from commercial landings in the other Atlantic coast states, we have to make the assumption that all stripers are processed and distributed in the state where landed. Given the lack of information on the import and/or export of striped bass products between states, this assumption will either inflate or underestimate the impacts in the states involved. To adjust the Virginia multipliers to account for this issue, the multipliers were divided by 40% which then inflates the multipliers to account for all fish being processed in-state. Please note this should be considered the maximum increase possible. This error inflates the actual economic activity attributable to striped bass economics for Virginia, and has a varying effect on the other states. The economic impact in states that process and consume lower proportions of their striped bass landings will be overstated, while states that process a higher-than-average percentage will have their economic impacts understated.
2. The multipliers derived from Kirkley et al (2000) only reported the economic effects at the state level. However, some of the processing, distribution and final sale of striped bass occur outside of the state, and many of the in-state companies handling striped bass buy supplies and services from out-of-state businesses. These additional economic impacts are intentionally left out of any state-level economic study because they also report economic activity in other states. To adapt the Virginia multipliers for use in estimating impacts at the U.S. level, they were inflated by percentages seen in other studies that examined impacts at the state and national levels. The U.S. level multipliers used to report overall economic activity (output) created by striper landings were **increased** 47%, the jobs multiplier upped 37%, and the income multiplier adjusted upward by 51%.