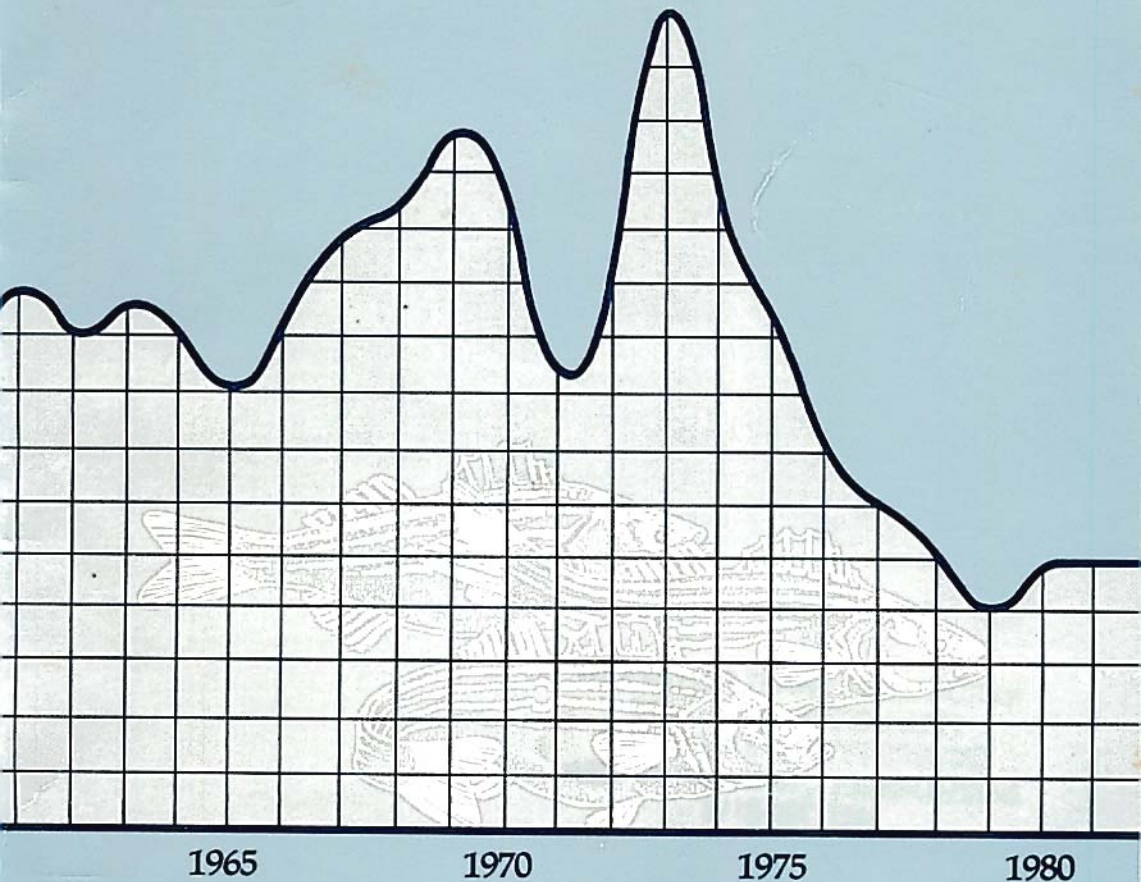


MDU-T-84-001

Stripers

The Economic Value Of the Atlantic Coast Commercial and Recreational Striped Bass Fisheries

Edited by
Virgil Norton, Terry Smith and Ivar Strand



\$trippers

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Preface

DECLINING STOCKS OF North Atlantic striped bass prompted legislators and management agencies to seek information concerning the economic importance of striped bass. One of the questions legislators and managers need answered is whether the resource has sufficient economic importance to warrant government expenditures on research, regulation of harvest, or augmentation of stocks through hatchery programs.

In generating the information necessary to address this issue, over 1500 industry participants were interviewed concerning their activities associated with striped bass. Existing commercial and recreational data were also obtained. As with most studies, data perfectly suited to our needs did not always exist and collection of such data would have required expenditures well beyond available funds. In these cases, the best available or affordable information was used.

This report is also a culmination and digest of individual studies at the participating universities. The material presented herein is only a portion of the information generated during the study. Those interested in economic information on subjects not dealt with in this document should contact individual contributors from the region of interest. The reader should recognize that this report is basically a snapshot of the industry as it existed during 1979 through 1980. Changes have occurred in the industry since 1980, especially in response to changes in legislation. Because of the time needed for data gathering, analysis and publication, implications of some recent changes are not incorporated into this report.

The contents of this report, however, should contribute some of the

information needed by policy makers. Descriptions of the commercial and recreational harvesting sectors by regions are presented first. Highlighted are the economic characteristics of these users along with other information of general interest. Following these descriptions are analyses emphasizing the economic value and activity generated by striped bass fishermen. The economic value section addresses the dollar value of the benefits arising from the recreational and commercial uses of stripers. Economic activity analysis estimates how much economic activity striped bass fishing creates, in terms of dollar volume of goods and services as well as employment. The analysis is based on three scenarios: activity associated with the current level of landings, activity implied by the high level of landings in the early 1970s, and activity under proposed management regulations. The information presented should help provide an understanding of the industry and some background for the discussion involved in the management process.

Acknowledgements

SEVEN INVESTIGATORS FROM four Sea Grant universities participated in the economic analyses required for the assessment. This report contains the findings of these analyses. Many individuals assisted the investigators during the study.

Field interviews to obtain primary data were conducted by Laurie Bates in New England; Jim Sieber and Ben Muse in New York and New Jersey; Jim Adriance, Rod Brennan and Brett Snyder in New Jersey, Delaware, Maryland and Virginia; and Mike Principe, Marcus Hepburn and other interviewers working on an allied study, "Recreational Fishing in the Sounds of North Carolina," in North Carolina, headed by Peter Fricke.

The efforts of all of the federal and state officials who provided data are appreciated. We also thank the many recreational and commercial fishermen; fish wholesalers, retailers and suppliers; and the restaurant, club and hotel operators who took time to answer questions related to their operations.

Support for the study was provided by the Sea Grant Programs and Agricultural Experiment Stations of each university; the U.S. Department of Commerce, National Sea Grant program and National Marine Fisheries Service (NMFS); and the U.S. Department of Interior, Fish and Wildlife Service.

This report represents scientific Article No. A-3691, Contribution No. 6667, of the Maryland Agricultural Experiment Station and Scientific Contribution No. 1030, Storrs (Connecticut) Agricultural Experiment Station. Computer support was also provided by the University of Maryland Computer Center.

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Ivar Strand

Introduction

AMERICANS HAVE BEEN catching and eating and arguing about striped bass for centuries, but seldom in our history has this popular fish caused as many controversies as it has during this last decade.

The cause of those controversies is scarcity. Commercial catches have been declining dramatically since 1974 when 14.7 million pounds of striped bass were reported caught and sold by commercial fishermen working rivers, estuaries and coastal waters from North Carolina to Maine. By 1980 the commercial catch for these same states totaled less than 5 million pounds. Similar catch declines—though less easily documented—were reported by sport fishermen.

We now have an estimate of the cost of that decline—at least, the cost in dollars and cents and jobs. Resource economists Virgil Norton, Ivar Strand and Terry Smith organized a three-year, 10-state study of the economic impact and value of the commercial and recreational striped bass fishery along the northeast Atlantic Coast. With their report, we have our best estimates to date of the economic structure and potential of the fishery that once flourished and of the fishery that still exists today—though in diminished form.

The seven participating economists found that:

- The decline in commercial and recreational catches since 1974 has cost the region 7,500 lost jobs and \$220 million in lost economic activity.
- Though much is lost, much remains. In 1980, the current commercial and recreational fishery was supporting 5,600 jobs, causing \$90 million in

annual spending and creating \$200 million in related economic activity in the coastal areas of the states.

- The economic impact of commercial and recreational fishing extends beyond the coastal counties of these 10 states. For every six dollars generated in coastal areas because of striped bass fishing, another one dollar's worth of output is created in inland counties. Similarly, for every five coastal jobs created, one inland job is generated.

- For society in general, the net economic value of commercial and recreational striped bass fishing is not the dollars people *actually* spend or make; it's the amount they are *willing* to spend above what they *have* to spend. This net value is estimated to be \$11.5 million annually, the value that federal planners might best use in evaluating the use of federal funds for maintaining or increasing a fishery that is so popular with so many people.

- To increase recruitment of new fish, the Atlantic States Marine Fisheries Commission has recommended that state legislators and fishery agencies impose greater restrictions on current harvesting practices. If those restrictions increase future stocks and harvests as predicted, then economic output in the region could grow by \$3.8 million and 63 new jobs.

- The cost of that improvement comes high in some regions. The size restrictions proposed for striped bass catches in the spawning rivers of the Chesapeake Bay will annually cost Maryland and Virginia \$6 million in lost economic activity and 250 lost jobs, while providing an immediate boost to harvests in the northern states. If the decline in striped bass stocks is not reversed, however, future losses to the Chesapeake could be even greater.

The study that produced these findings began with federal legislation known as the Chafee Bill or Emergency Striped Bass Act, an effort to encourage and coordinate striped bass research. Funds for the project originated with the National Marine Fisheries Services of the U.S. Department of Commerce and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior. Staff for the multi-state project included economists from the University of Maryland, the University of Connecticut, Cornell University and North Carolina State University. The Sea Grant Programs and Agricultural Experiment Stations of these universities provided additional support.

The study is designed to help resource managers, state legislators, and even the U.S. Congress—all of whom are pressed by pleas to restore a fishery that apparently carries considerable emotional and economic value in the 10-state north coastal region. This report includes economic

information on the structure and potential of the striped bass fishery, information that can be applied to the difficult social and political questions raised by the striped bass decline. Some of the major questions are:

- Is there sufficient economic impact to justify government expenditures on research, regulation of harvest and possibly replenishment of stocks through hatchery programs?
- How much public money should be spent maintaining the fishery?
- What would be the economic loss caused by additional catch restrictions?
- Should management efforts focus on the commercial fishery or the recreational fishery?

That last question remains one of the most difficult. Because striped bass is such a popular gamefish, charterboat captains, surfcasters, and a variety of rod and reel clubs have lobbied strenuously and successfully for anti-netting laws that have nearly eliminated commercial fishing in many states and severely restricted it in others. In Maryland and New York, regulations are expected to cut commercial catches significantly over the next several years. The state of Rhode Island, after a decade of debate, has proposed a complete ban on the catching, buying and selling of striped bass by both commercial and sports fishermen.

The issues are complex, the decisions difficult. Whether careful research can isolate the causes of decline, whether hatcheries can replenish the fishery, whether management can conserve the existing stocks, no one can predict. With this report, however, it is clear that restoring the striped bass fishery—a diminished fishery—is still worth considerable effort and expense.

—Michael W. Fincham
Communications Coordinator
Maryland Sea Grant College

\$trippers

The word "\$trippers" is written in a bold, black, serif font. The dollar sign (\$) is positioned at the start of the word, partially overlapping the letter 't'. Below the text, there is a thick, horizontal grey bar that spans the width of the word.

The Commercial Fishery

STRIPED BASS HAS historically been an important commercial species along the Atlantic Coast. It has been harvested in every state from Maine to North Carolina. Although there have been year-to-year fluctuations in annual landings, there was a general increase in commercial landings during the period 1924-1973 (Strand et al. 1980). Atlantic Coast commercial landings reached an all time high of 14.7 million pounds in 1973. Since then there has been a steady and precipitous decline in the catch of commercially harvested striped bass. The 1980 catch, according to NMFS preliminary data, was 4.5 million pounds, and had an estimated value of \$4.9 million.

In order to understand the nature and economic effects of the decline in commercial catch, the distribution of landings, the methods of harvest, and the marketing of striped bass were examined. The distribution of landings offers a general indication as to which states are most directly influenced by striped bass production. Analysis of harvest methods reveals the specific technology adopted because of existing physical conditions or state regulations. Information on costs indicates how much expense each technology requires in the production of striped bass. Finally, information on marketing shows the distribution routes, product forms, and price received for striped bass as it is moved from the waterman to the consumer.

Distribution of Landings

It is convenient to categorize the eastern coastal states in which striped bass harvest occurs according to four regions: New England (Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut), Mid-Atlantic (New York, New Jersey and Delaware), Chesapeake (Maryland and Virginia) and South Atlantic (North Carolina). To a large degree, this regionalization corresponds to different fisheries, each of which is discussed below.

The regions have contributed varying amounts to Atlantic landings since 1929 (Figure 1). The Chesapeake region accounted for about two-thirds of total landings from 1929 to 1973; the New England, Mid-Atlantic and South Atlantic regions contributed 7 percent, 14 percent and 14 percent, respectively. For the period 1974-1980, the Chesapeake's share declined to about 48 percent, while the New England, Mid-Atlantic and South Atlantic shares changed to 20, 19 and 13 percent, respectively. (See Strand et al. 1980 for additional information on the relative catch of striped bass by region and state.)

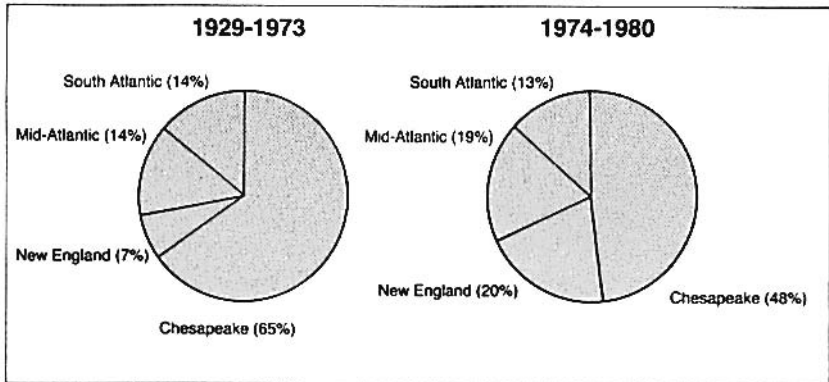


Figure 1. Commercial striped bass landings, by region

Massachusetts is the major striped bass harvesting state in New England, with Rhode Island accounting for most of the other landings (Figure 2). Connecticut has reported a small share in some years (it is now illegal to land commercially caught striped bass in Connecticut), while the Maine and New Hampshire landings have been less than one percent of the New England striped bass harvest.

Among the three states in the Mid-Atlantic, most striped bass are landed in New York. New Jersey has contributed about one-fifth of the harvest, while the Delaware share in recent years has been below one-tenth (Figure 3).

Maryland has accounted for about two-thirds of the commercial land-

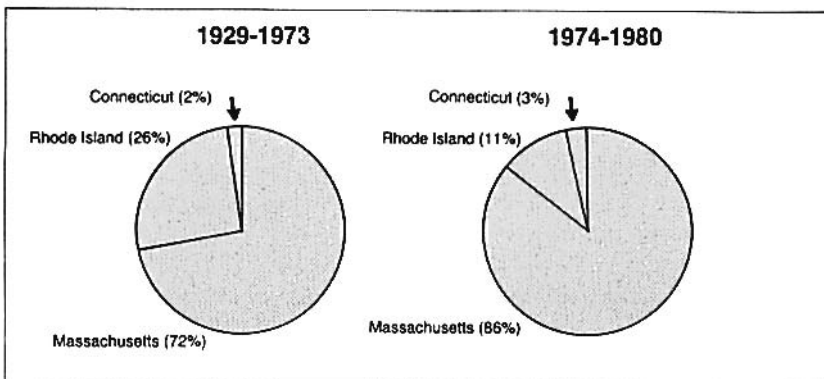


Figure 2. Commercial striped bass landings in New England, by state.

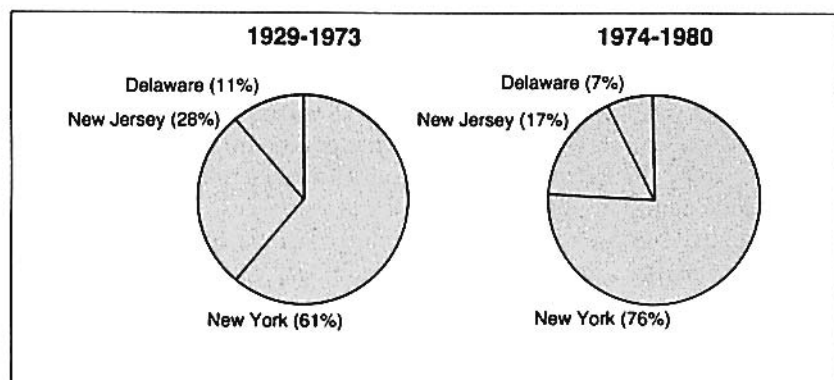


Figure 3. Striped bass landings in the Mid-Atlantic region, by state.

ings of striped bass in the Chesapeake region (Figure 4). Although the relative share of the Chesapeake landings in Maryland and Virginia has not changed greatly, the decline in harvest by fishermen in Maryland and Virginia has been dramatic. In 1973, the commercial catch was 7.9 million pounds. During the past three years, the annual harvest diminished to well below three million pounds.

For several decades prior to the mid-1960s, the annual commercial harvest of striped bass in North Carolina remained relatively stable. In 1966, landings of .66 million pounds were reported. In 1967, the harvest increased to over the million pounds. Landings remained high until 1978 when the annual harvest dropped back to near the 1966 levels.

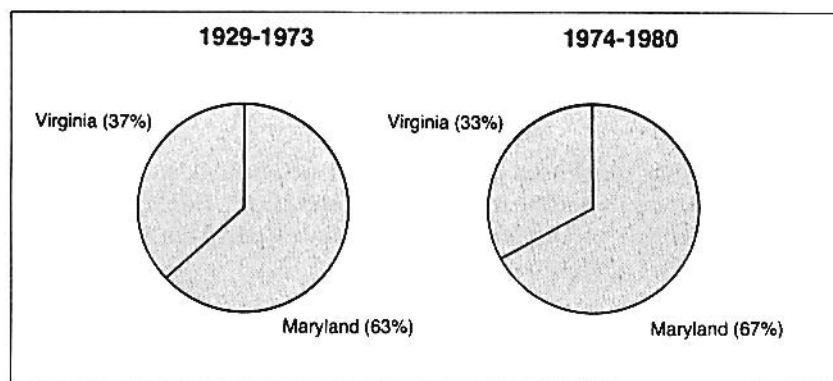


Figure 4. Striped bass landings in Chesapeake Bay, by state.

Seasonality in Landings

According to Berggren and Libbermann (1978), there are three major coastal stocks of striped bass along the U.S. Atlantic Coast. The Chesapeake stock accounts for 80 percent of the coastal migratory population, with migratory stocks from the Hudson and Roanoke rivers accounting for the balance. Since the Chesapeake stock is the largest, the seasonal harvesting pattern in each region is determined primarily by the migratory pattern of this stock. Young, sexually mature fish, predominately females three to four years of age, and a portion of the older population, migrate out of the Chesapeake Bay in April and May and move northward along the coast (Kohlenstein 1980). Some of these fish appear as far north as Cape Cod by early summer and remain off the coast of Massachusetts and Rhode Island until fall. A reverse migration begins in October along the northern part of their range. These fish return to the Chesapeake Bay in November and December. This migration is repeated each year and leads to a consistent seasonal pattern in commercial landings in each region. As a result, the majority of landings in New England and the Mid-Atlantic occur in the period from early summer to October. Maryland and Virginia landings peak in the spring and increase again in November and December. Most striped bass landed in North Carolina are caught in the early spring and late fall.

Harvesting Methods¹

As was pointed out by Strand et al. (1980), the methods of harvesting striped bass differ within and among regions. Three methods, however, account for most of the Atlantic Coast landings of striped bass. These are hand lines (or hook and line), set and drift gill nets.

New England

The major gear types used in harvesting striped bass in New England in 1980 were hook and line, floating trap and otter trawl. The Massachusetts fishery is entirely hook and line as a result of a law passed in 1945 making

¹Much of the information used in this and the following sections of this report was obtained through field interviews necessary to supplement published and unpublished data from national and state agencies and other sources. More than 1500 personal contacts were made along the coastal area from North Carolina to Maine with sport and commercial fishermen, wholesalers, retailers and restaurant operators. Details of the interviews, including copies of the questionnaires used, sample distributions, and other information, are available on request.

it illegal to harvest striped bass by any other means. Gear is also restricted to hook and line in Maine and New Hampshire.

Most striped bass in Rhode Island are commercially harvested using hand lines. Floating traps and otter trawls are also used in the Rhode Island commercial striped bass fishery. Since the mid-1970s, a shift toward greater use of hand lines has occurred. In 1974 approximately 49 percent of total catch was taken by hand lines and 48 percent by floating trap. In recent years hand lines have accounted for over two-thirds of the catch.

Floating traps are designed for harvesting species such as scup, butterfish, squid, and fluke, and landings of striped bass by this gear are considered incidental catch. During 1980 special permits were issued by the Rhode Island Department of Environmental Management for each trap location, and are valid for up to three years. In 1980, approximately six Rhode Island firms had permits for about 50 locations. Up to 25 locations are used in a season with 8 to 10 traps in place at any one time.

Summarized in Table 1 are characteristics of the typical New England hook and line operation. Major items of capital equipment are a skiff of 14 to 19 feet in length, a pickup truck and the hook and line gear. As was indicated above, striped bass occur in New England waters primarily during the summer and early fall. Tidal conditions, winds and currents affect the size of the striped bass harvest. Commercial fishermen fish about 80 days per year for this species, while fishing about 140 days for other species.

In 1980, the typical commercial hook and line fisherman in New England landed approximately 3,300 pounds of striped bass valued at about \$6,350. The price received averaged \$1.92 per pound. Expenses incurred

Table 1: Characteristics of commercial striped bass harvesters using hook and line gear, Massachusetts and Rhode Island, 1980

	Average	Range
Vessel Length (ft.)	17	14-19
Percent of Fishing Income from Striped Bass	40	10-100
Days Fished for Striped Bass	80	45-150
Days Fished for Other Species	140	0-300
Pounds of Striped Bass Harvested	3,300	200-10,000
Sales receipts from Striped Bass	\$6,350	\$350-\$20,000
Striped Bass Size Distribution:		
Small (< 5 lb.)	10%	0-20%
Medium (5-10 lb.)	13%	0-65%
Large (>15 lb.)	77%	35-100%

SOURCE: Survey data from University of Connecticut

in harvesting striped bass are shown in Table 2, along with a relative breakdown of expenditures by category. Major items include expenditures for fuel, wages and tackle. Based on average catch and expenses, a pound of striped bass costs \$1.71 to produce by hook and line in New England.

Table 2: Average annual expenditures attributable to striped bass, by Massachusetts and Rhode Island hook and line fishermen, 1980

Item*	Average Annual Expense	Range	Relative Expense
Fuel	\$ 900	\$ 225-2,700	16%
Wages	2,000	1,650-3,750	35
Nets	25	0-125	1
Lines/Ropes	10	0-45	1
Tackle	900	0-3,000	16
Truck Repair	100	0-450	2
Equipment Repair	360	0-1,200	6
Ice	11	0-50	1
Shipping	20	0-120	1
Supplies	215	0-1,000	1
Insurance	155	37-325	3
Interest	90	0-540	2
License Fees	20	8-80	1
Depreciation	300	0-1,500	5
Taxes	110	0-690	2
Dock Fees	130	0-450	2
Other	300	60-1,500	5
Total	5,646		100%

SOURCE: Survey data from University of Connecticut

*Does not include electronic equipment

Summarized in Tables 3 and 4 are characteristics and estimated expenses for a typical fish trap striped bass operation. Wages make up the largest expense, followed by fuel and tackle. Based on the average catch and expenses, a pound of striped bass costs \$1.38 to harvest. Because much of the catch is incidental, the expense data are likely to have large variation and the cost per pound figure may also vary widely among fishermen.

Mid-Atlantic

A summary of unpublished NMFS 1980 landings data for New York State, excluding the Hudson River, indicates that 93 percent of the report-

Table 3: Characteristics of commercial striped bass harvesters using fish traps, New England, 1980

	Average
Vessel Length (ft.)	70
Percent of Income from Striped Bass Harvest	43
Days Fished for Striped Bass	90
Days Fished for Other Species	120
Pounds of Striped Bass Harvested	70,000
Sales receipts from Striped Bass	\$129,500

SOURCE: Survey data from University of Connecticut

Table 4: Average annual expenditures attributable to striped bass, by New England fish trap fishermen, 1980

Item	Average Annual Expense	Relative Expense
Fuel	\$ 1,960	2%
Wages	40,142	41
Nets	14,700	15
Lines/Ropes	6,000	6
Floats/Leads	5,000	5
Equipment Repair	5,000	5
Insurance	8,400	9
License Fees	840	1
Depreciation	2,100	2
Taxes	12,600	14
Total	\$96,742	100%

SOURCE: Survey data from University of Connecticut

ed landings occurred in Suffolk County, with the remaining 7 percent from Nassau and Kings Counties (Table 5). The majority of fishing activity for striped bass in Suffolk County occurs along the southern coast of Long Island from Shinnecock Inlet eastward to Montauk Point. Table 5 also shows the 1980 striped bass landings by gear type.

Unfortunately, the small number of completed interviews, together with high variability in operations and confidentiality requirements, preclude presentation of data on economic activity by gear type for fishermen operating in New York. For the haul seiners, however, sufficient data exist to state they receive approximately \$2.00 per pound. The haul seine share system implies that wages vary directly with profits. Net revenues are first calculated and then divided equally among the crew. In one instance, there was another share which went to the boat owner. Striped

Table 5: Striped bass landings in New York by county and gear, 1980

Gear Type	Suffolk	Nassau and King	Total	Percent of Total
Drag Netters	65,628 lbs.	4,311 lbs.	69,939 lbs.	12%
Trappers	95,051	0	95,051	17
Handlines	178,148	36,349	214,497	37
Gill Netters	112,905	0	112,905	20
Haul Seiners	79,651	0	79,651	14
Total	531,383	40,660	572,043	
Percent	93	7		100

SOURCE: NMFS Office in Patchogue, New York

bass were important components of revenues in the April-through-June and September-through-November periods.

New Jersey's commercial fishery has been declining in recent years, due in part to the laws prohibiting the use of particular gear in certain state waters.² Commercial fishermen landed 40,000 pounds of striped bass in 1979 and about 25,000 pounds in 1980. Striped bass commercially harvested in 1980 came principally from by-catches of offshore druggers and from gill netters in Delaware Bay. As a result, the New Jersey counties reporting landings were, in order of increasing importance, Cape May, Ocean, Cumberland and Monmouth.

The seasonal variation in landings relates primarily to the migratory habits of the bass. The spring northern migration is harvested by the inshore (Cumberland County) gill net operations, whereas the fall/winter southern migration is taken by the offshore trawlers (Ocean and Cape May counties).

Otter trawls, gill nets and pound nets are the primary gear types used by New Jersey commercial fishermen who land striped bass. The average number of days fished by gill netters was reported to be 210, while that for trawlers was 260. The gill netters operate small boats and incur relatively small costs for fuel. For the larger trawlers (60 to 120 feet), however, fuel costs were reported to be as high as \$50,000 in 1980.

Large expenditures were also made for crew wages, equipment and repairs. It is important to note, however, that striped bass landings by these large trawlers are mostly incidental catch, and only a small portion of total expenses can be attributed to striped bass. Expenditures by har-

²Since 1952, netting in the territorial waters of New Jersey's Atlantic Ocean has been prohibited. In 1981, netting in all New Jersey waters was prohibited.

vesters for fuel, equipment, maintenance, and most other expenses are generally made within the county of operation. A notable exception to this is nets, which are often purchased directly from large net manufacturers located in Tennessee.

There are four ports in Delaware where most of the striped bass harvests are landed—two in Kent County (Port Mahon and Bowers Beach) and two in Sussex County (Misspillon and Indian River). The majority of the 1980 harvest was taken in March and April with the remainder harvested between November and January. Gill netting is the only gear type used to harvest commercially marketed striped bass. A typical Delaware netter uses a mid-sized (18-32 feet) work boat with an outboard motor and open bridge. One or two smaller (14-16 feet) skiffs are towed and used to lift the nets and store the fish. The boats are operated close to port. Delaware netters (estimated to consist of 32 crews) set about 25,000 yards of gill net in 1980.

The greatest concentrations of Delaware striped bass harvesters are found in Kent County followed by the northern section of Sussex County with a few in the upper bay area of New Castle County. Interview data indicate that Delaware gill netters fished an average of 200 days for finfish, including striped bass, in 1980, but none of those responding fished primarily for striped bass.

A sample of Delaware gill netters showed an average 1980 fuel expenditure attributable to striped bass of about \$400. This figure represents about 10 percent of gill netter's total 1980 fuel expenditures. The average expenditures in major expense categories attributable to striped bass effort in the Delaware gill net fishery during 1980 are given in Table 6.

Table 6: Average annual expenditures attributable to striped bass, by Delaware gill netters, 1980

Item	Average Annual Expense	Relative Expense
Fuel	\$ 393	10%
Nets	1,533	39
Lines & Ropes	263	7
Floats & Leads	1,221	31
Equipment Repair	107	3
Other	411	10
Total	\$3,928	100%

SOURCE: Survey data from University of Maryland

The operations normally have only one man and thus no wage figure is shown. Expenditures in most of the categories are made within the county of operation, with the exception of nets, which are purchased from manufacturers in Tennessee.

Chesapeake

The middle and upper Chesapeake Bay areas are the primary producers of striped bass in Maryland, accounting for nearly 72 percent of the total 1980 Maryland landings. The seasonality of striped bass landings varies in different parts of the state. The higher landings in the middle and upper bay counties are in part due to the location of spawning grounds and the extended season in the upper bay area. Landings in the lower bay and Potomac River regions occur principally in the late fall and early spring.

Gill netting is Maryland's primary commercial striped bass fishery, accounting for 97 percent of the total 1980 commercial striped bass landings. Anchor, drift and staked gill nets are used throughout the state, depending on the season, water conditions and legal restrictions. Boats used by Maryland gill netters range in size from large bay boats (30 to 50 feet) to small wood or fiberglass skiffs. Crew sizes vary from two to seven. Interview data suggest that about one-fourth of the 1,555 registered Maryland gill netters are part-time fishermen. Most full-time fishermen who fish for striped bass are also involved in crabbing, oystering, or fishing for other finfish species. Full-time fishermen annually averaged about 240 days on the water. Table 7 shows the characteristics of part-time and full-time fishermen.

Table 7: Average characteristics of all gill net operations (part-time and full-time) in Maryland, 1980

	Part-time Fishermen	Full-time Fishermen
Vessel Length (ft.)	23	35
Percent of Income from Striped Bass Harvest	27	46
Days Fished for Striped Bass	91	125
Days Fished for Other Species	15	115
Pounds of Striped Bass Harvested	4,970	18,866

SOURCE: Survey data from University of Maryland

Expenses incurred by Maryland gill netters for fuel, wages, equipment, and other items vary in different parts of the state. In Kent County, where the largest striped bass fishing operations are located, fishermen's average

fuel costs attributable to striped bass were nearly double the state average. Table 8 shows average expenses attributable to striped bass for the part-time Maryland gill net operations as well as those for the full-time fishermen. The average expense per pound landed for the full-time fishermen was \$1.20.

Table 8: Average annual expenditures attributable to striped bass, by the part-time and full-time fishermen using gill nets in Maryland, 1980

Item	Part-time Fishermen Expense	Relative Expense	Full-time Fishermen Expense	Relative Expense
Fuel	\$1,279	23%	\$ 2,550	11%
Wages	1,557	28	11,577	51
Nets	596	11	2,832	12
Lines and Ropes	313	6	694	3
Floats and Leads	261	5	837	4
Truck Repair/Rental	86	1	548	2
Equipment Repair	394	7	1,022	5
Other	1,030	19	2,657	12
Total	\$5,516	100%	\$22,717	100%

SOURCE: Survey data from University of Maryland

The contributions to income from striped bass fishing also vary widely geographically. In general, harvesters in the middle and upper bay counties rely more heavily on striped bass and other finfish than on shellfish. Many of the large Kent County harvesting operators told interviewers that the further decline of striped bass could force them to lay off entire crews and to seek employment elsewhere.

Virginia's striped bass landings are concentrated in the northern counties in an area lying between the Potomac and Rappahannock rivers known as the Northern Neck. This area produced nearly 95 percent of Virginia's 1980 reported striped bass landings. The Eastern Shore peninsula, made up of Accomack and Northampton counties, accounted for the remaining landings.

Seasonal fluctuations in landings coincide with the striped bass migration in the early spring and late fall. Landings in March and April accounted for 36 percent of the total 1980 Virginia landing, with another 47 percent landed during October, November and December.

During 1980, 82 percent of Virginia's striped bass landings were caught

in drift, anchor and staked gill nets. The type of gill net used depends on weather, water conditions and legal restrictions. In most areas, legal restrictions apply only to the size of the net and not to the type. Other gear types landing striped bass in Virginia include pound nets, otter trawls and handlines.

An estimated 761 full-time gill netters work in Virginia waters, with an additional 2,000-3,000 part-time or casual netters. Many of the part-time gill netters focus effort specifically on the striped bass because of the high ex-vessel price. Full-time netters, however, find that they cannot rely solely on the scarce and often unpredictable availability of striped bass. In northern counties, the striped bass accounted for 10 to 50 percent of gill netters' total 1980 seafood sales. In southern counties (south of the York River) less than one percent of harvesters' total seafood sales were from striped bass. Typical expenditures by Virginia striped bass fishermen for fuel, wages and other items are given in Table 9. The share of cost associated with wages was the lowest state average encountered in our interviews, representing only 20 percent of all costs.

Table 9: Average annual expenditures attributable to striped bass by Virginia fishermen, 1980

Item	Average Annual Expenditures	Relative Expense
Fuel	\$ 304	13%
Wages	484	20
Nets	482	20
Lines & Ropes	140	6
Floats & Leads	140	6
Truck Repair	58	2
Other	807	33
Total	\$2,415	100%

SOURCE: Survey data from University of Maryland

Virginia fishermen, especially those in northern counties, said the further decline of striped bass would hurt them economically, some to the extent of being forced out of fishing completely. All Virginia fishermen interviewed expressed the hope for an increased abundance of striped bass, and many indicated they would switch out of other fisheries and direct effort on the striped bass if stocks increased.

*South Atlantic*³

Striped bass in North Carolina are harvested by a variety of gear. Prior to 1967, the primary gear types for the capture of the species were pound nets, gill nets and haul seines, accounting for approximately 92 percent of the total harvest. Pound nets, used on the inside waters of the sounds, particularly in Albemarle Sound, on the average accounted for 37 percent of the total harvest. Gill nets (anchored) used in Albemarle Sound and its immediate tributaries, as well as in Pamlico Sound, contributed an additional 31 percent. Haul seines used on the outer beaches and at selected locations on Albemarle Sound and its tributaries or on Pamlico Sound provided 24 percent of the catch.

During the period 1967 through 1973, when the striper landings reached all-time highs, there were some significant changes in gear contributions to the annual harvests. Otter trawls, which had contributed little to the harvest in previous years, accounted for approximately 15 percent of the total landings. Gill nets were the primary gear used during the 1967-1973 period, comprising 45 percent of the total harvest. Haul seines came into increasing use, accounting for 29 percent of the harvest.

In the post-1973 period, the dominant gear types have been haul seines and gill nets, with the latter increasing in importance and dominating the fishery in recent years. Seines accounted for 43 percent of the total harvest in 1974. By 1978, following legislation restricting seine use in coastal waters, harvest by seines had decreased to only 3 percent of the total harvest. By 1980 they were no longer used.

The only other gear of note is the trawl, which continued to be used during the 1974-1980 period. As with seines, however, the catch dropped off drastically. By 1980, the trawl contributed only 4 percent to the harvest, even though it was ranked second behind the gill net for its overall contribution to the fishery, and gill nets contributed 87 percent of the total harvest for the commercial landings of striped bass.

North Carolina striped bass fishermen earn three-fourths of their income from fishing. In 1980, an average of 93 days were devoted primarily to effort on striped bass (Table 10).

The cost structure of North Carolina gill netters (Table 11) is similar to that found in Virginia, with fuel, wages and nets representing approximately 60 percent of total annual costs. The total cost is also similar and yielded an average cost of \$1.38 per pound.

³Since North Carolina was the only state in this region to report significant striped bass landings, any South Atlantic region reference refers only to the State of North Carolina.

Table 10: Characteristics of striped bass harvesters in North Carolina, 1980

	Average
Vessel length (ft.)	16
Days fished for Striped Bass	93
Days fished for Other Species	163
Pounds of Striped Harvested	1,477
Sales Receipts from Striped Bass	\$1,724

SOURCE: Interview data from North Carolina State University

Table 11: Average annual expenditures attributable to striped bass, by North Carolina gill netters, 1980

Item	Average Annual Expense	Relative Expense
Fuel	\$ 404	20%
Wages	500	25
Nets	467	23
Lines & Ropes	65	3
Floats & Leaders	29	1
Truck Repair and Rental	82	4
Equipment Repair & Maintenance	177	9
Shipping	30	2
Supplies	15	<1
Insurance	28	1
Interest	14	<1
License Fees	7	<1
Depreciation	20	1
Federal Tax	145	7
State Tax	38	2
Dock Slip Fees	1	<1
Miscellaneous	13	<1
Total	\$2,035	

SOURCE: Interview data from North Carolina State University

The large mesh gill net fishery for striped bass in the eastern area of the sounds of North Carolina is of recent origin. The former fishery for striped bass on the Outer Banks (north of Cape Hatteras, southward to Ocracoke) was a haul seine fishery operated on the outside beaches in late winter. Following legislation that restricted the operation of haul seines on the outside beaches, the number of crews dwindled. In the winter of 1980,

one crew from Buxton (Cape Hatteras) introduced a large mesh gill net to the winter striped bass fishery. The gear proved to be successful and by the 1981 season there were six crews operating the large mesh gill nets for striped bass in the Cape Hatteras to Ocracoke region. The fish caught are primarily larger females migrating into the embayed water in mid to late winter for spawning. The gill nets used in this fishery are constructed of monofilament webbing with nine and one-half-inch stretched mesh (four and one-quarter-inch bar). The nets are 80 to 120 yards in length and are fished as anchor gill nets. They are anchored along the inside waters usually within a range of five miles of the inlets and are set perpendicular to the tidal current running down the channels. The depths fished range from four to twelve feet or more. Once set, the nets are allowed to stand and fish overnight. They are marked with buoys at either end and the float line remains visible above water.

Crews of one or two per boat operate the fishery and may fish ten or more nets. The boats used in this fishery are 20 to 30 feet in length. Since the boats are used in other fisheries during the rest of the year, no special design features have developed. They are wooden or fiberglass semi-displacement hulls with inboard automobile or marine engines. Several of the smaller boats use outboard engines. Hydraulic net haulers or other specialized gear are not used.

Individuals engaged in this fishery are primarily full-time commercial fishermen. During other times of the year they participate in a variety of other fisheries such as the shrimp fishery, the hard crab fishery and gill-netting operations for other species.

Marketing

The marketing of striped bass on the Atlantic Coast involves a complex structure of intermediate and direct activities covering local and central market outlets. This structure and the related product flow are affected by state laws such as those regarding gear type, the selling of recreationally caught fish, closed seasons and the size of fish that may be landed in certain areas. Also important are the availability of striped bass, as influenced by stock size fluctuations, and the market quantity and prices of other species. Estimation of economic impacts and values of striped bass related activities requires an understanding of, and data on, the complex striped bass marketing structure along the Atlantic Coast.

A general indication of the flow of striped bass is given in Figure 5. Watermen sell striped bass to primary wholesalers, who sell to local

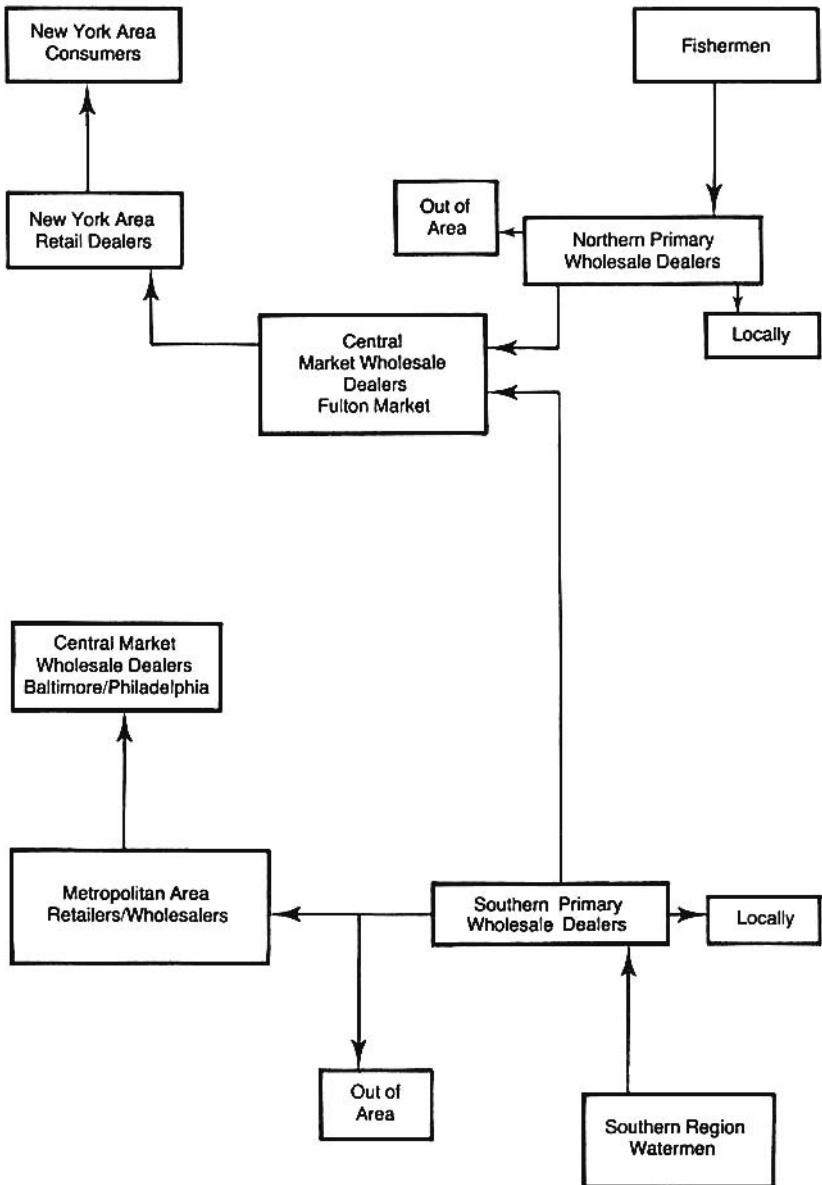


Figure 5. North Atlantic striped bass market flow.

outlets, to central market wholesalers, or to buyers outside the region (see Adriance 1982, for details on market flows). The volume passing through the Baltimore and New York (Fulton) central markets represented about 65 percent of the reported landings from 1972 to 1978. These central markets are key establishments for distribution of striped bass as well as for determining market prices.

New England

Wholesale dealers and fishing cooperatives are important to the market flow of striped bass in New England. There are approximately 60 such establishments, most of which function as primary wholesalers. In the Boston area, however, there are eleven secondary establishments which purchase significant quantities of striped bass from other establishments rather than directly from fishermen. The terms "primary" and "secondary" refer to the first and second handlers, respectively.

The primary wholesalers purchase from commercial or sport fishermen and ship to regional secondary markets in Boston or New York. These primary wholesalers also distribute striped bass locally to retail stores, restaurants, and other final markets.

Little processing of striped bass is done before it reaches the retail outlets. Most of the wholesalers only box, ice and ship the striped bass. This is in contrast to the filleting and other processing that takes place for many other species. This practice adds little value to the product and hence reduces the local economic impact relative to that associated with a product that is locally processed.

Approximately two-thirds of the striped bass handled by Massachusetts wholesalers in 1980 was purchased by them directly from commercial or sport fishermen. Barnstable County establishments handled the largest amount of striped bass relative to other counties in Massachusetts. Most of their purchases were from fishermen, although they did purchase some striped bass from wholesalers in Plymouth County. Bristol County wholesalers were second in volume to those in Barnstable County. Bristol County firms purchased primarily from fishermen, with about 10 percent of their product coming from Connecticut and Rhode Island fishermen. In Suffolk County, wholesalers bought striped bass from local fishermen as well as from the New York Fulton Market, Maryland wholesalers and Plymouth County wholesalers. Wholesalers in four other Massachusetts counties (Essex, Plymouth, Nantucket and Dukes) purchased from local fishermen.

Interviews with New England wholesalers indicated that their usual

marketing margin or mark-up is between 10 and 20 percent of the price paid to fishermen. This price is determined primarily by the Fulton Market situation. The mark-up, which usually amounts to 15 to 50 cents per pound, covers the cost of ice, packing materials, labor, shipping and return on investment.

Many retail establishments in New England sell striped bass. These range from small seafood speciality outlets to large supermarkets. Retailers generally purchase from local or central market wholesalers but occasionally (especially the smaller retail firms) purchase directly from fishermen. In some instances, wholesalers also perform retail services. Retailers generally buy striped bass whole and sell whole, filleted, or steaked products.

About three-fourths of the New England 1980 retail sales of striped bass flowed through Massachusetts outlets. Connecticut retailers accounted for about 20 percent with Rhode Island retail outlets making up the remaining 5 percent of New England sales. In addition to these retail sales, almost 300,000 pounds of striped bass were shipped by wholesalers in Suffolk County to supermarket chains outside of New England.

There are two basic pricing policies at the retail level. The retail mark-up on whole striped bass ranges from 10 to 50 percent. Fillet prices are established according to the rule "two and one-half times the knife," which means 2.5 times the cost of the fish to the retailer.

In 1980, over ten percent of the total New England product flow of striped bass was sold through more than 300 restaurants. Approximately 40 percent of the restaurant trade was in Massachusetts, 25 percent was in Rhode Island, and about 35 percent took place in Connecticut. At least 35,000 pounds of striped bass were shipped by wholesalers to restaurants outside the New England area.

Counties with large concentrations of restaurants serving striped bass in 1980 were: Barnstable and Suffolk, with 60 percent of the Massachusetts total; Providence and Newport, with 73 percent of the Rhode Island total; and Fairfield County, Connecticut, with 52 percent of the state's total. Restaurants do not carry a large inventory of striped bass at any time and usually offer it as a specialty entree. Restaurants generally purchase large whole striped bass from local fishermen, regional or local wholesalers, or from the Fulton Market. They then fillet or steak the fish and serve it baked, broiled, or poached.

Over two-thirds of the striped bass handled by Massachusetts restaurants in 1980 was purchased from primary or secondary wholesalers and distributors within the state. In Rhode Island, only one-fifth of the striped

bass handled by restaurants was purchased directly from fishermen with most being purchased from primary wholesalers within the state and from the Fulton Market. Striped bass served in Connecticut restaurants were generally purchased from the Fulton Market.

Most restaurants offering this item on their menus are the more expensive "white table cloth" type of eating establishment. Entree prices in 1980 for striped bass in New England ranged from \$6.00 to \$12.00, with \$10.00 representing the average.

Mid-Atlantic

The most important striped bass wholesale location in the Mid-Atlantic region is New York's Fulton Market. Striped bass are shipped to the Fulton Market by fishermen and wholesalers from Maine to North Carolina. The percentage of mark-up used by the wholesalers ranges from 10 to 15 percent, depending on the market situation. The range of wholesale prices observed during the 1980 survey was between \$2.00 and \$3.50 per pound. Table 12 illustrates the movement of striped bass from Fulton wholesalers to various destination points. Retail seafood outlets account for the largest proportion of sales by the wholesalers. Restaurants indirectly represent a greater quantity than is apparent from Table 12 because purveyors (who are buyers for specific enterprises) primarily supply restaurants.

Table 12: Distribution of striped bass by five Fulton Market wholesalers

Fulton Market Wholesalers	Destination			
	Restaurants	Retailers	Wholesalers	Purveyors
Wholesaler 1	20%	60%	—	20%
Wholesaler 2	—	75	10%	15
Wholesaler 3	50	50	—	—
Wholesaler 4	25	50	—	25
Wholesaler 5	10	30	20	40

SOURCE: Interview data from University of Maryland

Table 13 shows relative revenue from striped bass, the price and the substitutes for striped bass for five large retail seafood outlets in Manhattan. Four retail outlets preferred 2-4 pound striped bass and sold striped bass whole and in fillets. The other preferred 25-30 pound striped bass since sale was in the form of steaks. All retail outlets surveyed base selling price on a fixed percent markup over the wholesale purchase price.

Table 13: Contribution to total sales revenues, 1980 price per pound, and main substitutes for striped bass at five Manhattan retail seafood outlets

Outlet	Percent of Total Sales	1980 Price Per Pound	Main Substitute
Retail 1	5%	\$3.00-5.00	Sea Bass
Retail 2	5	3.00-4.00	none specified
Retail 3	1	3.00	Tilefish
Retail 4	1	5.99-6.50	Tilefish
Retail 5	2	4.50	Snapper

SOURCE: Interview data from Cornell University

The restaurant respondents carrying striped bass obtained their product primarily from seafood purveyors. Medium to large sizes of over five pounds are preferred by the restaurants contacted. The amount carried per year depends on the class and size of the restaurant. The low- to medium-price establishments carry striped bass only when the wholesale price is low. Substitutes are widely used, the most frequently mentioned being tilefish. The medium- to high-price restaurants are less vulnerable to fluctuations in the striped bass price. These establishments generally carry striped bass at all times. The potential substitute most often mentioned was salmon.

Responses from two private club restaurants in New York City were similar to those of other restaurants. The respondents felt that their sales volume for striped bass was lower than that for some public restaurants due to the menu variety required for their repeat club members. These clubs purchased their striped bass from purveyors. Size preferences were for the 5-10 pound fish and tilefish was considered the primary substitute for striped bass.

New Jersey wholesalers interviewed in Cape May and Cumberland counties bought striped bass from both commercial and recreational fishermen. Interviews with southern New Jersey wholesalers indicated that the inflow of recreationally caught striped bass into New Jersey markets is significant. Harvesters (commercial and recreational) bring their fish to wholesalers, who in turn sell to retail outlets or central markets.

Interviews with wholesalers and fishermen indicated that most commercially landed striped bass are bought by large wholesalers, boxed in ice and shipped directly to New York or Philadelphia markets. Wholesalers in Cape May, Cumberland, and Atlantic counties generally ship to the nearby Philadelphia markets, while those in Ocean and Monmouth coun-

ties ship to New York's Fulton Market. Striped bass not sold to central markets (about 10 percent of total landings) is generally sold whole to local retail outlets.

A sample of New Jersey restaurant and retail outlets handling striped bass in 1980 revealed that 50 percent of the restaurants and 30 percent of the retail outlets purchased their striped bass from wholesalers. The remainder purchased directly from commercial or recreational fishermen.

In Delaware striped bass move from the fishermen to small wholesalers, who in turn may act as middlemen for restaurants and larger wholesalers, or in many instances sell through their own local retail outlets. The local wholesalers often sell to large wholesalers who market in Philadelphia, Baltimore, or New York. In some instances local Delaware wholesalers buy from a central market and sell to restaurants.

Chesapeake

Wholesalers operating within Maryland vary widely in the amount of striped bass they handle. Interview data indicated that 95 percent of Maryland's striped bass landings flow to wholesalers; of this, three-fourths is handled by wholesalers in the northern Chesapeake area (north of Annapolis) and the remainder goes to southern bay wholesalers.

The destination of striped bass landed in Maryland is, to a large extent, determined by the size of the fish. A small percentage of commercially harvested striped bass flows directly to local restaurants or retail outlets. Those which measure less than 16 inches are generally sold to large Eastern Shore or Baltimore wholesale markets for distribution in Maryland, Delaware, or Virginia. The larger fish (greater than 16 inches) are sent primarily through Eastern Shore wholesalers to the Fulton Market.

Buyers of the striped bass are located throughout the coastal areas of the state. The largest markets for striped bass are located in Kent, Dorchester and Anne Arundel counties, as well as in the Baltimore City Fish Market. Fish are generally paid for with cash and shipped by truck to large wholesalers or to the Baltimore market. Wholesalers in Kent County attributed 77 percent of their 1980 finfish revenues to striped bass sales, while those in Wicomico and Worcester counties attributed only a small amount to striped bass.

Striped bass leaving Maryland wholesalers flow to a variety of users including restaurants, retail outlets and the large central markets. The destination is primarily determined by the size of fish and seasonal retail demand. Figure 6, compiled from wholesale interviews, shows the flow of striped bass from wholesalers to various destinations.

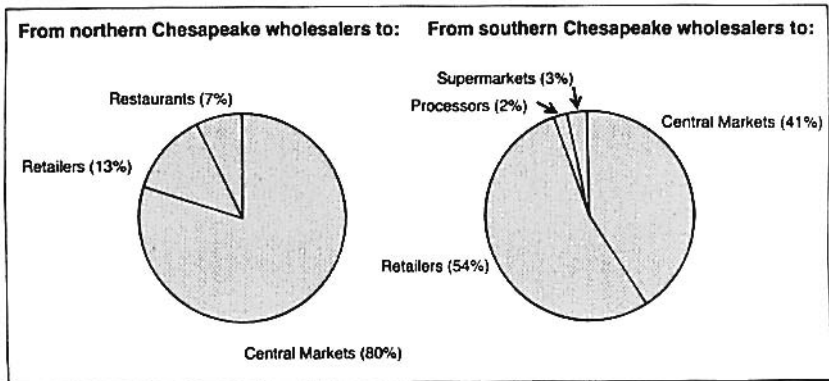


Figure 6. Flow of striped bass from Maryland wholesalers.

Interviews with restaurants throughout Maryland showed an average striped bass use of 2,634 pounds in 1980. Of the 50 seafood and French restaurants contacted, 60 percent handled striped bass at some time during 1980, generally serving it as an off-menu (Fish of the Day) special. The greatest concentrations of restaurants handling striped bass were found in the Washington, D.C. and Baltimore metropolitan areas. Restaurants serving striped bass in the Baltimore metropolitan area had an average entree price of \$10.35, while the state average was \$8.80. Comparisons made with prices of other entrees served in Maryland restaurants indicated that in most restaurants striped bass is served as a premium item. Restaurant proprietors indicated they would handle much more striped bass if it were more available at lower prices.

Maryland wholesalers, retailers and restaurant proprietors indicate a greater dependence on the striped bass relative to other states—though this dependence varied geographically and seasonally. Wholesalers, particularly in northern Maryland, indicated that the disappearance of the striped bass would have a marked effect on their economic stability, forcing some to lay off personnel and significantly scale down operations. Retail and restaurant establishments in the northern counties also stated that they would be hurt by further declines in commercial striped bass availability.

Interviews with Virginia wholesalers indicate that about 90 percent of the commercially landed striped bass leaves the state for markets in Baltimore, New York, North Carolina and as far south as Florida. A significant amount of striped bass also flows into the state from large Maryland

markets in order to meet seasonal retail demand. This flow pattern occurs because the local demand for striped bass in Virginia is strongest in the late spring, summer and early fall when the tourist trade is flourishing. Virginia landings, however, occur primarily in the late fall and early spring.

Virginia retailers and restaurants dealing in striped bass responded similarly to those in Maryland regarding the economic effect of the decline of striped bass.

South Atlantic

In North Carolina, striped bass are harvested by many small independent fishermen selling primarily to wholesalers. The wholesalers sort the whole fish by size, rebox, ice and ship the fish north by truck. The trucks are owned by the wholesalers or by independent truck lines. The smaller wholesalers tend to transfer the fish to other buyers who ship the fish in their trucks for a fee but who do not have ownership of the fish. Nearly all fish caught move through wholesalers to the northern markets. Most retailing of striped bass is done by wholesalers, but a small number of retail fish markets sell striped bass.

Some restaurants replied that they did not now serve striped bass due to its high price. They indicated striped bass would be put back on the menu if the price were lower (less than \$2.00 per pound) and if they could find a reliable supply.

The inlet gill net fishery of eastern North Carolina Sound represents a specialized fishery and therefore a somewhat specialized market process. Once caught, the fish are kept in boxes or on the decks of the boats. Most of the fish are large females in the 40-50 pound range. The local dealers who handle the catches are often unable to handle more than several hundred pounds of fish. Thus, a single fishing operation is faced with the situation of selling to several dealers to market their catch. As one fisherman stated, it is "... kind of like dropping a fish off here and a fish off there..." The local market for the striped bass is severely limited because the market links that existed in the past years to handle the substantially larger catches from the haul seine crews no longer seem to exist.

The Recreational Fishery

RECREATIONAL FISHING FOR striped bass has long been a popular sport along the East Coast. As the number of participants has increased and the catch declined, recreational fishermen have become more vocal in support of fisheries management for striped bass. Unfortunately, the fishery management agencies have had to work without estimates of the economic impact and value of this recreational fishery. To analyze the economic impact and value of the recreational fishery it was first necessary to estimate the annual East Coast recreational catch and then determine the direct total expenditures on recreational fishing. This study indicates that the recreational catch of striped bass by sportsmen fishing the coastal waters of the northeast United States often rivals or exceeds the reported catch of commercial fishermen working those same waters.

Methods

The analysis of recreational striped bass fishing is based on estimates of total effort (trips), catch rate and total catch, mean and total expenditures, and the central tendency or "norm" for the striped bass fishing trip. These estimates are based on the 1979 Marine Recreational Fishery Statistics Survey conducted by the National Marine Fisheries Service and on a separate survey conducted in 1980 by personnel working on this project.

Data from the 1980 NMFS survey were not yet available when this project began. This necessitated the use of data from two different years, 1979 and 1980. Recreational catch and effort were estimated from the 1979 NMFS survey data.⁴ These estimates are presented in this chapter. The expenditure data collected in 1980 were used to generate estimates of out-of-pocket expenses by type of expenditure (e.g., restaurant food purchases) of recreational striped bass fishermen; these numbers were used as input to the impact model described later.

The NMFS survey is based on a dual-frame sampling approach first described by Hiatt and Ghosh (1977). The approach uses two independent surveys.⁵ The first is a field survey of recreational fishermen (also known as a creel census), wherein fishermen are interviewed at the completion of their fishing trip by interviewers trained in fish identification. During this interview, information is collected on the catch for this trip, the type of trip and the total expenditures. Catch rates for striped bass for the type of trip are estimated from this survey.

⁴The similarity of the 1979 and 1980 participation rates was later borne out by analysis of the entire 1980 survey data.

⁵See Hiatt and Ghosh (1977) or McConnell and Smith (1979) for a more detailed explanation.

The second survey is an independent random telephone survey of households located in the coastal zone of each state. Each household contacted is asked if members have participated in recreational fishing in the prior two months. If the answer is "Yes," members of the household are interviewed to obtain specific trip information. The data collected from the telephone survey allow the estimation of participation rates per household (trips per household per two month period for the same categories of trips as in the field survey). These participation rates are multiplied by the total number of households from U.S. Bureau of Census data to produce estimates of total trips.

The final estimation step is to derive the total catch and total expenditures by multiplying the trip estimates by the mean catch rate or the mean expenditure estimates (from the field survey), respectively.

The 1979 NMFS survey collected information on 24,773 recreational fishing trips in the regions from Maine through North Carolina. Of these, 1,818 were seeking striped bass.⁶ The National Marine Fisheries Service also surveyed 44,325 households (Maine to North Carolina) by telephone. In addition to these data, the survey conducted by project personnel collected information on 505 striped bass fishing trips.

An important part of determining the economic activity associated with striped bass fishing is the analysis of a set of characteristics which represent the central tendency or "norm" of the group of fishermen. This offers guidance as to how the angler behaves on an average trip.

Averages for certain characteristics of striped bass trips are presented in Table 14. These data are derived from the 1979 NMFS survey. The mean catch rate for striped bass for all recreational fishing trips that involved the seeking or catching of striped bass was 0.54 fish per trip, or one fish in every 1.85 striped bass trips. Catch rate was lowest in New Jersey (one fish per 12 trips) and highest in Connecticut, New York and Maryland. Out-of-pocket expenditures ranged from \$20 in New Jersey to \$78 in Massachusetts.

Total Catch, Effort and Expenditures

The level of striped bass trips is determined by the overall effort level, i.e. the number of all recreational fishing trips. Total finfish trips were

⁶A striped bass trip is defined as a trip where the fisherman either stated he was seeking striped bass or had caught striped bass.

Table 14: Characteristics of the mean striped bass trip, 1979

	Average Expenditures (\$) ¹	Average Catch Rate (fish per trip) ²
New England	49.41	0.36
Maine	—	0.74
New Hampshire	26.67	—
Massachusetts	78.28	0.26
Rhode Island	22.58	0.24
Connecticut	48.13	0.96
Mid-Atlantic	58.79	0.48
New York	77.42	0.68
New Jersey	20.26	0.07
Delaware	87.93	0.33
Chesapeake	24.41	0.70
Maryland	23.54	0.71
Virginia	57.13	0.38
South Atlantic	46.33	0.35
North Carolina	46.33	0.35
Overall	41.14	0.54

SOURCE Derived from data in table 15

¹Total trip expenses divided by total trips.

²Striped bass per striped bass trip calculated as total catch divided by total trips.

estimated from the 1979 NMFS telephone survey as described above. Striped bass trips were estimated by multiplying this number by the 1980 proportion of striped bass trips in each state.

According to this approach, there were more than two million trips directed toward striped bass in 1979. Maryland, New York and Massachusetts, were the centers of activity. Total estimated catch for the East Coast was about 1.2 million fish. Maryland's high catch rate (Table 14) and high effort levels (Table 15) resulted in the largest estimated state catch, 649 thousand fish. The next most important harvest contributor was New York.⁷

⁷Catch is estimated using the 1979 NMFS survey because it is the only published information. Unofficial communication with NMFS personnel suggests that the 1980 striped bass catch is lower than the numbers shown in Table 15.

There are several important caveats to remember in considering these estimates of fishing effort. In many states, separating recreational and commercial fishing effort proved difficult during data collection. In some northern states, particularly Massachusetts and Rhode Island, the predominant commercial harvest comes from hook and line fishing—the

Table 15: Recreational trips, catch and expenditures, the striped bass recreational fishery, Maine to North Carolina, 1979

	Trips (000)	Catch (numbers of fish) (000)	Expenditures (\$000)
New England	517	185	\$25,547
Maine	23	17	— ¹
New Hampshire	17	—	456
Massachusetts	227	59	17,723
Rhode Island	181	44	4,119
Connecticut	67	65	3,249
Mid-Atlantic	610	290	35,863
New York	408	276	31,570
New Jersey	199	13	4,038
Delaware	3	1	255
Chesapeake	934	658	22,861
Maryland	910	649	21,467
Virginia	24	9	1,394
South Atlantic	109	38	5,051
North Carolina ¹	109	38	5,051
Total	2,170	1,171	\$89,262

SOURCE: Based on 1979 NMFS recreational survey.

¹North Carolina trips and expenditures were estimated from an independent survey of North Carolina recreational fishermen because the 1979 NMFS survey intercepted no fishermen seeking or catching striped bass in North Carolina.

same technique used in most recreational fishing. Since commercial landings are usually estimated from weigh-out slips of fish wholesalers and from port sampling, it is conceivable that many recreationally caught fish

are counted in the commercial sampling. Similarly, recreational sampling techniques—on-site interviews of returning fishermen—may also include commercial fishermen in the recreational fishing sample. The effect from these two potential sources of error is unknown.

Economic Value Of the Striped Bass Fisheries

ECONOMIC INFORMATION NECESSARY for an economic evaluation of the importance of striped bass has been examined by Strand and Norton (1980). From a national perspective, it is useful to have the net economic benefits or values attributable to a resource and to understand how these values change with federal policy. This need stems from the federal interest in national well-being. On the other hand, a state perspective is likely to focus on the local economic activity or impact generated by the resource and policies affecting it. The state interests stem from local and regional development goals. This chapter contains information relevant to the net economic benefits or values generated on the East Coast by striped bass fishing. The next chapter pertains to the income and employment activity associated with striped bass.

Net economic benefits are the value of consumption in excess of the opportunities foregone in production. Commercial and recreational users of striped bass receive satisfaction from consumption, the recreational experience, or income from harvest and marketing. Willingness to pay for the good is the dollar measure of the satisfaction to the purchaser of the product.⁸ Costs of production are the dollar measure of the opportunities foregone in its production.⁹ The difference is net economic benefit or what is referred to as the economic value of striped bass.

Although this definition is consistent for both recreational and commercial uses of striped bass, the fact that recreational fishermen are both producers and consumers of striped bass raises measurement problems and requires analytical techniques sufficiently unusual to warrant separate treatment of the two harvesting groups.

Recreational Benefits

The Measurement Concept

The usual procedure for measuring the "value" of any good, such as fish, is to use competitive market prices and quantities. If a sportfishing market existed, one could obtain market data on price, number of customers and number of fish landed per customer. With information from this private activity, a demand curve and supply curve for the fish could be estimated. The demand and supply curves (Figure 7) would show the

⁸Other benefit measures (e.g. willingness to sell) are assumed to be of similar magnitude to the willingness to pay. For the conditions necessary for the assumption to be valid, see Willig (1976).

⁹No consideration is given to the external costs of use (Scott, 1955). Measurement of these were beyond the scope of the report. Nor was an attempt made to estimate option or preservation values (see Strand and Norton 1980, for a discussion of these concepts).

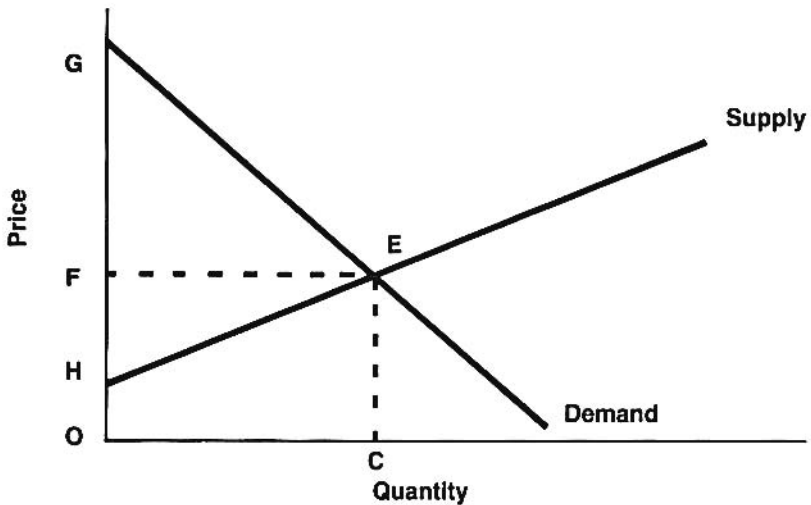


Figure 7. The conceptual basis for the estimation of net market value of sportfishing.

market revenue (FECO), the consumer surplus (net consumer benefit, GFE) and the producer surplus (net producer benefit, EFH) at equilibrium.

Usually, however, sportfishing does not take place in the limited access private market situation. Atlantic coastal states allow sportfishermen access to fishery resources without fees and thus there is not a direct access price associated with either the entire fishing trips or the fish. Therefore, implicit or derived prices must be used to determine the demand function. The most common approach to estimating the demand for sportfishing is through the use of trip costs. Variations in trips taken and cost of trips are used to examine implicitly how prices might influence trips.

For example, if striped bass fisherman A fishes five times a year and his trip costs are \$5 per trip, and striped bass fisherman B fishes two times when his trip costs are \$12 per trip, it is concluded from the travel cost approach that a fee of \$7 per trip imposed on fisherman A would reduce his trips from five to two. Such a comparison is warranted if A behaves like B when "price" is the same. This will occur only if A and B have the same tastes and income and face the same price for substitutes, and if other demand determinants are the same for each. Of course, these factors are not equal in practice and therefore the analysis must suitably account for these individual variations.

The consumer of the sportfishing trip is also the producer of the trip, and the estimated demand curve has both costs and willingness to pay

considered. The supply curve is normally assumed to be the average travel cost, and the area under the demand curve and above the supply curve is used as the measure of net benefits associated with the trip (Figure 8).

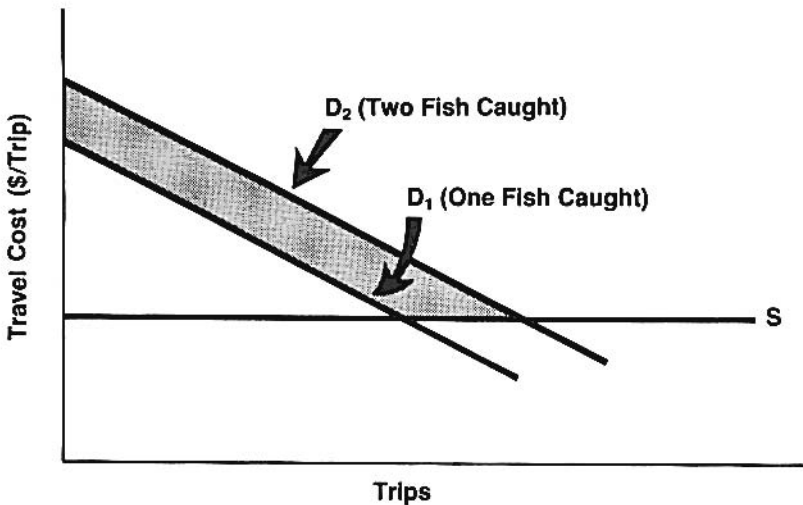


Figure 8. Benefits from additional catches per trip.

The problem remains, however, of determining what proportion of the benefits arise from catching the fish as compared to other desirable attributes of the fishing trip. One conventional method is to include the catch rate for the species along with cost in estimating number of trips. By observing how the demand curve shifts as catch rate changes, the researcher can determine how benefits change in response to catch rate changes. The area between the two curves in Figure 8 illustrates the increase in net benefits associated with a catch rate increase. One can thus determine how a change in creel limits (say from 2 fish to 1) will change the fisherman's net benefits from fishing or how much the catching of each fish is worth. Unfortunately, the number of fish caught during a trip is normally uncertain to the fisherman before the trip. The fisherman, therefore, must use an expectation of catch in making the decision of whether or not to go fishing. The expectation incorporates a subjective probability of catch, the accuracy of which depends mostly on the previous experience of the participant. If estimated actual catch is used to shift the demand curve shown in Figure 7, and the individual's expectation of catch is lower than actual catch, the measure of surplus is too low.

Estimated Net Value

Estimates were determined for the average recreational consumer surplus per trip for four regions: New England, Mid-Atlantic, Chesapeake and South Atlantic (see Snyder 1983, for details). The regions represent different types of fishermen. In New England, a summer/fall fishery exists in which many sportsmen sell their catch. The Mid-Atlantic fishery tends to be supported by a fall/spring migratory stock with shore fishing most prevalent. The Chesapeake is a year-round boat fishery with the large stripers not available in the summer and fall.

Table 16 contains the estimates of average daily consumer surplus per striped bass trip by region for 1980. The values ranged from \$169 per trip in the Mid-Atlantic to approximately \$39 per trip in the Chesapeake area. The representative New England and South Atlantic fisherman received a surplus of about \$86 and \$115 per trip, respectively. Differences relate to socio-economic characteristics, the type of fishing, the size of fish caught and other factors.

Table 16: Average consumer surplus per trip and marginal willingness to pay for the recreational experience of catching striped bass, by region, 1980¹

Region	Consumer Surplus per Trip	Marginal Willingness to pay for a Striped Bass per Trip
New England	\$ 86	\$2.23 (12.63) ²
Mid-Atlantic	169	7.44
Chesapeake	39	5.30
South Atlantic	115	1.34

¹Excludes sales value. See text for explanation and derivation of actual willingness to pay.

²Adjusted value, see text for explanation.

Also shown in Table 16 is the marginal willingness to pay for an additional striped bass per trip. These are the values that the sportfishermen would be willing to pay to have one additional fish on each trip. The value is derived by determining the individual's value of trips with the 1980 catch rate and with a marginal increase in the catch rate.

The rather low estimated value per fish in New England is not consistent with other information obtained in the analysis. The likely reason for this is related to the fact that many sport fishermen in New England sell their catch. The percentage of fishermen who reported selling their catch

ranged up to 90% in certain local geographic areas. The \$2.33 net value per fish estimated for New England fishermen may reflect only the recreation value associated with the fish. This is because the fishermen may discount the potential sales value of their catch when deciding to take the recreational trip. The uncertainty of catching fish may preclude sales considerations in the decision. Therefore, the actual net value associated with the recreational catch of striped bass in New England can be estimated as the net "sport value" plus the actual income from sales. Based on the survey, we estimate that up to approximately 60 percent of the fish caught by "recreational fishermen" in New England are sold. Considering an average weight of approximately 14.3 pounds per fish and a sales price of \$1.20 per pound, the additional weighted value per fish would be $.6 \times 14.3 \times \$1.20 = \10.30 . This, when added to the recreation value of \$2.33, gives a total net value in New England of \$12.63 per striped bass.

Although some of the recreational catch in other regions is sold, the survey results indicated the proportion of fish sold is likely not high enough to significantly affect the estimated net values. Therefore, no adjustments are made in the net value estimates for the other regions.

Total value of striped bass trips by state is shown in Table 17. These values are derived by multiplying the average consumer surplus of a striped bass trip from Table 16 by the estimated number of trips in the various states (Table 15). Based on value, the leading states are New York, New Jersey and Maryland. New York and New Jersey have relatively high numbers of trips and a large value per trip (\$169). On the other hand, Maryland has nearly twice as many trips as the next closest state but has a relatively low value per trip. In all, the 2 million striped bass fishing trips produced slightly under \$200 million dollars of net value or an average of about \$100 per trip.

These figures represent the value of trips taken by persons seeking or having caught striped bass. Sportfishermen often seek more than one species and gain satisfaction from boating and the outdoor aesthetics associated with the trips. To attribute the entire value of the trips to striped bass might seriously overstate the recreational benefits associated with only the catching of fish. To obtain an estimate of the value generated by the use of the resource, the marginal willingness to pay for striped bass (Table 16) was multiplied by the number of striped bass caught in the state (Table 15). The number reflects the catch in a state and the responsiveness of trips to catch. Because of the method used to estimate recreational demand, the recreational benefits vary proportionally to the catch (kept and released). This is important as the data on catch are not avail-

Table 17: Recreational trips and net value of striped bass sportfishing trips, by state and region, projected for 1980

	Trips ¹ (000)	Value of Striped Bass Sportfishing Trips (\$000)
New England	517	\$ 44,456
Maine	23	1,983
New Hampshire	17	1,498
Massachusetts	226	19,481
Rhode Island	182	15,694
Connecticut	67	5,800
Mid-Atlantic	610	103,089
New York	408	68,923
New Jersey	199	33,682
Delaware	3	484
Chesapeake Bay	934	36,131
Maryland	910	35,188
Virginia	24	943
South Atlantic	109	12,536
North Carolina	109	12,536
Total	2,170	\$196,212

¹Based on 1979 total trips and 1980 striped bass participation rates.

able for 1980. We thus used the 1979 published catch data. There are indications that the 1980 catch is substantially lower. When the NMFS publishes the official 1980 data, the recreational benefits can be adjusted by multiplying the 1979 benefits by a ratio of 1980 to 1979 catch.

Using the published information, the Chesapeake Bay and Mid-Atlantic regions received the most benefits with striped bass generating the largest recreational values in Maryland and New York. In all, \$8 million in net value can be directly attributed to recreationally caught striped bass (Table 18).

Commercial Benefits

The Measurement Concept

The same basic concepts described above can be applied to measure the benefits from commercial fishing, even though the marketing system

Table 18: Recreational catch and net value of striped bass caught, by state, 1979

Region State	Estimated Recreational Catch (\$000)	Estimated Net Value of Catch (\$000)
New England	185	\$2,337
Maine	17	215
Massachusetts	59	745
Rhode Island	44	556
Connecticut	65	821
Mid-Atlantic	290	2,157
New York	276	2,053
New Jersey	13	97
Delaware	1	7
Chesapeake	658	3,487
Maryland	649	3,440
Virginia	9	47
South Atlantic	38	51
North Carolina	38	51
Total	1,171	\$8,032

is more complex. For each marketing level (i.e., ex-vessel, wholesale and retail), a demand and supply curve could be estimated. The net value of the product to the demanders (i.e. ultimate consumers or middlemen) is the area under the demand curve but above the market price. This is shown as a consumer surplus, GFE, in Figure 7 on page 34.

It is possible that commercial fishermen gain net income from striped bass production and this is also considered. In Figure 7, when C pounds of fish are placed on the market, a price of F is negotiated. This results in consumers' surplus of GFE and watermen's revenues of FECO. In general, the watermen's surplus would be FEH. When watermen have a constant average expense per pound of striped bass harvested of F, there is no surplus to the watermen. A constant marginal cost less than F, would result in a positive producer surplus.

The Marketing Situation

As discussed earlier, institutional considerations are important in marketing striped bass and must be considered when estimating benefits.

Striped bass are obtained from the fishermen by local wholesalers and many are sold on consignment in the Fulton or Baltimore wholesale markets. Together, Baltimore and Fulton marketing represent about two-thirds of the reported commercial striped bass landings (Adriance 1982). Moreover, the industry in general uses either the Baltimore or Fulton market price to establish ex-vessel price for watermen (Yamashita 1982). Thus, events in the Baltimore and Fulton markets cannot be overlooked.

A second institutional factor is the market segmentation according to the size of fish. The Fulton Market has a 16" minimum size requirement and tends to receive the large striped bass. The Baltimore market, on the other hand, accepts 12" bass but cannot legally transfer striped bass that exceed 32". It, in general, receives small striped bass.

In the southern region (Delaware to North Carolina), primary wholesalers take fish on consignment and sell them to local retailers or to the central wholesalers in the Baltimore or Fulton market. Size and volume of the catch, and the availability of local markets are prime determinants of how much product is distributed to the various wholesale markets. The product then flows through retailers to the consumers. Small volumes in New York are processed (filleted or steaked) but the majority of New York retailers and nearly all Baltimore retailers sell whole (gutted/scaled) fish. The northern (north of Delaware) landings move in a similar pattern except the Baltimore market is not a primary market for the product. Volume not sold locally goes through the Fulton Market before reaching the consumer. The central markets both facilitate transfer of the product and provide a mechanism through which prices are established.

Through discussion with numerous fishermen and dealers, a model of price determination was derived. Monthly landings are considered a function of factors (e.g. seasonal availability) not related to price. The sales to wholesale markets primarily are a function of fish size and location of landings. Price determination appears to occur in the following manner:

- Quantity landed—(predetermined) based on factors such as weather, previous investments, work habits or availability of fish, rather than striped bass prices
 - Wholesale market quantity—based on landings and size of fish
 - Retail price—based on consumer preferences, retail quantity, substitute price, and income
 - Wholesale price—based on retail price, wholesale quantity and availability of other fish

- Ex-vessel price—based upon wholesale prices, landings and availability of local market alternatives.

The Statistical Model

In order to test whether this abstract system as shown is a reasonable description of short run behavior in the market, monthly data were gathered to determine whether these relationships were statistically significant. Baltimore and Fulton receipt data, as well as landings and landed value data, all collected by NMFS, were used. Seemingly unrelated regression was used to estimate coefficients of the model.

The results of the estimated system are shown in Tables 19 and 20. Quantity received in the Fulton Market from the northern region (north of Delaware) is correlated with landings in the region as are southern receipts and southern landings (Table 19). Prices at the various levels of marketing appear to be strongly influenced by sales within the market and the price established in the next higher market (Table 20). For southern ex-vessel price for the period 1976-1979, the Fulton wholesale price was a stronger determinant than was the Baltimore wholesale price. For a longer period (1972-1979), however, Baltimore prices were influential in determining southern ex-vessel prices. The difference may relate to the changing age structure of the striped bass population.

The coefficients shown in Tables 19 and 20 were used to estimate the commercial consumer and producer surplus generated by East Coast striped bass. An application of the theory of multi-market welfare¹⁰ was carried out based on the above estimates. When the price in the next higher level market is included as a right hand side variable in estimating a given market level price (e.g. the Baltimore wholesale price equation which has the Baltimore retail price in it), the area, GEF in Figure 7, represents the surplus to the buyers in *that* given market level. For price equations in which the next higher market price is not included, an area analogous to GEF represents surplus to participants in *all* market levels from buyers in that market up the chain. Thus, the Fulton price equation captures surpluses of both the ultimate consumer and retailer whereas the Baltimore wholesale price equation captures only the retailers' surpluses. To get consumers' surpluses in Baltimore, the retail price equation must be used.

The reported preliminary landings for 1980, which totaled 4,566 thousand pounds, were used to determine surpluses in the Fulton and Balti-

¹⁰See Just et al. (1982) for a complete discussion of multi-market welfare.

Table 19: Regression results for monthly quantity received in the Fulton and Baltimore markets, as related to regional landings, 1976–1979

Market	Dependent Variable (000's)	Constant	Independent Variables		
			Northern Landings (000's)	Southern Landings (000's)	Summer Dummy (1 = summer mos.)
Estimated Coefficients					
Fulton	Quantity Received from Northern States	51.6	.26 (5.73) ^t		148.8 (6.63)
	Quantity Received from Southern States	6.54		.43 (18.37)	
Baltimore	Quantity Received from Southern States	16.2		.18 (14.11)	

^t—Values shown in parentheses

more markets. Equations in Table 19 were used to predict that, out of the 4,566 thousand pounds, there would be a flow of 543 thousand pounds to the Baltimore market and 2,857 thousand pounds to the Fulton market. For the Baltimore market, this generated surpluses of \$179 thousand to retail consumers and \$82 thousand to retailers. The volume passing through the Fulton market is estimated to have generated \$1,260 thousand to retailers and consumers in 1980. The total benefits therefore of the 3,400 thousand pounds going through these two markets is \$1,522 thousand. These fish represented 74% of the total 4,566 thousand pounds harvested.¹¹

The remaining 1,166 thousand pounds are not accounted for in the model because data do not exist on their ultimate use and price. The

¹¹Ex-vessel price equations indicated there were no surplus profits to the wholesalers of striped bass.

Table 20: Regression results for striped bass price equations for various market levels, 1976-1979

Dependent Variable- Deflated Price (1967 \$/lb)	K	Independent Variables					
		Market Sales (000 lbs)	Baltimore Retail Price (\$/lb)	Fulton Wholesale Price (\$/lb)	Spring Dummy (1-Spring)	Income (\$000/ CAP)	Substitute Good Price (Index)
Estimated Coefficients							
Baltimore Retail	1.18	-.0035 (5.15) ¹			.29 (3.23)		
Baltimore Wholesale	.52	-.0016 (7.15)	.18 (4.58)				
Southern Ex-Vessel	.04			.53 (12.08)			
Fulton Wholesale	-.83	-.0015 (8.45)			.006 (.12)	.49 (1.98)	.00030 (.29)
Northern Ex-Vessel	.18			.38 (5.78)			

¹t-values shown in parenthesis
K = Constant

equation for northern shipments to Fulton accounts for nearly all northern landings and therefore, the remaining volume is considered to be landed by the southern states. These are either marketed in other central markets such as Philadelphia or Newport News or in local retail outlets. Using the Baltimore retail price coefficient (- .0035) and assuming these fish go through one market in the same seasonal distribution as southern landings, we calculated benefits of \$1,191 thousand.¹² The total benefits to consumers, retailers and wholesalers generated in 1980 reported landings is therefore \$2,713 thousand.

¹²An alternative assumption concerning disposition and surplus of these uncounted fish is that they yield the same average surplus per pound as fish passing through the Fulton and Baltimore markets. In this case, the benefits from these fish are calculated to be \$521 thousand.

The only remaining group to be considered is the commercial fishermen. The cost and revenue data of the Commercial Fishery chapter show that fishermen in southern states reported no revenues in excess of total costs. No surplus profit to fishermen is therefore estimated for southern fishermen. The hook and line fishery of New England, however, reported approximately \$.21/pound surplus. This figure is used to calculate surplus generated by the reported northern landings (1475 thousand pounds) as \$772 thousand in 1980.

The total net economic benefits from reported 1980 landings is estimated to be \$3,485 thousand (Table 21). The total is distributed to various

Table 21: Recreational and commercial net value of striped bass use by state and region, 1980

Region/State	Recreational Value ¹ (\$000)	Commercial Value (\$000)	Total Value (\$000)
New England	2,337	842	3,179
Maine	215	—	215
Massachusetts	745	780	1,525
Rhode Island	556	19	575
Connecticut	821	43	864
Mid-Atlantic	2,157	580	2,737
New York	2,053	547	2,600
New Jersey	97	22	119
Delaware	7	11	18
Chesapeake Bay	3,487	1,747	5,234
Maryland	3,440	1,410	4,850
Virginia	47	337	384
South Atlantic	51	316	367
North Carolina	51	316	367
Total	8,032	3,485	11,517

¹Recreational value based on 1979 catch.

states on the basis of landings and therefore is not necessarily of benefit to those states' residents. That is, many New York City or Connecticut consumers receive benefits from landings in the Chesapeake and in Table 21 these benefits are attributed to the Chesapeake, where landings occurred,

not where the benefits were derived. The fishermen benefits were distributed only to the northern states because no surpluses were observed for the southern fishermen.

One must recall, however, that the reported landings in 1980 were only a third of the reported record landings in 1974 of 14.7 million pounds. To show the benefits associated with a record year, we determined benefits in the Baltimore market for 1974 reported shipments. The Baltimore market benefits in 1974 were \$6.4 million or nearly 25 times the benefits estimated for 1980. This figure alone represents 50 percent of all 1980 recreational and commercial benefits.

Table 21 also summarizes the total net benefits generated by recreational and commercial users. On a regional basis, the New England and Mid-Atlantic areas each generated about 25% of the total. The Chesapeake region represented about 45-50% of the total, and the South Atlantic about 5%. The contribution of each region's sector was reasonably consistent. For example, recreation in the Chesapeake Bay contributed 43% of the total recreational benefit whereas commercial Chesapeake production represented 50% of the entire commercial benefits. The total net benefits to users of striped bass is estimated to be \$11.5 million in 1980.

The authors recognize the potential for underestimating landings and landed value due to possible under-reporting or the lack of coverage in all areas. The commercial benefits derived, therefore, are possibly underestimated and care should be taken when comparing recreational and commercial data.

Economic Impact Of the Striped Bass Fisheries

THE GENERAL CONCEPT of regional economic impact analysis is based on determining both the interrelationships among industry or economic sectors in a given geographic area, and the interaction between economic activity in that area and economic activity outside the area. The objective of regional impact analysis is to determine the change in total economic activity that is generated from an initial change in expenditure.

Some key considerations in measuring economic activity changes are:

- What is the initial change in expenditure?
- In what economic sector(s) does the change in expenditure take place?
- What is the rate of spending by the economic sector(s) in the geographic area of interest as compared to "leakages" or expenditures outside the area?
- How is the spending by the initially affected sector(s) distributed among all economic sectors in the area?

The completed regional economic analysis, then, yields the estimated dollar amount of economic activity changes after all the effects of an initial change in expenditure are dissipated throughout the economy of the geographic area.

For example, assume a sport fisherman who is from a non-coastal area travels to a coastal area to fish for striped bass. While he is in the coastal area he buys \$20 worth of gasoline for his car from a local service station. This \$20 can be considered as an initial increase in expenditure in the coastal area. Assume further that the service station operator re-spends the \$20 dollars as follows:

- a. Eleven dollars for the gasoline to a wholesaler/refinery located outside the coastal area
- b. Two dollars to hired workers who live in the local area
- c. One dollar for upkeep on the station (to a local painter and a local plumber)
- d. Two dollars to a local utility company
- e. One dollar to the local landlord who owns the service station property
- f. One dollar for federal and state taxes
- g. Two dollars to the local grocery store for groceries for his family

Now it can be seen that of the \$20 initial increase expenditures, \$12 (a and f) will immediately flow outside of the local area as "leakage. The remaining eight dollars (b,c,d,e and g) have been respent in the coastal area and are available to those represented in b,c,d,e and g for further respending. Some of the further respending will be in the local area, and the remainder will flow outside of the area.

At this point, considering only the first set of respending activity by the station operator, we can see that the initial \$20 increase in expenditure has resulted in total spending in the local area of \$28 (the initial \$20 plus the \$8 respent in the area by the operator). Therefore, even at this early stage of the spending and respending that will take place as a result of the initial change in expenditure, the multiplier effect is 1.4. The multiplier is derived by dividing the initial change in expenditure of \$20 into the total new economic activity at this point of \$28.

Of course, additional respending will take place with the eight dollars still remaining in the local area. The initial \$20 could generate \$25, \$30 or even \$40 more in additional economic activity. This would represent multipliers of 2.25, 2.5, or 3.0 respectively. The higher the multiplier, the greater the effect an initial expenditure will have on the local community.

It is clear that the total economic effect (as expressed through the multiplier) of an initial change in expenditures depends greatly upon the "leakage" out of the local area. In the example above, if the wholesaler/refinery in (a) is located in the local coastal area, a much larger proportion (\$19 of the \$20) of the initial expenditure would remain in the local area to be used for stimulating local income and employment.

Methods

The purpose of the impact phase of this study was to measure the economic activity, as described above, associated with the existence of the striped bass commercial and recreational fisheries. The study covered the 10 coastal states from Maine through North Carolina. The states were divided into coastal and non-coastal areas. The coastal area was specified as the two-county wide band of counties along the coast. This resulted in two areas (coastal and non-coastal) in all states except Rhode Island and Delaware, which are defined as coastal in their entirety.

The approach used for the analysis was the "Harris Model" (See Harris 1973; and Harris and Norton 1978). As indicated in Harris and Norton, the principal driving force of the model is a set of industry location equations that explain changes in output by county. The explanatory

variables are: a partial measure of location rent, which accounts for the marginal transportation cost of shipping goods out of each region, the marginal transportation costs of obtaining inputs at the place of production, the cost of labor, the value of land, prior investment, prior production, demand and input scarcity. Included are equations to explain population migration, with the explanatory variables being wage rates, changes in employment and the amount of labor surplus or deficit. Based on these parameters, the changes in income, employment and output resulting from an initial change in economic activity can be estimated.

In order to use the model, it was necessary to obtain extensive information through personal field interviews and published and unpublished data. It was necessary to identify not only the amount of expenditures associated with the striped bass commercial and recreational fisheries but also where (coastal vs. non-coastal) and in which economic sectors it was spent. The expenditures derived from the field interviews were classified and divided among eleven economic sectors: fishery, hotels and other lodging, personal and repair service, amusements and recreation, water transportation, food stores, gas stations, eating and drinking establishments, miscellaneous retail stores, state and local government, and federal government.

As implied by the latter two sector categories, it was necessary to obtain estimates of state and federal administration, research and enforcement expenditures on the striped bass resource.

Estimated Impacts

For the purpose of this analysis the economic impacts associated with three alternative situations were estimated:

- Scenario I: The commercial and recreational striped bass fisheries as they existed in 1980
- Scenario II: The commercial and recreational striped bass fisheries as projected to result from the management changes recommended in the Atlantic States Marine Fisheries Management Plan for Striped Bass
- Scenario III: The hypothetical commercial and recreational fisheries that could have existed in 1980 if the striped bass stock size would have been as large as it was in the early 1970s

The economic activity in terms of generated output and employment changes was estimated for each of these scenarios.

Scenario I

The basis for this scenario was the striped bass commercial and recreational fisheries as they existed in 1980. The recreational and commercial fishery data from the previous chapters formed the primary input for this analysis. Specifically, we used the recreational trip expenditures calculated from our 1980 supplementary survey, and commercial value of the harvest by county as reported by the National Marine Fisheries Service and supplemented by information for state agencies.

Table 22 is a summary of the estimated economic impact in the coastal areas of the commercial and recreational striped bass fisheries in 1980. Total direct expenditure associated with these fisheries was about \$90 million in the coastal areas of the 10 states covered in this study. It is difficult to specify the breakdown of these expenditures between commercial and recreational fisheries because of the sharing of port facilities in some areas, and primarily, because in some areas recreationally caught fish are sold and therefore enter the commercial channels, creating income and employment in the commercial fisheries sector.

Table 22: Estimated coastal area economic impacts of striped bass commercial and recreational activity: Scenario I.

Region	1980 Expenditures (\$000)	Associated Total Output (\$000)	Economic Activity Multiplier	Jobs	Expenditure per Job Created
New England	\$26,630	\$ 60,775	2.29	1,888	\$14,105
Mid-Atlantic	36,259	82,323	2.20	2,245	16,151
Chesapeake	23,993	48,706	2.03	1,214	19,764
South Atlantic	2,946	8,491	2.88	330	8,927
Total	\$89,828	\$200,295	2.24	5,677	\$15,823

As is indicated in Table 22, the initial expenditures of \$90 million in the coastal areas of these 10 states generated a total of over \$200 million of economic output and employment of more than 5600 people. The economic activity multiplier ranges from 2.03 in the Chesapeake region to 2.88 in North Carolina. The relatively low multiplier in the Chesapeake may be a reflection of the fact that there are no major refineries in Maryland and thus much of the fuel expenditures flow directly out of the

state to other regions. The multipliers indicate that each dollar spent by sport or commercial fisheries generates a total of two to three dollars of additional economic output in the coastal areas of the states covered in this study.

The last column in Table 22 indicates that increase in expenditures on striped bass necessary to create one more job in the coastal areas. The expenditure required ranges from about \$9,000 to \$20,000.

If the expenditures on the striped bass commercial and recreational fisheries in 1980 had somehow been eliminated, total output in the coastal areas of the four regions could have been diminished by \$200 million, and up to 5677 people would have lost their jobs in the sectors affected by the striped bass fisheries.

There are additional effects on the non-coastal areas. Under Scenario I, these non-coastal generated effects were estimated to be \$32.7 million of output and 1050 associated jobs. Therefore, in general, for the 10 states considered in this study, the non-coastal effects on output and jobs was about 20% of the coastal area effects. This means that for every six dollars generated on the coast, an additional one dollar of output is generated in the non-coastal areas. Similarly, for every five jobs generated in the coastal counties by the existence of the striped bass fisheries, an additional job is generated in the non-coastal counties. Even though the economic activity associated with striped bass is primarily concentrated in the coastal areas, the non-coastal areas of the states derive considerable economic activity from the striped bass fisheries.

Scenario II

The analysis for Scenario II was based on the Striped Bass Management Plan adopted by the Atlantic States Marine Fisheries Commission. The principal changes are in the minimum size of striped bass commercial and recreational fishermen may keep. The purpose of the increased minimum sizes is to allow more fish to spawn in the hopes that the overall stock size will increase. The management plan specifies the general effects the new regulations are expected to have on recreational and commercial catches in the Chesapeake and non-Chesapeake regions. Using these changes and the implied effects on expenditures, the Harris Model was re-run to reflect this scenario. As is indicated in Table 23, the overall effect of the proposed management plan, assuming a new equilibrium is established, will be an increase in output of almost four million dollars in the 10 states and an increase in employment of 63 people. The positive changes in the New England, Mid-Atlantic and South Atlantic regions come at some expense to

the Chesapeake region. However, it is important to note that if the proposed plan is necessary to protect and preserve the existence of striped bass commercial and recreational fisheries in the Chesapeake, this region is better off with the plan results than with no striped bass fisheries.

Table 23: Differences in estimated economic impact for alternative scenarios

Region	Effects of Management Plan ¹		Effects of Larger Striped Bass Population ²	
	Impact (\$000)	Jobs	Impact (\$000)	Jobs
New England	+ 4,580	+ 151	+ 78,119	+ 2,477
Mid-Atlantic	+ 4,427	+ 159	+ 105,238	+ 2,974
Chesapeake	- 6,080	- 257	+ 24,074	+ 1,607
South Atlantic	+ 931	+ 10	+ 11,065	+ 438
Total	+ 3,858	+ 63	+ 218,496	+ 7,496

¹This is the estimated economic impact of changes in catch predicted by the Atlantic States Marine Fisheries Commission if the Proposed Commission Striped Bass Management Plan is adopted (see Appendix A of the Commission Plan).

²This is the estimated additional output and jobs generated if the striped bass commercial landings and recreational trips had been in 1980, what they were in 1974.

Scenario III

As is indicated in Table 23, if the Striped Bass stock level had been in 1980 what it was in the early 1970s, the four regions would have gained \$220 million in output and 7500 jobs. These numbers can be used as a general indication of the loss in economic activity as a result of the decline in the striped bass resource since the early 1970s.

Summary

THE RESULTS OF a comprehensive review and analysis of the 1979-1980 North Atlantic striped bass fishery indicate a wide breadth of activity associated with an economically valuable resource. Harvest seasons, methods and costs illustrate the geographic diversity in commercial production. The predominant summer and early fall catches in New England are accomplished with hook and line and cost approximately \$1.70 per pound. Peak harvests in late fall, winter and spring by Chesapeake gill netters cost approximately \$1.20 per pound. Chesapeake commercial catch is generally comprised of smaller fish than occur in New England. Additionally, the recreational fishery captures substantial numbers of stripers from a variety of access points including private and party boats. The distinction between commercial and recreational fishing is obscured in New England and parts of the Mid-Atlantic due to the large percentage of "recreationally caught" striped bass which are sold to wholesalers and therefore enter the commercial market channels.

The economic benefits generated from 1980 commercial and recreational harvest of striped bass were substantial, even for the relatively low stock levels during that year. For the ten states from Maine to North Carolina, a total net economic value of nearly \$12 million was generated. Slightly over two-thirds of the total was associated with recreational harvest while the remainder arose from commercial harvest. Care must be exercised in comparing commercial and recreational benefits, however, because the commercial harvest data are reputed to be substantially underreported, leading to potential underestimates of commercial benefits.

It was also found that consumer benefits in the Baltimore market were nearly 25 times larger in 1974 than in 1980, even though the annual marketings were only three times larger. This suggests substantial returns from policies or research which increases production.

In addition to the net benefits generated for society in general, the striped bass fisheries produce important income and employment opportunities in the coastal areas. The 1980 commercial and recreational striped bass fisheries resulted in \$90 million direct expenditures in the coastal areas of the 10 states. These direct expenditures generated a total direct and indirect contribution in the coastal areas of over \$200 million in economic output and employment for over 5600 people.

Although most economic impacts occur in the coastal counties, the study shows that there are also important non-coastal area impacts. For every six dollars of output and five jobs created in the coastal counties, striped bass fishing creates an additional one dollar and one job in the non-coastal areas.

The study indicates that up to \$218 million of economic activity and 7500 jobs may have been lost to the coastal areas of the 10 states as a result of the decline of the striped bass resource since the early 1970s. Furthermore, although other regions gain relative to the Chesapeake regions as a result of the proposed Atlantic State Marine Fisheries Commission Striped Bass Management Plan, there is a net gain in economic activity and jobs in the four regions combined.

References

- ADRIANCE, J.G. 1982. A Market Model for the North Atlantic Striped Bass Industry. M.S. Thesis. Department of Agricultural & Resource Economics, University of Maryland.
- ATLANTIC STATES MARINE FISHERIES COMMISSION. 1982. Interstate Fisheries Management Plan for the Striped Bass of the Atlantic Coast from Maine to North Carolina. Prepared by the State of Maryland, Department of Natural Resources.
- BERGGREN, T.J. and J.T. LIBBERMAN. 1978. Relative Contribution to Hudson, Chesapeake, and Roanoke Striped Bass, *Morone saxatilis*, Stocks to the Atlantic Coast Fishery. U.S. Fish. Bull. 76:335-345.
- HARRIS, C.C. 1973. The Urban Economics, 1985: A Multiregional, Multi-Industry Forecasting Model. Lexington Books, Lexington, Mass.
- HARRIS, C.C. and V. J. NORTON. 1978. The role of economic models in evaluating commercial fishery resources. Am. J. Ag. Econ. 60(5): 1013-1020.
- HIETT, R.L. and D.N. GHOSH. 1977. A Recommended Approach to the Collection of Marine Recreational Finfishing and Shellfishing Data on the Pacific Coast. Human Sciences Research, McLean, Va.
- JUST, R.E., HUETH, D.L. and A. SCHMITZ. 1982. Applied Welfare Economics and Public Policy. Prentice Hall. Englewood Cliffs, N.J.
- KOHLNSTEIN, L.C. 1980. Aspects of the Population Dynamics of Striped Bass (*Morone saxatilis*) Spawning in Maryland Tributaries of the Chesapeake Bay. Ph.D. Dissertation JHU. JHU/PPSE T-14.
- MCCONNELL, K.E. and T. P. SMITH. 1979. Marine Recreational Fishing in Rhode Island. University of Rhode Island Marine Memorandum 62, Kingston, R.I.
- NATIONAL MARINE FISHERIES SERVICE. 1980. Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coasts, 1979. Current Fishery Statistics Number 8063.
- SCOTT, A. 1955. The fishery—the objectives of sole ownership. J. Pol. Econ. April:116-124.
- STRAND, I.E. and V. J. NORTON. 1980. Economic Information Needs in the Management of the Striped Bass Resource. Reprint to the Northeast Regional Office of the National Marine Fisheries Service, Gloucester, Mass.
- STRAND, I.E., V.J. NORTON and J. ADRIANCE. 1980. Economic Aspects of Commercial Striped Bass Harvest. In H. Clepper ed. Fifth Annual Marine Recreational Fisheries Symposium. Boston, 1980. Sport Fishing Institute.
- SNYDER, R.R. 1983. Specification Errors and Surplus Values for Recreational Striped Bass Fishing. M.S. Theses. Department of Agricultural & Resource Economics, University of Maryland.
- WILLIG, R.D. 1976. Consumer surplus without apology. Am. Econ. Rev. 66(4):589-597.
- YAMASHITA, V.F. 1982. Marketing of Striped Bass in the Chesapeake States of Maryland and Virginia. M.S. Thesis. Department of Agricultural and Resource Economics, University of Maryland.

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