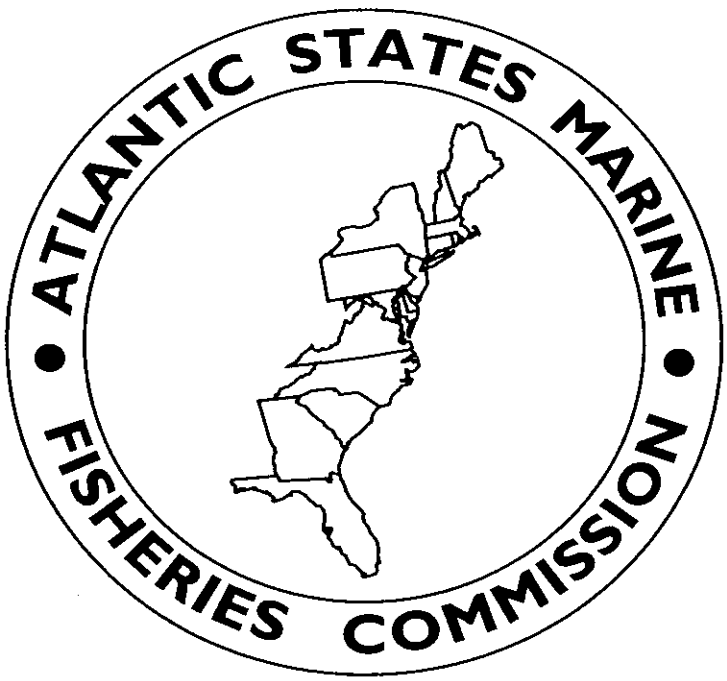
Fishery Management Report No. 28
of the

Atlantic States Marine Fisheries Commission



Fishery Management Plan for Black Sea Bass

Prepared Jointly with the Mid-Atlantic Fishery Management Council

October 1996

Atlantic States Marine Fisheries Commission

Fishery Management Report No. 28

Fishery Management Plan for Black Sea Bass

and

Mid-Atlantic Fishery Management Council

Amendment 9 to the Summer Flounder Fishery Management Plan:

The Fishery Management Plan for Black Sea Bass Fishery

October 1996

prepared by:

Mid-Atlantic Fishery Management Council

and the

Atlantic States Marine Fisheries Commission,

in cooperation with the

National Marine Fisheries Service,

New England Fishery Management Council, and

South Atlantic Fishery Management Council

2. SUMMARY

This Fishery Management Plan for the Black Sea Bass Fishery (FMP), prepared by the Mid-Atlantic Fishery Management Council (Council) and the Atlantic States Marine Fisheries Commission (ASMFC, Commission), is intended to manage the black sea bass (*Centropristis striata*) fishery pursuant to the Magnuson Fishery Conservation and Management Act of 1976, as amended (MFCMA) and the ASMFC Interstate Fisheries Management Program Charter. The management unit is black sea bass in US waters in the western Atlantic Ocean from Cape Hatteras, North Carolina northward to the US-Canadian border. The objectives of the FMP are to:

1. Reduce fishing mortality in the black sea bass fishery to assure that overfishing does not occur.
2. Reduce fishing mortality on immature black sea bass to increase spawning stock biomass.
3. Improve the yield from the fishery.
4. Promote compatible management regulations between State and Federal jurisdictions.
5. Promote uniform and effective enforcement of regulations.
6. Minimize regulations to achieve the management objectives stated above.

Overfishing for black sea bass is defined as fishing in excess of the F_{max} level. Based on current conditions in the fishery, F_{max} is 0.29 (an annual exploitation rate of 23%).

The recovery strategy calls for minimum fish sizes and commercial gear regulations in year 1 (1996) and 2. In years 3 to 5, target exploitation rates would be 48% for black sea bass. In years 6 and 7, the target exploitation rates would be 37% and in year 8 and subsequent years, the target exploitation rate would be based on F_{max}.

The following is a summary of the management measures adopted by the Council and Commission to implement the fishing mortality rate reduction strategy (a complete description of the adopted management measures is in section 9.1):

<u>Management measures for all years</u>

1. Operator permits for commercial and party and charter boats.
2. Vessel permits for party and charter boats.
3. Vessel permits for commercial vessels (permits to sell) under a moratorium on entry of additional vessels into the fishery. Vessels with documented landings of black sea bass for sale between 26 January 1988 and 26 January 1993 qualify for a moratorium permit to land and sell black sea bass under this moratorium program.
4. Dealer permits (permits to purchase).
5. Permitted vessels may only sell to permitted dealers.
6. Party and charter boat, commercial vessel, and dealer reports.
7. The hinges and fasteners of one panel or door in black sea bass pots or traps must be made of one of the following degradable materials:
   a. untreated hemp, jute, or cotton string of 3/16" (4.8 mm) diameter of smaller;
   b. magnesium alloy, timed float releases (pop-up devices) or similar magnesium alloy fasteners; or
   c. ungalvanized or uncoated iron wire of 0.094" (2.4 mm) diameter or smaller.
8. A maximum size of 18" diameter for rollers used in roller rig trawl gear.
9. Special management zones around artificial reef areas.

Management Measures for Years 1 and 2

1. A 9" total length (TL) minimum fish size in all fisheries. Black sea bass less than 9" TL could not be sold.

2. The minimum otter trawl mesh size for vessels retaining more than 100 lbs of black sea bass would be 4.0" or 3.5" square (stretch mesh inside measure).

3. Black sea bass pots would be required to have a minimum escape vent of 1 - 1/8" X 5 3/4", 2.0" in diameter, or 1.5" square. The escape vent provision would be implemented at the start of the first calendar year following FMP approval so the fishermen would not be required to pull their pots and rebuild them in the middle of the season.

Management Measures for Years 3 and Subsequent

1. Prior to year three and annually thereafter, the Council and Commission, working through a joint Monitoring Committee, would evaluate the success of the FMP relative to the overfishing reduction goal and propose adjustments to the management system. Beginning with year three, additional measures include:

   a. A commercial quota with Federal permit holders being prohibited from landing (selling) after the quota had been landed. Quota overruns would be deducted from the subsequent year. All states are required to prohibit black sea bass sales from state waters following federal sales prohibition.

   b. A coastwide possession limit, season, and recreational harvest limit.

2. The minimum fish size, minimum mesh size and threshold, escape vent size, possession limit, and recreational season could be adjusted annually through framework action.

TABLE OF CONTENTS

4. INTRODUCTION

4.1. DEVELOPMENT OF THE PLAN

The Council began development of a fishery management plan (FMP) for black sea bass in 1978. Although preliminary work was done to support the development of an FMP, a plan was not completed.

In January 1990, the Council and the Atlantic States Marine Fisheries Commission (Commission) began development of a fishery management plan for black sea bass as an amendment to the Summer Flounder FMP. However, development of a black sea bass plan was delayed through a series of amendments to the Summer Flounder FMP and work on a separate Black Sea Bass FMP was not resumed until 1993.

In 1996, the National Marine Fisheries Service (NMFS) requested that black sea bass regulations be incorporated into another FMP to reduce the number of separate fisheries regulations issued by the federal government. As a result, the Council Black Sea Bass FMP was incorporated into the summer flounder regulations as Amendment 9 to the Summer Flounder FMP. The Commission approved the Black Seabass FMP as a separate FMP, not as an amendment to the Summer Flounder FMP.

4.2 PROBLEMS FOR RESOLUTION

4.2.1. Black Sea Bass are Overexploited

Commercial landings of black sea bass have declined dramatically from the peak landings of 22 million pounds reported in the 1950's. In fact, commercial landings in 1994 were about 2.0 million pounds, or about 60% of the 1983-1994 average of 3.4 million pounds. In addition, recreational landings were 2.9 million pounds in 1994, lower than the 1983-1994 average of 3.8 million pounds.

Landings-per-unit-effort (LPUE) from the Mid-Atlantic trawl fishery has been used as an index of abundance for black sea bass. Standardized LPUE, defined as metric tons per days fished for trips landing more than 25% black sea bass, peaked at 11.3 in 1984, and then declined to a low of 1.6 in 1992. Standardized LPUE increased slightly to 3.2 in 1993 (NEFSC 1995).

The NEFSC has conducted a spring and autumn offshore survey for a number of species, including black sea bass, since 1972. The spring offshore survey has been used as index for black sea bass recruits (fish longer than 20 cm SL) and the autumn inshore survey data as an index of pre-recruits (fish less than 11 cm SL). The spring recruit index was generally high in the late 1970's, ranging from 2.0 to 6.09 fish per tow. The spring index declined from 6.09 fish per tow in 1977 to a low of 0.2 per tow in 1982. More recently the spring index was 0.87 in 1993 and declined to 0.28 in 1994 (NEFSC 1995). The fall pre-recruit indices show a similar trend (i.e., relatively low recent values compared to the mid-1970's).

Analyses conducted by the NEFSC indicate a strong correlation between the fall pre-recruit index and commercial catch per unit effort in the trawl fishery (NEFSC 1993). The index for pre-recruits indicated that above average year classes were produced in 1977, 1982, and 1986. Recruitment for 1992 and 1993, based on this index, was well below average (NEFSC 1995). Recruitment was above average in 1994.

Based on current conditions in the fishery, yield per recruit analysis indicates that F_{max} for black sea bass is 0.29 (NEFSC 1995). Based on the results of a virtual population analysis, the fishing mortality rate was 1.05 in 1993 (an annual exploitation rate of 60%) . This, coupled with the above information, that is, the decline in landings, reduced LPUE, and low survey indices, indicates that black sea bass are overexploited.

4.2.2. Mixed Species Fishery

The Mid-Atlantic mixed species trawl fishery relies principally on summer flounder, *Loligo* squid, scup, and whiting, but also harvests significant quantities of black sea bass, winter flounder, witch flounder, yellowtail flounder, and other species either as bycatch or in directed fisheries. Many of these species are also principal components of the southern New England trawl fisheries since stock migrations occur between the Mid-Atlantic Bight and this area.

Generally, fishing activity follows these species as they make annual migrations from south to north and from offshore to inshore waters. Fishing effort is concentrated northerly and inshore in summer when a wide range of vessels have access to the stocks. In winter, effort is concentrated southerly and offshore, primarily by larger vessels. Although the majority of landings are taken by otter trawls, black sea bass are landed by many other types of fishing gear including pots, traps, and hand lines. At any particular time, fishermen may target a single species with certain gear, but significant bycatch of other species usually occurs in conjunction with the targeted species, depending on the fishing technique.

The occurrence of black sea bass and other species in commercial catches of the Mid-Atlantic and southern New England regions complicates the identification of appropriate and effective management strategies. Close coordination of regulatory measures is therefore necessary to properly manage this species assemblage.

The Council and Commission have included no measures in this FMP at this time to specifically address the mixed trawl fishery problem, although the Council and Commission considered the implications of the mixed trawl fishery when developing the proposed measures. The Council is working to develop a mixed trawl fishery management strategy and the framework management measures put in place through this FMP could be used to implement the measures developed through this process.

4.2.3. Increased Fishing Pressure

Nearly all the major groundfish fisheries in New England (haddock, yellowtail flounder, redfish, cod, etc.) have had their stocks severely depleted or have current catch levels which exceed long term potential catch (USDC 1990). There have also been declines in South Atlantic and Gulf of Mexico fishery resources. Consequently, it is probable that more effort will be directed towards black sea bass, exacerbating current problems of high exploitation rates. Because of the potential for an increased number of entrants into the fisheries, increases in effort by present participants, as well as technological advances that have increased the efficiency of gear, there is a need to limit and reduce effort in the black sea bass fishery.

4.2.4. Lack of Uniform Management

The highly migratory nature of black sea bass complicate the development of management strategies since fishing activities in the EEZ or waters of a few states could adversely impact the stocks. The SAFMC Snapper/Grouper FMP contains a 8" TL minimum size limit for black sea bass in the South Atlantic EEZ, but no regulations for black sea bass exist for the New England or Mid-Atlantic EEZ. In addition, although several states have minimum size limits for black sea bass, no unified approach currently exists to protect this valuable species in state waters.

4.2.5. Inconsistent and Inadequate Enforcement

There is a lack of uniform regulations affecting the black sea bass fisheries which is partly due to the inconsistent regulations among states and between states and federal jurisdictions. FMP advisors report a lack of consistency in enforcement between states, the EEZ, and/or parts thereof, due to various interpretations of the rules by enforcement officers, which led to confusion and resulted in fishermen seeking ways to avoid the rules. Adequate funding at the state and federal level for enforcement personnel, training, and equipment is problematic. In addition, sanctions resulting from noncompliance with regulations are insufficient to encourage industry compliance with state and federal laws. Permit sanctions combined with fines are likely to be a more effective deterrent than fines alone.

Effective enforcement requires that fishery participants perceive both the likelihood of enforcement contact and the application of standards to be uniform throughout the management unit. The perception of fairness is essential in the promotion of voluntary compliance. Proper training of fishery enforcement officers is important in this regard.

4.2.6. Lack of Data
National Standard 2 states that "measures shall be based upon the best scientific information available." Although recreational and commercial catch data for black sea bass are adequate to formulate and implement management measures, data collection should be improved. An improved data base will allow the Council to more finely tune the management system to the needs of the fishery. These data are necessary to assess the impact and effectiveness of management measures, as well as monitor reductions in fishing mortality and increases in stock size to determine if additional amendments to the FMP will be necessary. For example, the absence of a permit to sell requirement in some states, which allows direct sale of catch to retail establishments by fishermen, may result in under reporting of commercial landings that complicates the development, implementation, and enforcement of fishery management strategies.

4.2.7. Habitat Degradation

Black sea bass are continental shelf species that spend significant portions of their lives in coastal waters. Black sea bass make inshore and northern migrations during warm months and are found in tidal bays and sounds as well as the ocean environment. Those same areas are known to be increasingly affected by coastal development (e.g., dredging, marinas, and docks) and the related declines in habitat quality and quantity. This increase in habitat degradation plays an important role in black sea bass population health.

It is likely that the most significant habitat degradation affecting this species is in the estuaries and near-shore areas used by juvenile black sea bass as nursery areas.

4.3. MANAGEMENT OBJECTIVES

The objectives of the FMP are to:

1. Reduce fishing mortality in the black sea bass fishery to assure that overfishing does not occur.
2. Reduce fishing mortality on immature black sea bass to increase spawning stock biomass.
3. Improve the yield from the fisheries.

4. Promote compatible management regulations between state and federal jurisdictions.

5. Promote uniform and effective enforcement of regulations.

6. Minimize regulations to achieve the management objectives stated above.

4.4. MANAGEMENT UNIT

The management unit is black sea bass (*Centropristis striata*) in US waters in the western Atlantic Ocean from Cape Hatteras, North Carolina (35°15.3' N latitude) northward to the US-Canadian border.

4.5. MANAGEMENT STRATEGY

Overfishing for black sea bass is defined as fishing in excess of the F_{max} level. F_{max} is a biological reference point that corresponds to the level of fishing mortality (F) that produces the maximum yield per recruit. Based on current conditions in the fishery, F_{max} is 0.29.

The Council and the ASMFC Management Board approved a recovery strategy that reduces overfishing on black sea bass over a 8 year time frame. The recovery strategy calls for minimum fish sizes and commercial gear regulations in year 1 (1996) and year 2. These regulations would reduce mortality on small black sea bass, i.e., those black sea bass less than 9" TL . Beginning in year 3, additional regulations will be implemented to reduce mortality on larger fish. These regulations will include a commercial quota and a recreational harvest limit. In years 3 through 5, target exploitation rates will be 48%. In years 6 and 7, the target exploitation rates will be 37% and in year 8 and subsequent years, the target exploitation rate will be based on F_{max}. Currently, the exploitation rate associated with F_{max} is 23%.

5. DESCRIPTION OF THE STOCK

5.1. SPECIES DESCRIPTION AND DISTRIBUTION

Black sea bass is a continental shelf species that is common in Atlantic coastal waters from Cape Cod, Massachusetts to Cape Canaveral, Florida (Kendall 1977). Black sea bass and *Centropristis striata* are the common and scientific names for the species (American Fisheries Society 1980). Black sea bass are also known as black fish, tally-wag, hannahill, black-will, black-Harry, black perch, black bass, bluefish, and rock bass (Kendall 1977). Black sea bass may attain ages as great as 15 years but rarely exceed lengths of 20 inches (NEFSC 1993). Black sea bass are characterized by a robust body, large head and moderately pointed snout. In general, they are smoky gray, dark brown, or blueish black in color. A complete generic description of the species can be found in Miller (1959).

Black sea bass undertake seasonal migrations north of Cape Hatteras, North Carolina probably in response to changes in temperature. Black sea bass move inshore and north in summer and offshore and south in winter (Musick and Mercer 1977). South of Cape Hatteras, black sea bass are non-migratory, year round residents (Cupka *et al.* 1973, Kendall 1977).

Black sea bass are distributed primarily in the southern offshore portion of the Mid-Atlantic Bight during winter in depths of 240 to 540 feet (Musick and Mercer 1977). Larger and older fish move offshore sooner and winter in deeper water than do younger fish (Kendall 1977). Black sea bass prefer water temperatures of at least 48°F during the winter months.

Black sea bass move to the waters of the Mid-Atlantic Bight as water temperatures warm in the spring, generally beginning inshore migrations in April. During the summer months, black sea bass are most abundant in depths of less than 120 ft (Musik and Mercer 1977). In the fall, black sea bass move out of Mid-Atlantic estuaries as temperatures fall below 57°F and migrate offshore to intermediate depths by November (Musik and Mercer 1977).

Based on tagging data and other information, two populations of black sea bass are believed to occur along the Atlantic coast with a separation at Cape Hatteras, NC (Mercer 1978). Shepherd (1991) conducted detailed morphometric and meristic analyses on black sea bass collected from Massachusetts, New Jersey, and Virginia and concluded that black sea bass north of Cape Hatteras formed a unit stock.

5.2. ABUNDANCE AND PRESENT CONDITION

Landings-per-unit-effort (LPUE) from the Mid-Atlantic trawl fishery has been used as an index of abundance for black sea bass. Standardized LPUE, defined as metric tons per days fished for trips landing more than 25% black sea bass, peaked at 11.3 in 1984, and then declined to a low of 1.6 in 1992 . Standardized LPUE increased slightly to 3.2 in 1993 (NEFSC 1995).

The NEFSC has conducted a spring and autumn offshore survey for a number of species, including black sea bass, since 1972. The spring offshore survey has been used as an index for black sea bass recruits (fish longer than 20 cm SL) and the autumn inshore survey data as an index of pre-recruits (fish less than 11 cm SL). The index for larger fish declined from a high of 6.09 fish per tow in 1977 to a low of 0.20 per tow in 1982 (Table 1). However, the 1992 value of 1.99 is slightly above the 1972 to 1994 average of 1.54. The spring recruit index declined to 0.87 in 1993 and 0.28 in 1994 (NEFSC 1995).

Analysis conducted by the NEFSC indicates a strong correlation between the pre-recruit index and commercial catch per unit effort in the trawl fishery (NEFSC 1993). The index for pre-recruits indicates that above average year classes were produced in 1977, 1982, and 1986 (Table 1). Recruitment for 1992 and 1993, based on this index, was well below average. Recruitment was above average in 1994 (Shepherd, pers. comm.).

5.3. ECOLOGICAL RELATIONSHIPS AND STOCK CHARACTERISTICS

5.3.1. Spawning and Early Life History

Studies on age at maturity indicate that most black sea bass reach sexual maturity between ages 1 and 4 with 50% mature by age 2 (NEFSC 1993). The length at which 50% of the black sea bass are sexually mature is about 7.7 inches TL (NEFSC 1993).

Unlike most fish, black sea bass are protogynous hermaphrodites. This means that most black sea bass function first as females, then undergo sexual succession and become functional males. Cochran and Greir (1991) identified the hormonal changes that regulated this sexual succession or transformation in black sea bass.

In general, sex ratios favor females at smaller sizes and younger ages and males at larger sizes and older ages. Based on a compilation of several studies, the probability that a female black sea bass will undergo sexual transformation was greatest between 7 and 10 inches TL (Shepherd pers. comm.) (Table 2).

Black sea bass spawn in the Mid-Atlantic Bight primarily between Chesapeake Bay and Montauk, Long Island. Spawning occurs in the open ocean at depths of 60 to 140 ft. Spawning begins in June off Chesapeake Bay and later in the summer off southern New England (Musik and Mercer 1977).

Black sea bass produce colorless, buoyant eggs that are spherical and approximately 0.9-1.0 mm in diameter. Mercer (1978) derived fecundity relationships for 25 black sea bass collected in the Mid-Atlantic. The relationship between total fecundity (F - thousands of eggs) and total weight (W - grams) was:

$$F = -587.684 + 348.053 (\log W)$$

Fertilized black sea bass eggs hatch in approximately 75 hours at a temperature of 61°F. Wilson (1891) described the embryonic development of black sea bass and Kendall (1972) described black sea bass larvae.

5.3.2. Age and Growth

Mercer (1978) aged 2905 black sea bass collected from commercial fisheries and trawl surveys in the Mid-Atlantic from 1973 to 1975. She found that back-calculated mean lengths almost doubled between ages 1 and 2 and then the rate of growth declined steadily thereafter (Table 3). She did not age any black sea bass older than 9 and larger, older fish were not well represented in the samples. Mercer (1978) also found significant differences in growth rates between male and female black sea bass.

Length-age data (all sexes combined) was fit to the von Bertalanffy growth equation. This equation, which relates age to length, is:

$$L_t = 469 (1-e^{-0.182(t-0.1056)})$$

where L_t is mean standard length (mm) at age t.

Most scientific publications report lengths of black sea bass in standard lengths. The standard length is the length of the fish from the tip of the snout to the posterior end of the hypural bone. However, most state regulations and the regulations pertaining to size in this FMP are in total length. Total length, the length along the mid-line of the fish from the tip of the snout to the tip of the tail, can be derived from standard length using the following formula (G. Shepherd pers. comm.):

$$TL = 1.42076 (SL) - 30.5$$

where length is measured in millimeters.

5.3.3. Length-Weight Relationship

Mercer (1978) developed length-weight relationships for black sea bass collected from the Mid-Atlantic Bight. Based on a sample of 2016 fish, the derived equation was:

$$\log w = -4.9825 + 3.1798 (\log l)$$

where weight (w) is in grams and length (l) is standard length in millimeters. Mercer (1978) also found significant differences between sexes with males heavier than females of the same length.

5.3.4. Mortality

The instantaneous natural mortality rate (M) is defined as annual losses experienced by black sea bass from all natural and anthropogenic factors except commercial and recreational fishing. The NEFSC assumed an M of 0.2 for black sea bass in the most recent stock assessment (NEFSC 1995).

Because they lacked age-length data, the ASMFC Black Sea Bass Technical Committee used length frequency data from commercial fisheries to derive estimates of fishing mortality rates. Estimates ranged from 0.35 to 0.7 depending on the fishery sampled and the year the length samples were obtained. Based on that analysis, they concluded that current fishing mortality rates on black sea bass were 0.6 or higher.

More recently, the NEFSC used an age-based virtual population analysis to estimate stock sizes and fishing mortality rates for the northern population of black sea bass. Average fishing mortality rates for fully recruited age classes (ages 3-6) were high throughout the time period 1984-1993, exceeding 1.0 in every year (Table 4). NEFSC (1995) estimated F in 1993 to be 1.05 (an annual exploitation rate of 60%).

5.3.5. Food and Feeding

Black sea bass are opportunistic bottom feeders that eat crustaceans, fish, molluscs, echinoderms, and plants (Hildebrand and Schroeder 1928, Miller 1959, Cupka *et al.* 1973, Link 1980, Steimle and Ogren 1982). The primary diet items for adult black sea bass are crabs and fish whereas young black sea bass eat shrimp, isopods, and amphipods (Kendall 1973). Food consumption varies seasonally in association with spawning activity. Feeding slows during the spawning season (Cupka *et al.* 1973) and is heaviest in the 6-month period following spawning (Hoff 1970).

5.3.6. Predators and Competitors

Specific predators of black sea bass have not been identified in detailed food habits studies. However, it is probable that black sea bass are eaten by large piscivores (e.g., bluefish) whose range overlaps that of black sea bass (Kendall 1977).

Black sea bass share common food resources and habitat preferences with a number of fish that comprise the hard bottom reef fish community of the Mid Atlantic Bight (Eklund and Targett 1991).

5.3.7. Parasites, Diseases, Injuries and Abnormalities

Several different kinds of acanthocephalans, cestodes, and nemotodes have been found encysted in black sea bass digestive tracts (Linton 1901). Cupka *et al.* (1973) found that black sea bass collected from South Carolina waters were generally free of external parasites.

5.4. MAXIMUM SUSTAINABLE YIELD

Maximum sustainable yield has not been estimated for black sea bass. MSY estimates are generally derived from production models and these models have not been used in black sea bass stock assessments.

The Black Sea Bass FMP implements a fishing mortality rate (F) reduction strategy to reduce fishing mortality rates on black sea bass from current levels (1.05) to F_{max} (0.29) over an 8 year time frame. F_{max} is the biological reference point used to define overfishing and is the fishing mortality rate that maximizes the yield per recruit. This reduction in fishing mortality coupled with minimum fish size and gear regulations will allow for significant stock rebuilding such that sustainable yields (i.e., annual landings) that greatly exceed the current landings will be possible.

5.5. PROBABLE FUTURE CONDITION

If recruitment is below average in 1995 and/or 1996, spawning stock biomass will continue to decline. In fact, because the fishery tends to reduce incoming year classes rapidly (NEFSC 1993), even the production of a good year class will not increase stock biomass without the implementation of an effective management strategy to reduce fishing mortality on both small and large fish.

6. DESCRIPTION OF HABITAT

6.1. DISTRIBUTION OF THE SPECIES, HABITAT REQUIREMENTS, AND HABITATS OF BLACK SEA BASS

6.1.1. Distribution of Black Sea Bass and Habitat Requirements

Black sea bass inhabit the Atlantic coastal waters, commonly from Cape Cod to Cape Canaveral (section 5.1). Occasionally black sea bass occur in the Gulf of Maine and as far south as Miami or occasionally to the Florida Keys (Miller 1959). Black sea bass move inshore and north in summer and offshore and south in winter in the Mid-Atlantic Bight (Musick and Mercer 1977). In the South Atlantic Bight they are year round residents and do not undertake seasonal migrations. The mid-Atlantic and south Atlantic stocks of this species are considered distinct (Shepherd 1991) and there is probably little overlap in habitat use by the two populations (Steimle pers. comm.). A subspecies occurs along the eastern and northern coastal areas of the Gulf of Mexico (Mercer 1979).

Black sea bass are distributed primarily in the southern offshore portion of the Mid-Atlantic Bight during winter in depths of 240 to 540 feet (Musick and Mercer 1977). Larger and older fish move offshore sooner and winter in deeper water than do young of year specimens (Kendall 1977, Musick and Mercer 1977). Black sea bass prefer water temperatures of at least 48° F, and move to the waters of the Mid-Atlantic Bight beginning in April. During the summer months, sea bass are most abundant in depths of less than 120 ft (Musick and Mercer 1977). The movement of black sea bass out of mid-Atlantic estuaries may occur as temperatures fall below 57° F (Musick and Mercer 1977). South of Cape Hatteras, where they reside in an area year round, they prefer depths of from 30 to 350 ft with most between 60 and 180 ft. Larger specimens are found mainly in the deeper water (Cupka *et al.* 1973).

Location of spawning has been inferred from the distribution of ripe females and small larvae (Kendall 1977). In the Mid-Atlantic Bight, black sea bass spawn primarily between Chesapeake Bay and Montauk, Long Island in the open ocean in depths of 60 to 140 ft. Spawning occurs earlier in the year in the southern part of their range with spawning beginning in June off Chesapeake Bay and later in the summer off southern New England (Musick and Mercer 1977). Spawning extends from January to June in the south Atlantic region, peaking from March to May (Cupka *et al.* 1973, Mercer 1978, Link 1980, Wenner *et al.* 1986, and Able *et al.* 1995).

Extensive sampling offshore in the Mid-Atlantic resulted in small catches of larvae from June to November from North Carolina (the southern extent of the sampling) to New Jersey. Seasonally, there was some indication of northward progression of larval occurrences (Kendall 1972).

Juvenile black sea bass occur in saline areas of estuaries along the coast from Florida to Massachusetts. Musick and Mercer (1977) identified high salinity sections of estuaries in the Mid-Atlantic Bight as nursery grounds for young of year and yearling black sea bass. Juveniles enter these areas from July to September. In South Carolina estuaries, juveniles were found from July to November in salinities of 8.8 to 37.8 ppt. and at temperatures of 42° to 87° F (Cupka *et al.* 1973). Juveniles apparently move inshore after early larval development offshore and become demersal at total lengths of between 0.5 to 1 inch (Kendall 1972). They are generally associated with hard bottom such as oyster beds (Kendall 1977 and Arve 1960) or artificial reefs.

Able *et al.* (1995) described the early life history of black sea bass in the Mid-Atlantic Bight and a New Jersey estuary. In New Jersey coastal waters, larvae first appear in July but occur through October-November. By fall, individuals had generally moved from New Jersey, and other estuaries, and were found on the inner continental shelf from southern Massachusetts to Cape Hatteras. During the winter, they were concentrated in the southern portion of the Mid-Atlantic Bight from New Jersey and south, especially at the edge of the continental shelf. In New Jersey, they moved back into estuaries in early spring, at the same approximate maximum sizes as in the previous fall. Yearlings also migrate offshore in the fall, overwinter on the continental shelf and then return to estuaries the following spring. They reach relatively small sizes by 12 months of age, in part, because of little or no growth during the winter. Able *et al.* (1995) reported that during the summer, benthic juveniles on the inner shelf were collected or observed primarily in accumulations of surf clam *Spisula solidissima* valves or smaller pieces of shell and occasionally in burrows in exposed clay. While in the estuary they were collected from areas with structured habitats such as shell accumulations in marsh creeks, peat banks and a dredged boat basin. In summary, the accumulated data suggest that black sea bass utilize both estuarine and inner continental shelf habitats as nurseries during the first summer, and that these nurseries are of similar quality based on similar growth rates.

Black sea bass is one of the most abundant species of the fish community on natural hard bottom reef areas in the Mid-Atlantic Bight (Eklund and Targett 1991). These authors sampled the black sea bass trap fishery off the coast of Maryland and northern Virginia and found that black sea bass comprised over 96% of the catch overall. The other abundant species were: spotted hake, tautog, red hake, conger eel, scup and ocean pout. The catches of each species fluctuated through time, apparently as a result of seasonal migration patterns. Most species appeared to migrate inshore in the spring and offshore in the autumn. The fish community on hard bottom areas in the Mid-Atlantic Bight differed considerably from that reported from South Atlantic Bight reef areas as well as from smooth bottom areas on the Mid-Atlantic Bight continental shelf. The above described natural hard bottom fish assemblage corresponds well with that characterized by Steimle and Figley (1996) for structure-oriented reef-fish.

6.1.2. Habitats of Black Sea Bass

The near shore spawning areas and the inshore nursery areas are essential for the survival of black sea bass. These areas are also utilized for summer feeding by adults. Major alterations to the habitat could be disruptive to the species' life cycle.

The Council, attempting to coordinate and obtain the best information available, requested each state from North Carolina to Maine to identify the critical black sea bass habitat under their jurisdiction. The following paragraphs are paraphrased from the responses of the states' black sea bass experts.

Young of the year black sea bass are commonly caught in North Carolina estuarine waters from Oregon Inlet to Cape Fear from March through October (J. Ross pers. comm.). They are most common along the eastern portion of Pamlico Sound behind the barrier islands, in Core Sound, and along the intercoastal waterway from Cape Lookout to Cape Fear. Black sea bass are found in relatively high salinity waters, but have been caught in salinities as low as 9‰. They occur over grass flats, in channels, around bridges and pilings and generally over sandy bottoms (J.Ross pers. comm.). Black sea bass are also common in near shore ocean waters off North Carolina, with largest concentrations found over rocky bottoms and around the numerous wrecks and artificial reefs. Younger fish are more prevalent near shore, but larger fish are also common during the summer months.

Black sea bass are abundant in Virginia's Territorial Sea, seaside bays and Lower Chesapeake Bay during spring, summer, and fall months (Figure 1). Juveniles move into Chesapeake Bay waters in March and April at about 2.3 inches total length. Trawl surveys continue to catch sea bass until December, but the number of fish encountered diminishes after September (Bonzek *et al.* 1991, 1992, and 1993). Juvenile sea bass in the Chesapeake Bay move to deeper water during the colder months, but some may remain inshore year-round, especially during mild winters. By the time they have reached a length of about ten inches, most sea bass have permanently left inshore waters for coastal and ocean habitats (Boyd pers. comm.). Black sea bass are rarely encountered in salinities less than 12 ppt. and are most common at salinities above 18 ppt. (Musick and Mercer 1977). Juveniles concentrate in deeper grass flats and sponge communities, adults generally are found over rough, hard bottom. This species' preference for structured habitat makes oyster beds, wharves, channels, wrecks and pilings favored habitat. Virginia's Artificial Reef Program provides additional suitable habitat for black sea bass, with four Atlantic Ocean reef sites and seven Chesapeake Bay reef sites. A three year study of two Chesapeake Bay reef sites and one Atlantic Ocean reef site identified the black sea bass as the most abundant reef fish (D. Boyd pers. comm.).

Young sea bass have frequently been encountered during the coastal bay trawl survey in Maryland, primarily during the late summer and early fall. They are also caught in commercial crab pots throughout the summer. Sea bass in the Chesapeake are known to frequent wrecks and other structures as far north as Rock Hall. Beyond this, little is known of their habitat and movements (Casey pers. comm.). Maryland's Reef Program provides policy and guidelines for rebuilding and restoring reefs. Maryland has seven sites between one and 18 miles offshore that provide additional habitat for black sea bass (Butowski pers. comm.).

The entire ocean coast and both coastal bays provide ideal habitat for both juvenile and adult black sea bass in Delaware (Cole pers. comm.). Although Delaware's trawl survey does not effectively sample black sea bass, a distribution map (Figure 2) was based on both trawl data and anecdotal information collected from recreational fishermen and indicated that the vast majority of the Delaware estuary below the C and D Canal is used by black sea bass for feeding and nursery.

Black sea bass migrate from offshore, overwintering grounds to inshore coastal waters of New Jersey in May (Scarlett pers. comm.). Important summering and nursery areas include inshore ocean waters at depths less than 120 ft and estuaries from Sandy Hook Bay to Delaware Bay. Spawning occurs in near shore coastal waters at depths from 18 to 48 ft. Able *et al.* (1995) stated that larvae first appear in July but occur through October-November in New Jersey.

The critical habitat for black sea bass in New York waters is similar to that defined below for Connecticut waters by Simpson (Mason pers. comm.). Structured bottom habitat is important for black sea bass.

Black sea bass occur in low numbers from at least April through November in trawl survey catches (Figure 3) from Long Island Sound (Simpson pers. comm.). Young-of-year are taken on hard substrate (sand/shell/cobble) nearshore including harbors and estuaries where salinities are above 20 ppt. The largest concentrations of sea bass taken in the trawl survey occur on sand and transitional (mixed sand/mud) substrates, typically in depths greater than 60 feet. Simpson (pers. comm.) reports that black sea bass in Long Island Sound feed principally on amphipods and small crabs, but also on mysids, copepods, and hydroids. Commercial catches of sea bass appears to be concentrated in the central portion of Long Island Sound, where depths are generally greater than 60 ft and the bottom types are sand and transitional (Simpson pers. comm.). Recreational catches are sparse. The few black sea bass taken are caught incidentally in the summer flounder or scup fisheries.

Juvenile black sea bass have been collected frequently during both the Coastal Fishery Resource Assessment Trawl Survey (Lynch 1994) and the Juvenile Fish Survey (Powell 1992) during the spring, but primarily in the fall. Black sea bass have been found to be distributed over eel grass beds (Powell 1992) and over sandy, hard and rocky bottom types,

usually in association with submerged rock piles, obstructions and ledges (Lynch 1994). Little is known of their habitat and movements in Rhode Island waters (Gray pers. comm.).

Black sea bass, age 2 and older, migrate north to inshore Massachusetts waters in early May. The spring Massachusetts recreational and commercial fisheries for black sea bass are highly concentrated in May through June in shoal (less than 30 ft) waters within the northern portion of Nantucket Sound (Figure 4). Although spawning occurs elsewhere in Nantucket Sound, concentrated activity occurs north of a line from Point Gammon east to Succonesset Point. Within this spawning area, fish usually aggregate on sand bottom broken by ledge. Spawning occurs along the southern Massachusetts coast from the middle of May through July as inferred from the distribution of ripe females, eggs, and larvae in Nantucket Sound and Buzzards Bay. Collings *et al.* (1981) collected black sea bass late stage eggs in upper Buzzards Bay from early June through late July. Eggs were collected in water temperatures of 63° to 73° F with highest concentrations around 65° F. After spawning adult black sea bass disperse to ledges and rocks in deeper water. South of Cape Cod, adults remain in the sounds and bays until at least November (Currier pers. comm.). Shoal grounds in Buzzards Bay, Vineyard Sound, and Nantucket Sound are critical nursery areas for 0 age group black sea bass (Currier pers. comm.). Black sea bass are less common in Cape Cod Bay. Larvae were collected in low densities during July and August (Scherer 1984) but were considered, in terms of their reproductive range, stragglers from more southern waters. Collette and Hartel (1988) report black sea bass taken in Massachusetts Bay from areas north of Boston (Nahant, Salem Harbor, and Beverly) and south of Boston (Cohasett Narrows) at the turn of the century.

Black sea bass are taken only rarely in the New Hampshire recreational fishery, hence there are no habitat studies available (Grout pers. comm.).

Black sea bass are nearly absent in Maine waters (Langton pers. comm.).

In 1985, the National Oceanic and Atmospheric Administration (NOAA) began a program to develop a comprehensive data base on the distribution and relative abundance of selected fish and invertebrate species in the Nation's estuaries. The Estuarine Living Marine Resources (ELMR) program was conducted jointly by the National Ocean Services's Strategic Environmental Assessments (SEA) Division and the National Marine Fisheries Service (NMFS). The objective was to develop a consistent data base on the spatial and temporal distribution, relative abundance, and life history characteristics of fishes and invertebrates to enable comparisons among species and estuaries. These data are to be combined with other NOAA data sets to better define and understand the biological coupling of estuarine and marine habitats (USDC 1994a).

While the importance of estuarine areas to fish and invertebrate populations is well documented, few consistent and comprehensive data sets exist that allow examinations of the relationships of many species found in or among groups of estuaries. Most of the distribution and abundance data for estuarine-dependent species is for the offshore life stages where major sampling programs have focused, and does not adequately describe estuarine distributions. Because life stages of many species use both estuarine and marine habitats, it is necessary to combine information on distribution, temporal utilization, and life history strategies to understand the linkages between estuaries and nearshore/offshore areas. No nationwide data base that would allow these evaluations existed prior to ELMR.

Three salinity zones provide the spatial framework for organizing information on species distribution and abundance within each estuary. These zones are tidal fresh (0.0 to 0.5 ppt), mixing (0.5 to 25.0 ppt), and seawater (25.0 ppt and greater). Four criteria were used to identify species: commercial value, recreational value, indicator of environmental stress, and ecological value. A data sheet was developed for each species in each estuary, including information on spatial distribution by salinity zone, temporal distribution by life history stage, and relative abundance level. Each data sheet was then reviewed by experts with local knowledge of particular species and/or estuaries.

The ELMR program is an important step in developing an information base to bridge the gap between site-specific estuarine problems and regional management strategies. Filling this gap is more important now than ever, as it is clear that the cumulative effects of small changes in many estuaries may have a total systemic effect throughout large segments of the Nation's estuaries and coastal ocean. Although the knowledge available to conserve and protect estuaries continues to be limited, the ELMR data base will allow comparisons among species, groups of species, specific life stages and times of year within an estuary, and geographic regions. The estuaries evaluated for the Mid-Atlantic are presented in Figure 5.

The spatial distribution and relative abundance of black sea bass was evaluated for the Mid-Atlantic (Table 5). The ELMR programs in the South Atlantic and the North Atlantic did not delineate black sea bass. The monthly temporal distribution of black sea bass in the Mid-Atlantic (south of Cape Cod) is identified in Tables 6 and 7.

Besides using highly structured habitats ("hard bottom" or vegetated), juvenile black sea bass have been recently reported to be common at the mouths of small salt marsh creeks in New Jersey (Hales and Able 1994). Hales and Able (1994) also report that these young of year stay within a limited area after they settle within their estuarine "nursery" area. This habitat fidelity can be significant to survival and health if it means they are hesitant moving from a settlement area during some period of stress (Steimle pers. comm.).

The diets of adult sea bass strongly suggest that their habitat needs must include surrounding "non-reef" habitats where they commonly feed, especially on small rock crabs, sand shrimp, razor clams, and similar open-bottom prey (Steimle pers.

comm. from observations from several collections of black sea bass from artificial reefs). Steimle and Figley (1996) note that the only specific reef-associated prey, found in the stomachs of 265 adult sea bass collected from two artificial reefs off souther New Jersey, were a few juvenile cunner. This suggests to the authors that black sea bass may use reefs for shelter or other reasons but are not dependent on the epifauna colonizing reef habitats for food. The shelter offered by the reef habitat can support feeding, however, by reducing the black sea bass's exposure to predation while feeding on crabs near the reef. This suggests that the availability of off-reef forage is an important consideration when planning the use of artificial reefs as part of any management strategy for black sea bass (Steimle and Figley 1996).

During seasonal migrations, black sea bass habitat needs should be similar to scup, summer flounder, northern sea robin and spotted hake, a species assemblage in which they are closely associated from trawl catch data (Musick and Mercer 1977).

According to Steimle (pers. comm.) researchers at the University of Connecticut (Mark Dixon, Peter Auster and Lance Stewart) believe that empty hinged clam shells (e.g. surf clams or ocean quahogs) in beds or patches may provide essential habitat for juvenile black sea bass after they leave the estuaries in the fall and have to survive until the spring on the basically flat sand bottom of the coastal and offshore Mid-Atlantic Bight. The recognition, definition and protection of these possibly critical juvenile "wintering grounds" needs further exploration.

As identified by many of the states, black sea bass use artificial habitat as well as natural structures. A preferred alternative in this plan calls for the establishment of a process for implementing Special Management Zones (SMZs) in order to regulate black sea bass harvest around artificial reefs. The concept is that the permit holder for an artificial reef established in federal waters would petition the Mid-Atlantic Fishery Management Council for SMZ designation based on site specific factors. The process is to be based on that established in the South Atlantic Fishery Management Council's Snapper/Grouper Fishery Management Plan, and as recommended by the ASMFC Artificial Reef Committee. Many artificial reefs, including those constructed by State governments, are located in the EEZ. If management measures are needed to control fishing on and around those artificial reefs, they must be developed through an FMP. Providing a process through which the Council can develop these measures on a case by case basis is an efficient way of achieving this control.

In June 1995 the Council adopted five policy statements on artificial reefs and the associated effects of reef activities on fisheries under Council authority. The goal is to have Council policy for artificial reefs such that all States in the Mid-Atlantic are treated uniformly. As stated in the National Plan (1985), the Federal role is one of providing technical assistance, guidance and regulations for the proper use of artificial reefs by local governments in a manner compatible with other long-term needs and to improve coordination and communication on artificial reef issues.

1) Each new EEZ artificial reef site proposal must have a stated conservation and management objective.

It is the Council's position that unless an organization (local government or association) has a conservation and management objective for a reef site, there is no way to evaluate the potential costs and benefits associated with a reef proposal. In essence, without stated objectives an artificial reef proposal is little more than "ocean dumping".

2) The MAFMC endorses the National Artificial Reef Plan (1985) and encourages staff to work with ASMFC, NMFS, and the States in the updating of plan.

The MAFMC was not heavily involved in the development of the National Artificial Reef Plan in the early 1980's because of higher priorities for fisheries that were under management or attempting to be managed at that time. It is now the understanding that ASMFC is leading the reevaluation and updating of the Reef Plan and staff is encouraged to work closely in this endeavor. Artificial reefs have become much more important to MAFMC activities with the expansive efforts by States to locate additional reefs in the EEZ, as well as our management of additional species that frequently inhabit artificial reefs (e.g. black sea bass).

3) Only materials identified and acceptable in either the National Artificial Reef Plan (USDC 1986) or the Reef Material Criteria Handbook (1992) or revisions thereof should be used for the creation of artificial reefs.

The Council wants only materials that are "environmentally acceptable" to be used in artificial reefs. Environmentally acceptable deals with both the toxicity of materials and also the issue that materials have to be compatible with the reef site. The latter deals with the potential energy levels at the site, and the issue that what may be acceptable at one site may be unacceptable at a different site that has a much different energy level at the bottom. The Council is greatly concerned over the usage of tires for artificial reef sites specifically. Tires have recently been shown (MD studies) to be toxic to certain organisms at reef sites with low salinity (e.g. bays and estuaries where salinities of 15 ppt or less occur), but appear to not be toxic in high salinity. The Council still believes that tires are an inappropriate material because of high energy levels in the ocean which inevitably leads to tire structure breakdown and thus mobility off the reef once they get caught up in ocean currents.

4) No fishery management regulations may be implemented for any artificial reef in the EEZ without concurrence by the MAFMC.

The Magnuson Act states that the Council shall "prepare and submit to the Secretary a fishery management plan with respect to each fishery within its geographical area of authority that requires conservation and management. . . " It is the intent of the MAFMC that they agree with any attempt at fishery management around any artificial reef in the EEZ in the Mid-Atlantic off of New York through Virginia.

> 5) The Council will attempt to facilitate communication on the siting of any new artificial reef in the EEZ with various user groups of the proposed site.

Siting of new artificial reef is regulated by the US Army Corps of Engineers and often commercial and sport fishing interests are not well informed of Corps activities. Also individual States may coordinate with fishing interests within their State on artificial reefs, but the highly migratory nature of many fisheries necessitates information transfer to organizations beyond individual States. Council staff will attempt to widely distribute information on new sitings in the initial stages of reef proposals.

These five policy statements should help facilitate Federal, State, and local activities in the Mid-Atlantic and can only be beneficial to the ocean and coastal habitats.

Artificial reefs are being constructed in the Atlantic and Gulf of Mexico for several reasons, including to address a presumed habitat limitation for black sea bass and other reef-fish (Steimle pers. comm.). Besides harvest regulation, recent theories on factors that limit the maintenance of reef-fish populations put more emphasis on juvenile recruitment than on adult habitat limitation (Bohnsack 1989). This suggests that the habitat needs of adults to maintain sustainable populations of reef-fish, such as black sea bass, should be considered. Habitat protection and enhancement efforts for black sea bass perhaps should be refocused (summer and winter) to this critical portion of the population (Steimle pers. comm.).

Steimle (pers. comm.) also suggests that some man-made estuarine habitats, such as abandoned piling fields, may be important to black sea bass juveniles, and other species, because they replace the habitat functions lost elsewhere, e.g., by bulkheaded and filled salt marsh. The function of these man-made habitats should be evaluated and perhaps replaced before or while they are removed to "restore" any habitat.

6.2. HABITAT CONDITION

Black sea bass are exposed to the full range of human activities and environmental conditions during their life history. Assessments made by the Ocean Pulse and Northeast Monitoring Programs indicate extensive, detrimental amounts of toxic organic and inorganic contaminants, such as heavy metals, PCBs, and petroleum hydrocarbons in the various physical compartments of the marine ecosystem (Boehm and Hirtzer, 1982; Boehm, 1983; Pearce, 1979; Reid *et al.* 1982). This is particularly true for sediments in the Mid-Atlantic Bight that receive contaminated dredged materials, sewage sludge, and industrial wastes. Elevated levels of petroleum hydrocarbons have even been found in all estuaries as far north as Maine. Elevated PCB levels have been found in sediments and biota in Buzzards Bay, in the New York Bight apex, as well as other locations (Reid *et al.* 1982).

A recent study by Steimle *et al.* (1994) has found that important black sea bass prey, such as rock crabs, sand shrimp, and other benthic invertebrates collected in the New York Bight apex contained high concentrations of several potentially toxic metals. Concentrations were especially high near the former 12-mile, sewage sludge disposal site. Black sea bass that are seasonally resident or transient through this area are at risk from eating this prey (Steimle pers. comm.).

Generally, the nation's most contaminated estuaries are in highly urban areas (Turgeon *et al.* 1989) such as those around much of the Mid-Atlantic coast. Turgeon *et al.* (1989) describe concentrations of toxic metals and toxic organics in Long Island Sound and relate them to nation wide levels as found in mussel tissues and fish livers, however since the fish were not specified, it is unknown whether black sea bass were included in the study. Zdanowicz and Gadbois (1990) provide a data summary for the baseline phase of the National Status and Trends Program during 1984-1986. Estuaries over the entire range of black sea bass were sampled for concentrations of selected chemical contaminants, as well as indicators of potential biological effects from 20 sites throughout the northeast region. Unfortunately, no data specific to black sea bass are presented.

Most research on the toxicological effects of various contaminants in fish is recent and ongoing. Many anomalies probably have not been described or their magnitude documented. The Councils encourage fishermen to report or provide fish with tumorous type growths to: Dr. John C. Harshberger, Director, Registry of Tumors in Lower Animals, Smithsonian Institution, Museum of Natural History, Washington, DC 20560 (202-357-2647).

Chemical contaminants of coastal waters include inputs from municipal and industrial wastewater, agricultural pesticides and fertilizers, animal waste, urban nonpoint sources, stormwater runoff and atmospheric deposition. Within the Mid-Atlantic region (Cape May to Cape Fear, as defined in the Mid-Atlantic Marine Research Program 1994), there are more than 75 coastal counties and cities that have one or more publicly owned treatment works discharging to coastal waters. Toxic components of these contaminants include heavy metals such as lead, cadmium, chromium, zinc, copper, silver and mercury, and organic compounds such as DDT, chlordane, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). All of these compounds are generally due to discharges to coastal waters from human activities,

although there are some cases of natural concentrations. In the Mid-Atlantic region, northern Chesapeake Bay (especially Baltimore Harbor) and the Elizabeth River in Virginia contain the highest levels of these contaminants except for DDT (Mid-Atlantic Marine Research Program 1994). Lead, silver, zinc, DDT, chlordane, and PCBs have high concentrations at sites within Delaware Bay (Figures 6-9). DDT, chlordane and PCBs are now banned for the most part, but continue to exist in the environment and are used in other countries. Atmospheric deposition of toxins such as pesticides and PCBs may be more of a problem in marine waters than on land, since there may be more bioconcentration of pesticides and PCBs in marine food chains (NRC 1993). The National Research Council recommends source control of pollutants, since many toxic substances are difficult and/or expensive to remove from wastewater.

Coastal areas are vitally important as feeding, spawning, and nursery grounds for black sea bass. However, population shifts to coastal areas and associated industrial and municipal expansion have accelerated competition for use of the same habitats. It has been projected (48 FR 53142-53147) that demographic shifts during the 1980s and 1990s will result in, 75% of the US population living within 50 miles of the coastlines (including the Great Lakes). As a result, these habitats have been substantially reduced and continue to suffer the adverse effects of dredging, filling, coastal construction, energy development, pollution, waste disposal, and other human related activities. In the case of wetlands, from 1954 to 1978 there was an average annual loss of 104,000 acres which was a ten fold annual increase in acreage lost between 1780 and 1954 (48 FR 53142 - 53147). The pressure on coastal and ocean habitats is nowhere greater than in the densely populated, industrialized Northeast. It is obvious that new systems are needed to conserve habitats and living marine resources, while facilitating the completion of necessary, compatible economic developments.

Toward this goal, NMFS issued its formal Habitat Conservation Policy in November 1983 (48 FR 53142-53147). The goal of the policy is: "to maintain or enhance the capability of the environment to ensure the survival of marine mammals and endangered species and to maintain fish and shellfish populations which are used, or are important to the survival and/or health of those used, by individuals and industries for both public and private benefits: jobs, recreation, safe and wholesome food and products." The Habitat Conservation Policy provided impetus to NMFS's Regional Action Plan (RAP) process which is to foster coordinated management and research responses to major habitat conservation issues and problems, and to develop better steps to address them in the future (USDC 1985).

The Regional Action Plan process identified six water management units in the Northeast region (Figure 10). The boundaries of each water management unit (WMU) were established on the basis of the biogeographic consistency of the entire WMU and its distinctness from other WMUs. Each WMU is relatively consistent in its physical and chemical characteristics with normal latitudinal and seasonal variations in temperature, salinity, and nutrient content. The biota include both endemic and migratory species that exhibit normal seasonal fluctuations in species composition, individual population size, and geographic distribution. These six units are: Coastal Gulf of Maine, Gulf of Maine, Georges Bank West to Block Channel, Coastal Middle Atlantic, Middle Atlantic Shelf, and Offshelf (USDC 1985).

The Coastal Gulf of Maine WMU encompasses an area bounded seaward by the observable limits of coastal processes, including riverine and estuarine plumes, coastal upwelling and diurnal tidal fluxes. Geographically, the area is bounded on the northeast by the Canadian Border and on the southwest by Cape Cod. This zone is generally marked by steep terrain and bathymetry, joining at a rock bound coastline with numerous isles, embayments, pocket beaches, and relatively small estuaries. Circulation is generally to the southwest along Stellwagen Bank, and finally offshore at Cape Cod. The habitats are presently affected by ocean disposal and effluents from major urban areas, along with significant nonpoint source pollution associated with the various rivers. Continued pressure to fill already depleted marsh and shallow water areas occurs in most parts of the area (USDC 1985).

The Gulf of Maine is a partly enclosed sea of 55,000 square miles separated from the Atlantic Ocean by Browns and Georges Banks. It is an area of five major basins, floored with clays and gravelly silts, and broken by rocky outcroppings, numerous ledges and banks. The circulation is only generally understood: a seasonal clockwise gyre swings around the Gulf and joins the clockwise gyre on the northern edge of Georges Bank. Presently, threats to the area are from the coastal Gulf of Maine and from ships transiting the area (USDC 1985).

The Georges Bank West to Block Channel WMU includes Georges Bank, the Great South Channel, and Nantucket Shoals. These areas have similar habitats, biota and hydrographic regimes. Overall, this WMU is highly productive and heavy fishing pressure is exerted on its numerous fish and shellfish. It is threatened by Outer Continental Shelf (OCS) exploratory drilling and by nonpoint source pollution from atmospheric fallout, general circulation patterns, and marine transportation activities (USDC 1985).

The Coastal Middle Atlantic WMU encompasses a zone from Cape Cod southwest to Cape Hatteras. The area is characterized by a series of sounds, broad estuaries, large river basins and barrier islands. The predominantly sand bottom is characterized by a ridge and swale topography. The waters of the Coastal Middle Atlantic have a complex and seasonally dependent pattern of circulation. Seasonally varying winds and irregularities in the coastline result in the formation of a complex system of local eddies and gyres. Currents tend to be strongest during the peak river discharge period in late spring and during periods of highest winds in the winter. In late summer, when winds are light and estuarine discharge is minimal, currents tend to be sluggish, and the water column is generally stratified. The Coastal Middle Atlantic provides major habitats for anadromous, estuarine, and endemic species. Migratory species play a major role in this WMU, and make up the predominant stocks in various seasons. Estuaries provide major spawning and nursery areas for many of the endemic and migratory species. These species are presently affected by nonpoint and point

sources of pollution from major rivers and urban areas, as well as by direct loss of habitat caused by filling of wetlands, damming and diversion of rivers, and mosquito ditching in marshes (USDC 1985).

The Middle Atlantic Shelf WMU covers the area from the Block Island Front southward to Cape Hatteras. The inshore boundary follows the observable limits of coastal processes, primarily estuarine plumes, and lies approximately 30 miles from the coast. This WMU generally is characterized as a sandy plain, with a ridge and swale topography. Numerous submarine canyons intersect this area. The surface circulation over the shelf can be divided into a two celled system, separated at the Hudson Valley. The subsurface and bottom circulation tends to flow in a westerly-southwesterly direction that varies with the passage of weather systems and offshore warm core rings. Hydrographic conditions vary seasonally from vernal freshening and warming, through summer stratification, to fall/winter breakdown and cooling. This WMU has a different faunal composition than the Gulf of Maine or Georges Bank. Fish populations are predominantly migratory, and species composition varies with season. It is threatened by OCS exploratory drilling; by nonpoint source pollution from atmospheric fallout, general circulation patterns, and marine transportation activities; and by ocean disposal of sewage sludge and industrial wastes (USDC 1985).

The Offshelf WMU encompasses the zone defined by the mean observable limits of the shelf-slope front seaward to the mean axis of the Gulf Stream. The area is overlain by the Slope Water Regime, a mass of relatively warm saline water having a generally weak circulation to the southwest. The upwelling area along the inner boundary of the shelf-slope front is high in productivity and rich in commercially valuable fish and shellfish. Offshore, the Gulf Stream undulates as it moves to the northeast, forming a dynamic boundary from which warm core rings are borne. These rings spawned at a rate of about eight per year, are about 50 to 100 miles in diameter; they break off east of the area and transit to the southwest, eventually coming in contact with the shelf at southwestern Georges Bank. The passage of each ring marks a major event in the hydrographic regime and may significantly affect the biota of the shelf-slope front and possibly of the shelf itself. Other than ring passages, impacts on the offshelf waters are primarily from nonpoint source pollution from atmospheric fall out, marine transportation, and from point source pollution from dumping at deep water dump site 106 and ocean incineration (USDC 1985).

Each of the oceanic areas identified in section 6.1 as important for black sea bass is subject to numerous man caused habitat threats. Rather than spend extensive efforts detailing degradation in individual oceanic systems (an effort generally already being performed by the individual States), this section will broadly address the major types of abuse (i.e., agricultural, urbanization, and industrialization) dominant in the largest, most important areas (i.e., Chesapeake Bay, Hudson River/Long Island Sound, and the New England coast).

Extensive urban development along the western shore of the Chesapeake has resulted in human population and industrial growth at the expense of the natural environment. The Baltimore - Washington - Norfolk corridor is a major demographic region where numerous commercial and industrial activities are centered. These activities have adversely affected the environment through habitat modification and destruction, and the introduction of contaminants in point and nonpoint source discharges. The eastern shore of the Bay is primarily agricultural and residential. Uncontrolled agricultural and suburban runoff, however, also introduces significant quantities of sediments, trace metals, and chemicals that degrade water quality.

The Hudson River/Long Island Sound area is heavily urbanized and in parts industrialized or supportive of large scale agriculture. The middle and upper Hudson River valley and eastern Long Island support extensive agricultural areas and large populations with the associated habitat abuses. The lower portion of the Hudson River area, northern New Jersey, and western Long Island are inhabited by the greatest concentration of people anywhere in the US as well as supporting extensive utility, petro-chemical, and other heavy industry.

The New England coast, since heavily developed, has some of all three major types of abuse. However, the areas are generally localized (i.e., an individual power generating station or urbanized center) and since the estuaries are only used on a limited basis, the abuses do not seem as detrimental as those in the previously mentioned systems.

In summary, the most concise synopsis of the health of the Nation's marine environments can be viewed as that presented in the findings of the Congressional Office of Technology Assessment report (1987):

"Estuaries and coastal waters around the country receive the vast majority of pollutants introduced into marine environments. As a result, many of these waters have exhibited a variety of adverse impacts, and their overall health is declining or threatened."

"In the absence of additional measures, new or continued degradation will occur in many estuaries and some coastal waters around the country during the next few decades (even in some areas that exhibited improvements in the past)."

"In contrast, the health of the open ocean generally appears to be better than that of the estuaries and coastal waters. Relatively few impacts from waste disposal in the open ocean have been documented, in part because relatively little waste disposal has taken place there and because wastes disposed of there usually are extensively dispersed and diluted. Uncertainty exists, however, about the ability to discern impacts in the open ocean."

6.3. GENERAL CAUSES OF POLLUTION AND HABITAT DEGRADATION

6.3.1. General Habitat Degradation Threats

The Council, in efforts to coordinate with NMFS, has adopted the NMFS Regional Action Plan (USDC 1985) and identified environmental threats as potential issues that may affect the black sea bass habitat.

Estuarine and coastal lands and waters are used for many purposes that often result in conflicts for space and resources. Some uses may result in the absolute loss or long term degradation of the general aquatic environment or specific aquatic habitats, and pose theoretically significant, but as yet unquantified, threats to the biota and their associated habitats. Issues arising from these activities, and the perceived threats associated with them, are of serious concern to the public.

Multiple use issues are constantly changing, as are the real or perceived impacts of certain activities on living marine resources. The coastal and oceanic activities that generate these issues can threaten living marine resources and their habitats. Threats to resources occur when human activities cause changes in physical habitat, water and sediment chemistry, and structure and function of biological communities.

The Coastal Middle Atlantic and Coastal Gulf of Maine WMU share similar activities that threaten habitats and the well being of living marine resources in estuarine and near shore areas (USDC 1985). Likewise, the Gulf of Maine, Georges Bank, Middle Atlantic Shelf and Offshore WMUs share similar activities that threaten the welfare of biota and habitats in offshore areas.

The following discussion identifies and describes each multiple use issue and the potential threats associated with that issue (USDC 1985). For the purposes of this discussion, an "issue" is a point of debate or controversy evolving from any human activity, or group of activities, that results in an effect, product, or consequence. Environmental and socio-economic issues remaining to be resolved satisfactorily with regard to their impacts on marine organisms, their habitats, and man developed from the multiple, often conflicting uses of coastal lands and waters.

6.3.1.1. *Waste Disposal and Ocean Dumping*

The Atlantic Ocean off the northeastern United States has been and continues to be used for the disposal of wastes, including sewage sludge, dredged material, chemical wastes, cellar dirt, and radioactive material. Some waste treatment methods, such as chlorination, pose additional problems to aquatic species. Habitats and associated organisms have been degraded by long term ocean disposal, particularly of sewage wastes. Sewage pollution causes closure of shellfish beds,and occasionally, of public swimming areas. Additional research on the impacts of ocean disposal at deep water dump sites is urgently needed (USDC 1985). A recent potentially serious problem is the at sea incineration of toxic wastes.

Ocean disposal of sewage sludge, industrial waste products, dredged material, and radioactive wastes degrades water quality and associated habitats. The deep water dump site is 106 miles offshore off the mouth of the Hudson River due east of central New Jersey. Concentrations of heavy metals, pesticides, insecticides, petroleum products, and other toxics all contribute significantly to degradation of waters off the northeastern States. Organic loading of estuarine and coastal waters is an emerging problem. Symptoms of elevated levels include excessive algae blooms, shifts in abundance of algal species, biological oxygen demand (BOD) increases in sediments of heavily affected sites, and anoxic events in coastal waters. Changes in biological components are a consequence of long term ocean disposal. Harmful human pathogens and parasites can be found in biota and sediments in the vicinity of ocean dump sites. In addition, shellfish harvesting grounds have been closed because of excessive concentrations of pathogenic and indicator species of bacteria.

Many of the above issues and concerns may also be germane to the dumping of fish and shellfish waste in the ocean. The closure of land based processing plants because of the plants inability to meet National Pollution Discharge Elimination System (NPDES) or State Pollution Discharge Elimination System (SPDES) effluent requirements encourages the attempts for at sea disposal. While fishery byproducts may be nutritive in value, problems of BOD increases, excessive algal blooms, and concentrations of pathogenic bacteria, may all be associated with ocean disposal of fisheries products. The onus of proof of no environmental harm must fall to the group that wants to use the ocean for disposal purposes.

The deeper waters of the offshore WMUs present a different set of problems, compared with shallower waters, with respect to oceanic currents, warm core rings, and other physical and chemical oceanographic processes. Furthermore, less is known and understood about deep water ecosystems than their shallow water counterparts. It is imperative that studies be undertaken to reveal the fate and role of contaminants in deep water ecosystems, and to refine information about the shelf ecosystem through which these materials may be transported (USDC 1985).

6.3.1.2. *Coastal Urbanization*

Half of the human population makes its home within 60 miles of one ocean or another (Zero Population Growth Reporter 1994a). In the US, the home is often accompanied by: a car, and an oil leak that trickles into the nearby stream and down to the shore; a lawn, showered with pesticides that wash "away" in the rain; a neighboring farm, and manure that seeps down to the bay, firing an algae bloom; and a paper mill, spilling traces of toxic dioxin into the river. The list goes on.

The US population rose 85 percent within 50 miles of the coastlines between 1940 and 1980, compared to 70 percent for the nation as a whole (Zero Population Growth Reporter 1994b). To accommodate development and create beach view property, mangroves, marshes and dunes are torn away. Some 110 million Americans live in marine coastal zones,and their number is growing. Each year more beaches close because of contamination as waste from overloaded sewage systems is dumped into oceans. In 1992, the 60 million Americans that live along the Atlantic coastal region saw 1,713 beach closings.

The US Census Bureau projects that by the year 2000, the US population will reach 275 million, more than double its 1940 population. The United States has the third highest population in the world.

The U.N. Food and Agriculture Organization now estimates that all 17 of the world's major fishing areas have either reached or exceeded their natural limits, and that 9 are in serious decline (Postel 1994). It is widely acknowledged that many of the North Atlantic fisheries are seriously depleted and arguments rage over who is to blame. Pogo had the answer: "We have met the Enemy, and he is Us."

Brouha (1994) points out our dilemma and states: "All our scientific work will be for naught if world human population growth and resource consumption are not stabilized soon. Unchecked growth, subsidies that support unsustainable resource use, and natural resource policies focused on short-term economic gains have created a conundrum for the long-term economic integrity and productivity of global ecosystems."

Ehrlich (1990) states the problem best: "No matter how distracted we may be by the number of problems now facing us, one issue remains fundamental: Overpopulation. The crowding of our cities, our nations, underlies all other problems."

Tremendous development pressures exist throughout the coastal area of the Northeast Region. More than 2,000 permit applications are processed annually by the NMFS Northeast Region for commercial, industrial, and private marine construction proposals. The proposals range from generally innocuous, open pile structures, to objectionable fills that encroach into aquatic habitats, thereby eliminating their productive contribution to the marine ecosystem. The projects range from small scale recreational endeavors to large scale commercial ventures to revitalize urban waterfronts.
Associated with marine construction are a number of impacts which affect living marine resources directly, and indirectly through habitat loss or modification. Many of these projects are of sufficient scope to singly cause significant, long term or permanent impacts to aquatic biota and habitat; however, most are small scale causing minor losses or temporary disruptions to organisms and environment. The significance of small scale projects lies in the cumulative effects resulting from the large number of these activities.

Urban construction is not limited to the shore, but upland development, too, which can adversely impact aquatic areas. One of the major problems arising from urban development is the increase in nonpoint source contamination of estuarine and coastal waters. Highways, parking lots, and the reduction in terrestrial vegetation and fringe marshes facilitate runoff loaded with soil particles, fertilizers, biocides, heavy metals, grease and oil products, PCBs, and other material deleterious to aquatic biota and their habitats. Atmospheric emissions resulting from certain industrial processes contain sulphurous and nitrogenous compounds that contribute to acid precipitation, a growing source of concern in some fresh water sections of tidal streams. Nonpoint pollution is incorporated in water, sediments, and living marine resources. Although nonpoint sources of pollution do not usually cause acute problems, they can contribute to subtle changes and increases of contaminants in the environment (USDC 1985).

As residential, commercial, and industrial growth continues, the demand for potable, process, and cooling water, flow pattern disruption, waste water treatment and disposal, and electric power increases. As ground water resources become depleted or contaminated, greater demands are placed on surface water through dam and reservoir construction or some other method of freshwater diversion. The consumptive use of significant volumes of surface freshwater causes reduced river flow that can affect down stream salinity regimes as saline waters intrude further upstream.

Turek *et al.* (1987) identified numerous studies that have correlated freshwater inflows and fishery resource production. Salinity is a primary ecological factor regulating the distribution and survival of marine organisms. The amount of freshwater entering an estuary determines physicochemical variables (e.g. salinity, temperature, and turbidity) directly affecting physiological processes in organisms. Salinity is a primary factor regulating estuarine primary production. In addition, salinity governs fish distribution by secondarily restricting predator distribution (Turek *et al.* 1987).

Water that is not lost through consumptive uses is returned to the rivers or streams as point source waste water discharges. Although the waste water generally is treated, it still contains contaminants. Domestic waste water contains residual chlorine compounds, nutrients, suspended organic and inorganic compounds, trace metals and bacteria. Industrial discharges may contain many dissolved and suspended pollutants, including metals, toxic substances, halogenated hydrocarbons, petroleum products, nutrients, organics and heat.

Construction in and adjacent to waterways often results in elevated suspended solids emanating from the project area. The distance the turbidity plume moves from the point of origin is dependent upon tides, currents, nature of the substrate, scope of work, and preventive measures employed by the contractor.

Excessive turbidities can abrade sensitive epithelial tissues, clog gills, decrease egg buoyancy, reduce light penetration; thereby affecting photosynthesis of phytoplanktonic and submerged vegetation, and cause localized oxygen depression. Suspended sediments subsequently settle, which can destroy or degrade productive shellfish beds and nursery sites.

The effects of turbidity and siltation are generally, but not always, temporary and short term. Other construction activities can result in permanent loss or long term disruption of habitat. Dredging can degrade productive shallow water and destroy marsh habitat or resuspend pollutants, such as heavy metals, pesticides, herbicides, and other toxins. Concomitant with dredging is spoil disposal, which traditionally occurred on marshes or in open water. Shoreline stabilization can result in gross impacts, through filling of intertidal and sublittoral habitat; or cause subtle effects, resulting in the elimination of the ecotone between shore and water, or through the scouring of benthic habitat by reflective wave energy.

Sewage treatment effluent produces changes in biological components as a result of chlorination and increased contaminant loading. Sewage treatment plants constructed where the soils are highly saturated often allow suburban expansion in areas that would have otherwise remained undeveloped, thereby exacerbating already severe pollution problems in some areas.

Another aspect of urban development is nonpoint source pollution, which is caused by land based activities that result in materials being transported to aquatic areas. Certain pollutants (pathogens, phosphorus, sediments, heavy metals, and acid precipitation) from nonpoint sources are demonstrable problems in Atlantic coastal and estuarine waters (USDC 1985). Nonpoint source pollution appears to be a chronic threat that will affect the Northwest Atlantic Ocean in the upcoming decades.

Another problem resulting from coastal development and construction is the use of creosoted or CCA treated lumber. The continued use of treated lumber in new or repair/replacement of submerged structures brings structure seeking species like black sea bass in enhanced exposure to toxic contaminants released by this lumber.

Diversion of freshwater to other streams, reservoirs, industrial plants, power plants, and municipalities can change the salinity gradient downstream and displace spawning and nursery grounds. Patterns of estuarine circulation necessary for larval and plankton transport could be modified. Such changes can expand the range of estuarine diseases and predators associated with higher salinities that affect commercial shellfish.

Industrial waste water effluent is regulated by EPA through permits. While the NPDES provides for issuance of waste discharge permits as a means of identifying, defining, and where necessary, controlling virtually all point source discharges, the problems remain due to inadequate monitoring and enforcement. It is not possible presently to estimate the singular, combined, and synergistic effects on the ecosystem impacted by industrial (and domestic) waste water.

6.3.1.3. *Energy Production and Transport*

Energy production facilities are widespread along Atlantic coastal areas. Electric power is generated by various methods, including land based nuclear power plants, hydroelectric plants, fossil fuel stations, and possibly future offshore floating nuclear power plants. These facilities compete for space along the coastal zone; they require water for cooling and, in the case of coal fired plants, generate voluminous amounts of fly ash and sulfur dioxide, as well as electricity. In addition, hydroelectric plants, with their need for dams, substantially modify river courses and affect anadromous fish runs and/or restoration programs.

The impacts on the marine and estuarine environment resulting from the various types of power plants include water consumption, heated water and reverse thermal shock, entrainment and impingement of organisms, discharge of heavy metals and biocides in blow down water, destruction and elimination of habitat, and disposal of dredged materials and fly ash (USDC 1985).

The Outer Continental Shelf (OCS) exploratory and production drilling and transport may affect biota and their habitats through the deposition of drilling muds and cuttings. Oil spills resulting from well blowouts, pipeline breaks, and tanker accidents are of major concern. Seismic testing operations can interfere with fishing operations and damage or destroy fishing gear. In addition, exclusion areas around drilling rigs can result in conflicts between fishermen, both recreational and commercial, and the oil companies.

6.3.1.4. *Port Development and Utilization*

All ports require shoreside infrastructure, mooring facilities, and adequate channel depth. Ports compete fiercely for limited national and international markets and continually strive to upgrade their facilities. Dredging and dredged material disposal, filling of aquatic habitats to create fast land for port improvement or expansion, and degradation of water quality are the most serious perturbations arising from port development. All have well recognized implications to living marine resources and habitat.

6.3.1.5. *Agricultural Development*

Agricultural development can affect fisheries habitat directly through physical alteration and indirectly through chemical contamination. Fertilizers, herbicides, insecticides, and other chemicals are washed into the aquatic environment with the uncontrolled nonpoint source runoff draining agricultural lands. These chemicals can affect the growth of aquatic plants, which in turn affects fish, invertebrates, and the general ecological balance of the water body. Additionally, agricultural runoff transports animal wastes and sediments that can affect spawning areas, and generally degrade water quality and benthic substrate. Excessive uncontrolled or improper irrigation practices often exacerbate the contaminant flushing as well as deplete and contaminate ground water. One of the most serious consequences of erosional runoff is that the frequent dredging of navigational channels results in dredged material that requires disposal, often in areas important to living marine resources (USDC 1985).

6.3.1.6. *Marine Mineral Extraction*

Mining for sand, gravel, and shell stock in near shore coastal and estuarine waters can result in the loss of infaunal benthic organisms, modifications of substrate, changes in circulation patterns, and decreased dissolved oxygen concentrations at deeply excavated sites where flushing is minimal. Sand and gravel mining tends to result in suspended materials at the mining sites, and turbidity plumes may move several miles from individual sites. Mining also results in ranges in sediment type or sediment quality, often over areas measurable in square miles. Deep borrow pits created by mining may become seasonally or permanently anaerobic (USDC 1985).

Coastal sand mining to support beach restoration projects is another potential threat to consider, especially since the habitat needs of overwintering juveniles are so poorly understood. It may be important for these projects to avoid areas that are rich in clam shells or near other "reef" habitats (Steimle pers. comm.).

6.3.1.7. *Other Effects of Nonpoint Pollution (NPS)*

Many of the adverse impacts associated with NPS were discussed above under individual threats. Cumulatively, however, the effects of this environmental insult may have much more far reaching implications for fisheries resources. Estuarine and riverine plumes entering coastal waters are influenced by Coriolis and other dynamic forces. These plumes may remain as discrete water masses flowing close to the coast for hundreds of miles.

6.3.1.8. *Coastal and Wetland Use and Modification*

Intense population pressures have adversely affected many estuarine and marine habitats along the Atlantic coast. Demand for land suitable for home sites, resorts, marinas, and industrial expansion has resulted in the loss or alteration of large areas of wetlands through dredging, filling, diking, ditching, upland construction, and shoreline modification.

As residential and commercial use of coastal lands increased, so does the recreational use of coastal waters. Marinas, public access landings, private piers, and boat ramps all vie for space. Boating requires navigational space, a place to berth for some boat owners, and boat yards for repair and storage.

As population densities increase in these areas, greater pressures are exerted to develop remaining lands, and the demand for nuisance insect control on adjacent undeveloped wetlands either through chemical or physical (i.e., ditching) methods, also intensifies.

In addition to residential and recreational development, other competing uses further contribute to the destruction or modification of wetland areas. Agricultural development can significantly affect wetlands. Common flood control measures in low lying coastal areas include dikes, ditches, and stream channelization. Wetland drainage is practiced to increase tillable land acreage. Wildlife management techniques that also destroy or modify wetland habitat include the construction of dredged ponds, low level impoundments, and muskrat ditches and dikes (USDC 1985).
In general wetland loss is not something the Council can directly affect. The Council's Congressional mandate is to reduce fishing mortality when a resource is overfished. Loss of habitat and reduced ability to reproduce because of environmental degradation are generally considered part of the natural mortality estimate when stock assessments are performed and thus outside the control of the MFCMA. It is becoming increasingly apparent that fishing mortality reductions are significantly hampered by the constant loss of species habitat.

Significant coastal wetlands have been lost recently. Tiner (1987) in a report entitled "Mid-Atlantic wetlands. A disappearing natural treasure", quantifies the current status and recent trends in wetlands in the Mid-Atlantic. The trends are alarming. Between 1955 and 1981, Delaware lost about 42,000 acres of coastal wetlands and inland vegetated wetlands. Delaware lost 3.8% of its coastal wetlands. Between 1955 and 1978, about 24,000 acres of Maryland's coastal wetlands and inland vegetated wetlands disappeared. Maryland lost 9% of its coastal wetlands. Between 1956 and 1977, over 63,000 acres of Virginia's coastal and inland vegetated wetlands were lost, with an overall loss of 6.3% of the coastal wetlands. The coastal areas of Virginia, Maryland, and Delaware are absolutely essential habitat for young stages of black sea bass.

The NMFS 1985 priorities on the multiple use issues and threats to living marine resources were identified in the RAP document (USDC 1985). Activities identified as high priority included urban and port development, ocean disposal, dams and agricultural practices. Medium priority activities included industrial waste discharges, domestic waste

discharges, and OCS oil and gas development (Table 8). These priorities are currently being re-evaluated (Peterson pers. comm.).

Finally, habitat alteration by the fishing activities themselves is perhaps the least understood of the important environmental effects of fishing (National Research Council 1994a). Alterations to resource habitats due to fishing may result from the loss of habitats of non-target species, such as species encrusting cobbles, or of other epibenthic habitats, which may be important nursery areas for juvenile fish; from the alteration of nutrient levels and bottom sediment, including destruction of habitat by bottom trawling, dredging, and other fishing and processing operations; and from the generation of suspended debris that can have lethal effects long after fishing activities have ceased.

According to Steimle (pers. comm.) there have been reports from the artificial reef experts in New York and New Jersey (Steve Heins and Bill Figley) that some past or current reef habitats, especially older wrecks or mussel beds, in parts of the Mid-Atlantic are being purposely destroyed or flattened to facilitate the unobstructive use of "rock-hopper" trawls targeting reef-fish such as black sea bass and tautog. Some wreck salvage operations can be highly destructive to reef habitat value, as well. Reduced-profile reefs are less attractive and useful as habitat for reef-fish, including black sea bass, and are more prone to being covered by sediments and lost as functional habitat. This threat is the reason that roller rig size is limited.

The loss of traps or nets on reef habitats, which continue to ghost fish, is another habitat threat that is partially dealt with by rapidly degraded panels on traps. Snagged trawl or gill nets on reef wrecks also increase the loss of hooked fishing gear and lead weights on reefs, which further contributes to the degradation of habitat value, and possibly increases the likelihood of metal contamination (Steimle pers. comm.). Steimle (pers. com.) proposed that lost nets can be retrieved by divers, and a coded tag marking system, associated with licenses, on nets could facilitate assigning responsibility.

6.4. PROGRAMS TO PROTECT, RESTORE, PRESERVE, AND ENHANCE THE HABITAT OF THE STOCKS FROM DESTRUCTION AND DEGRADATION

The MFCMA provides for the conservation and management of living marine resources (which by definition includes habitat), principally within the EEZ, although there is significant concern for management throughout the range of the resource which includes the State controlled waters. The MFCMA also requires that a comprehensive program of fishery research be conducted to determine the impact of pollution on marine resources and how wetland and estuarine degradation affects abundance and availability of fish.

The MFCMA established Regional Fishery Management Councils that have the responsibility to prepare fishery management plans which address habitat requirements, describe potential threats to that habitat, and recommend measures to conserve those habitats critical to the survival and continued optimal production of the managed species. The NMFS Habitat Conservation Policy (48 FR 53142 - 53147), specifically Implementation Strategy 3, established the basis for a partnership between NMFS and the Councils to assess habitat issues pertaining to individual manages species. Under MFCMA, the action agencies (such as the Corps of Engineers) have to respond within 45 days to any Council's comments on habitat issues.

Other NMFS programs relative to habitat conservation are found in the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, and the Anadromous Fish Conservation Act of 1965. The NMFS shares responsibilities with the FWS for conservation programs under these laws.

In addition to the above mentioned NMFS programs, other laws regulate activities in marine and estuarine waters and their shorelines. Section 10 of the River and Harbor Act of 1899 authorizes the Army Corps of Engineers (COE) to regulate all dredge and fill activities in navigable waters (to mean high water shoreline). Section 404 of the Clean Water Act of 1980 authorizes EPA to regulate the discharge of industrial and municipal wastes into waters and adjacent wetlands. EPA has delegated authority under Section 404 to the COE to administer all dredge and fill activities under one program. Section 401 of the Clean Water Act authorizes EPA, or delegated States with approved programs, to regulate the discharge of all industrial and municipal wastes. The EPA and COE also share regulatory responsibilities under the Marine Protection, Research, and Sanctuaries Act of 1972.

All of the activities regulated by these programs have the potential to adversely affect living marine resources and their habitat. The NMFS, EPA, FWS, and State fish and wildlife agencies have been mandated to review these activities, assess the impact of the activities on resources within their jurisdiction, and comment on and make recommendation to ameliorate those impacts to regulatory agencies. Review and comment authority is provided by the Fish and Wildlife Coordination Act of 1934 (as amended 1958) and the National Environmental Policy Act of 1969. Consultative authority extends to all projects requiring federal permits or licenses, or that are implemented with federal funds.

Other legislation under which NMFS provides comments relative to potential impacts on living marine resources, their associated habitats, and the fisheries they support include, but are not limited to, the Coastal Zone Management Act of 1972; the Marine Protection, Research, and Sanctuaries Act of 1972; and the Endangered Species Act of 1973 (Section 7 consultation).

A more detailed discussion of the pertinent legislation affecting their protection, conservation, enhancement, and management of living marine resources and habitat can be found in the NMFS Habitat Conservation Policy (48 FR 53142-53147).

In addition, NMFS and the other Federal resource agencies are involved in other programs with the States (e.g., NMFS administers Saltonstall-Kennedy and Fish and Wildlife Service administers Wallop-Breaux programs) that provide grants to conserve fish habitats and improve fisheries management.

Individual States also regulate wetlands, which complements Federal habitat conservation programs. Over the past two decades, the United States has devised various public and private programs to protect and manage this valuable wetland resource. Unfortunately, most of these programs have addressed only limited aspects of the wetlands protection problem, and they have been adopted haphazardly and incoherently (The Conservation Foundation 1988). This has led to duplication and uncertainty, at times imposing burdensome costs. The existing programs also leave major gaps in the protection effort.

The members of the National Wetlands Policy Forum (The Conservation Foundation 1988) firmly believe the nation cannot afford to allow the present situation -- with its inadequate wetlands protection, its confusion, its costs and frustration -- to continue. The National Wetlands Policy Forum members recognize that wetlands protection is only one of many issues the nation is facing, but they believe it clearly merits a higher priority than it has received in the past.

The preservation and restoration of wetlands and essential estuarine habitats are mainly State responsibilities as well as the Federal EPA and Corps of Engineers. The Council's Habitat Committee which generally includes personnel from ASMFC, Fish and Wildlife Service and the Coast Guard works closely with the ASMFC Habitat Committee and the EPA and Corps. Numerous meetings have been held with these agencies during the development of this FMP. Several projects (Cedar Island development, marina development in Ocean City, Dam Neck dredge spoil disposal, Assawoman canal dredging, etc.) have been commented on and modified because of impacts to habitat for species managed by MAFMC.

6.5. HABITAT PRESERVATION, PROTECTION AND RESTORATION RECOMMENDATIONS

Management of fisheries requires both control of fishing mortality (by the Councils and the Commission) and preservation and restoration of habitat (by the States, EPA, and the Corps of Engineers). As noted above as a purpose for this action, the Council intends to work closely with these other agencies for habitat preservation.

As stated in section 4, black sea bass are overexploited. Recognizing that black sea bass are in poor shape, it is worthwhile to stress habitat conservation for increasing the survivability of juveniles, as well as management actions to control fishing mortality, which will strengthen the use of the habitat information in meeting the MAFMC mandates that "irreversible or long term adverse effects on fishery resources and the marine environment are avoided."

Black sea bass are dependent on estuarine habitats for much of their life (section 6.1). It is precisely these habitats that are most vulnerable to anthropogenic impacts and loss. It is probable that fishing mortality rates on black sea bass may be the primary reason for the declines noted. However, the critical habitat areas designated by the States (section 6.1.2) must be protected in order to allow black sea bass populations to rebuild and be maintained when fishing mortality rates are reduced.

In order to resolve the above problems and prevent overfishing for this species, very significant reductions in fishing mortality will be required. The reductions in fishing mortality are needed to reduce the risk of stock failure. The Council has the ability to control fishing mortality and reduce that component of risk through the Magnuson Act.

Equally important to reducing risk is the quality of the habitat. In this area the primary Federal responsibility is that of EPA and the Corps of Engineers, since the Magnuson Act only allows the Council the right to comment on proposals. Spawning and nursery areas and migratory pathways must be protected and kept viable if the stringent fishing regulations are to succeed. Successful fishery management requires a partnership between the fishery managers and the habitat protection agencies for the programs to succeed. It would not be fair to place stringent regulations on the fishermen in order to solve the stock problems, only to lose any gains to pollution and habitat degradation. The recommendations that follow are made in keeping with this philosophy.

It is the policy of the Mid-Atlantic Fishery Management Council to oppose any loss of aquatic habitat or wetlands which contributes to the conservation of fish stocks. Where loss of habitat is unavoidable locally, the Council endorses recreation of quantitatively and qualitatively equivalent habitat. The Council recognizes the multiple resource base of our coastal areas and recognizes the need to accommodate other natural resource management objectives with special sensitivity to goals that may be contrary to the objectives of fishery management. The intent of the Council is to support no net loss of fishery habitat while minimizing all detrimental alterations of these essential habitats.

This policy is intended to allow the MAFMC to optimize the management of fisheries in the Mid-Atlantic EEZ through a concerted effort to establish a quality habitat and to seek to reverse the serious problems affecting the reproduction, size

frequency and distribution of fish. The Council will accomplish this through participation in the review of private and government projects which would adversely affect fish production.

The Council is deeply concerned about the effects of marine and estuarine habitat degradation on fishery resources. They have a responsibility under the MFCMA to take into account the impact of habitat degradation on black sea bass. The following recommendations are made in light of that responsibility and are in full accordance with the Council's Habitat Policy and Position Paper on Habitat and the Environment.

1. All available or potential natural habitat for migratory black sea bass should be preserved by encouraging management of conflicting uses to assure access by the fish to essential habitat and maintenance of high water quality standards to protect black sea bass migration, spawning, nursery, overwintering, and feeding areas.

2. Filling of wetlands should not be permitted in or near nursery summering areas. Mitigating or compensating measures should be employed where filling is unavoidable. Project proponents must demonstrate that project implementation will not negatively affect black sea bass, their habitat, or their food sources.

3. Best engineering and management practices (e.g., seasonal restrictions, dredging methods, disposal options, etc.) should be employed for all dredging and in water construction projects. Such projects should be permitted only for water dependent purposes when no feasible alternatives are available. Mitigating or compensating measures should be employed where significant adverse impacts are unavoidable. Project proponents should demonstrate that project implementation will not negatively affect black sea bass, their habitat, or their food sources.

4. The disposal of sewage sludge, industrial waste, and contaminated dredged material in black sea bass habitat, including the New York Bight, should not be allowed. Advanced garbage, industrial waste, and sludge handling techniques are now available and must be encouraged. Specifically:

a. The Council opposes ocean dumping of industrial waste, sludge and other harmful materials.

b. The Council requests EPA require each permitted ocean dumping vessel be required to furnish detailed information concerning each trip to the dump site. This might be in the form of transponders; locked Loran C recorder plots of trip to and from the dump site; phone call to EPA when vessel leaves and returns to port; or other appropriate method to ascertain that vessels dump only in designated areas.

c. The Council requests fishermen and other members of the public to report to the EPA, Coast Guard and the Council any observance of vessels dumping other than in the approved dump sites. A list of permitted vessels would accompany this request with the additional request for reporting of any vessel not on the approved list. The report should include date, time, location (longitude, latitude, Loran bearings), vessel name of the dumping vessel, the nature of the material dumped, name of reporting individual and vessel. This would enable EPA to take appropriate action against illegal dumping.

d. The Council strongly urges state and federal environmental agencies to reduce the amount of industrial waste, sludge and other harmful materials discharged into rivers and the marine environment, and for these agencies to increase their surveillance monitoring and research of waste discharge. The Council requests that the Environmental Protection Agency implement and enforce all legislation, rules and regulations with emphasis on the best available technology requirements and pretreatment standards.

5. Ocean disposal of fish waste should not be allowed in any areas where environmental harm may occur. The burden of proof that no environmental harm exists should be on the entity proposing the disposal. An environmental monitoring program to characterize the proposed site prior to, during, and after disposal occurs must be undertaken and is the financial responsibility of the entity benefiting from the use of the ocean environment. As an example, the dumping of fish wastes in areas of surf clams or scallops could provide enrichment that could trigger undesirable organisms, such as algae which produce poisoning (PSP).

6. The siting of industries requiring water diversion and large volume water withdrawals should be avoided in black sea bass critical areas. Project proponents must demonstrate that project implementation will not negatively affect black sea bass, their habitat, or their food supply. Where such facilities currently exist, best management practices must be employed to minimize adverse effects on the environment. All Federal and State agencies regulating projects which alter freshwater inflows should consider the cumulative effects to estuarine production in their decision-making processes.

7. Dechlorination facilities should be used to destroy chlorine at sewage treatment plants and power plants.

8. No toxic substances in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife, and aquatic life should be discharged. The EPA's Water Quality Criteria Series should be used as guidelines for determining harmful concentration levels. Use of the best available technology to control industrial waste water discharges must be required in areas critical to the survival of black sea bass. Any new potential discharge into critical areas must be shown not to have a harmful effect on black sea bass. In calculating potential impacts, the stratification affects of mixing zones should be carefully considered.

9. The EPA, for the EEZ, and States, for the Coastal Zone, should review their water quality standards and make changes as needed with respect to the habitat requirements of black sea bass migratory passage and feeding and to maintain edible black sea bass; that is, flesh and organ buildup of contaminants must be considered.

10. Water quality standards in nursery, spawning, feeding, and areas of migratory passage should be enforced rigidly by State or local water quality management agencies, whose actions should be carefully monitored by the EPA. Where State or local management efforts (standards/enforcement) are deemed inadequate, EPA should take steps to assure improvement; if these efforts continue to be inadequate, EPA should assume authority, as necessary.

11. Appropriate measures must be taken as soon as possible to reduce acid precipitation and runoff into estuaries and near shore waters.

12. EPA and appropriate agencies must establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to black sea bass nursery areas to minimize pesticide, fertilizer, and sediment loads to these areas critical for survival. The effective width of these vegetated buffer strips varies with slope of terrain and soil permeability. The Soil Conservation Service and other concerned Federal and State agencies should conduct programs and demonstration projects to educate farmers on improved agricultural practices that would minimize the wastage of pesticides, fertilizers, and top soil and reduce the adverse effects of these materials.

6.7. HABITAT RESEARCH NEEDS

The National Status and Trends Program of NOAA (USDC 1987 and 1989) should provide guidance in making intelligent decisions involving the use and allocation of resources in the nation's coastal and estuarine regions. These decisions require reliable and continuous information about the status and trends on environmental quality in the marine environment. Four general objectives have been established for the early years of the National Status and Trends Program (USDC 1987 and 1989). Those objectives are (1) to establish a national data base using state of the art sampling, preservation, and analysis methodologies; (2) to use the information in the data base to estimate environmental quality, to establish a statistical basis for detecting spatial and temporal change, and to identify areas of the nation that might benefit from more intensive study; (3) to seek and validate additional measurement techniques, especially those that describe a biological response to the presence of contaminants; and (4) to create a cryogenic, archival specimen bank containing environmental samples collected and preserved through techniques that will permit reliable analysis over a period of decades. While the Council concurs with these objectives, efforts by this program or other NMFS programs also must look at specific issues which include:

1. It is necessary that scientific investigations be conducted on black sea bass to emphasize the long term, synergistic effects of combinations of environmental variables on, for example, reproductive capability, genetic changes, and suitability for human consumption.

2. The Council recommends the following areas for future habitat directed investigations: field studies on the direct and indirect effects of contaminants on mortality of black sea bass; studies on the interactive effects of pH, contaminants, and other environmental variables on survival of black sea bass; and continued studies on the importance of factors controlling the production and distribution of food items that appear in the diet of young black sea bass.

7. DESCRIPTION OF THE FISHERIES

7.1. DOMESTIC COMMERCIAL FISHERY

Commercial landings of black sea bass have been recorded since the late 1800's. These data indicate that commercial landings north of Cape Hatteras varied around 6 million pounds from 1887 until 1948 when they increased to 15.2 million pounds (NEFSC 1992). Reported landings increased to a peak of 22 million pounds in 1952, declined to 1.3 million pounds in 1971 (Figure 11), and in recent years have fluctuated between approximately 2 and 4 million pounds (Table 9).
Commercial black sea bass landings averaged approximately 3.6 million pounds per year or 49% of the total landings, recreational and commercial landings combined, 1983-1992 (Table 9). In 1994, fishermen landed approximately 5.0 million pounds of black sea bass of which commercial landings accounted for approximately 2 million pounds. This represents a decline from 4.3 million pounds, the largest amount of black sea bass landed by commercial fishermen during the period 1983 to 1994.

Traditionally, two gears, fish otter trawls and fish pots/traps have accounted for the majority of commercial landings on a coastwide basis. These two gears accounted for nearly 90% of the landings from 1983 to 1992 (Table 10). Other important gear include hand lines (5%) and lobster pots (1%).

Otter trawls, which harvested 56% of the black sea bass coastwide, accounted for the majority of the black sea bass landings in most states with the exception of Massachusetts, Delaware and Maryland (Table 11). Fish pots and traps accounted for the majority of the landings in these states. In addition, hand lines harvested a significant proportion of black sea bass in Massachusetts, New York, Virginia and North Carolina.

During the period 1983 to 1992, the proportion of black sea bass harvested by otter trawls has generally declined (Table 12). In 1984, otter trawls accounted for over 76% of the landings whereas in 1991 less than 25% of the sea bass landed commercially were harvested by this gear. Conversely, the percent of sea bass caught by fish pots and traps has generally increased with almost 62% of the landings attributable to this gear in 1991.

In 1994, approximately 87% of the commercial landings came from the EEZ (Table 13). Coastwide, from 1983 to 1994, an average of 84% of the sea bass landed commercially came from federal waters. By subregion, EEZ landings were predominant in the Mid-Atlantic area each year from 1983 to 1992 (Table 14). In New England, the landings were almost equally divided between state and federal waters from 1983 to 1987 with a predominance in state waters from 1988 to 1991. In 1992, EEZ landings accounted for 64 and 89% of the landings in the New England and Mid-Atlantic regions, respectively. North Carolina landings of black sea bass came almost exclusively from the EEZ during this time period.

Based on average monthly landings for the period 1983-1992, most black sea bass were harvested in federal waters from January through May with peak landings in February (Table 15). In state waters, landings peaked in May. Coastwide, in state and EEZ waters combined, landings peaked in February with a ten-year average of 501 thousand pounds.

In 1994, 77% of the total commercial landings of black sea bass came from three states: New Jersey (47%), Maryland (11%), and Virginia (19%) (Table 16). Based on a ten year average, 1983-1992, New Jersey and Virginia were the predominant states accounting for 26% and 24% of the landings, respectively (Table 17).

7.2. DOMESTIC RECREATIONAL FISHERY

Saltwater angling surveys were conducted for the entire Atlantic coast in 1960 (Clark 1962) and 1965 (Deuel and Clark 1968) by the US Fish and Wildlife Service and in 1970 (Deuel 1973) by the National Marine Fisheries Service. Beginning in 1979 and continuing to present, the NMFS has conducted annual Marine Recreational Fishing Statistical Surveys (MRFSS). This survey is designed to expand interview data on catch and angler effort from both on site creel census and telephone surveys to state and regional levels. The MRFSS distinguishes between fish available for identification and measurement by the interviewers (Type A), fish used as bait, filleted, or discarded dead (Type B1), and fish released alive (Type B2). The sum of types A, B1, and B2 comprise the total recreational catch whereas types A and B1 constitute total recreational landings. MRFSS estimates of catch and effort were recalculated in 1995 using an improved methodology to make the estimates more accurate.

Recreational fishermen caught 7.2 million black sea bass in 1994; they landed approximately 3.4 million (Table 18). However, both the recreational catch and landings were below the ten year average values of 9.1 and 5.3 million, respectively. The total weight of recreational landings in 1994, approximately 2.9 million pounds, was also less than the ten year average of 3.8 million pounds (Table 9).

Substantially more black sea bass were landed in the Mid-Atlantic than in either New England or North Carolina during each year from 1983 to 1994 (Table 19). In the Mid-Atlantic, the amount of black sea bass landed ranged from a low of 1.21 million pounds in 1984 to a high of 11.7 million pounds in 1986.

Recreational fishermen in the Mid-Atlantic landed more sea bass from the EEZ in 1994, with 86% of all sea bass landed in the Mid-Atlantic (Table 20). Based on a twelve year average, EEZ landings were predominant in the Mid-Atlantic accounting for 65% of the landings by weight. Conversely, state landings were predominant in the North Atlantic for most years during the period 1983 to 1994. In North Carolina (north of Cape Hatteras), state and EEZ landings were almost equally divided between the two areas from 1983 to 1994 (Table 20).

Recreational fishermen on party or charter boats accounted for most of the black sea bass landings from 1983-1992 (Table 21). Anglers fishing from party/charter and private/rental boats caught approximately the same percentage of black sea bass by number for the 1983 to 1992 period.

Anglers in New Jersey landed the highest percentage of all black sea bass landed by recreational fishermen along the Atlantic coast, accounting for 53% of the total (Table 22). Recreational landings from New Jersey, Virginia, Maryland, and New York accounted for over 90% of the black sea bass landed from Maine to Cape Hatteras, NC, 1983 to 1992 (Table 22).

8. ECONOMIC CHARACTERISTICS OF THE FISHERY

Black sea bass is an important component of the commercial and recreational fisheries from Massachusetts to North Carolina. The economic characteristics of the commercial and recreational black sea bass fisheries are described in the following sections. Throughout this description, it is important to note the distinction between economic value and economic impact.

Economic value is a measure of willingness to pay for a good or service. Ex-vessel value in the commercial sector is thus a measure of processor and wholesaler willingness to pay for black sea bass in the dockside market. Likewise, retail value is a measure of final consumer willingness to pay for black sea bass at supermarkets, seafood shops and restaurants. Economic impact, on the other hand, is a measure of expenditures made by people engaged in a particular activity, and the employment, income, tax revenues, etc. which result from these expenditures. Often, it is said that recreational fishermen spend "x" dollars on gear, boats, travel, etc., and generate "y" amount of employment or "z" dollars in tax revenue.

Clearly, black sea bass are valuable to both recreational anglers and seafood consumers who do not or cannot fish for themselves. Also, individuals and firms engaged in the commercial harvesting and marketing of black sea bass make expenditures and generate employment in the course of business activities, just as participants in the recreational fishery do. Black sea bass have economic value in both recreational and commercial uses and black sea bass related activities have economic impact in each use.

When considering the relative benefits of black sea bass to the two sectors, commercial values must be compared to recreational values and commercial impacts must be compared to recreational impacts. Unfortunately, recreational values are not easily measured and too often, economic impacts of recreational fishing are erroneously contrasted with ex-vessel value in the commercial sector. The reader is cautioned to avoid this confusion when impact and value estimates are presented in the following sections.

8.1. COMMERCIAL FISHERY

As a general rule, commercial fisheries are divided into three different components: harvesting, processing and marketing. Different degrees of specialization and integration within each of these components exists among different fisheries. That is, many individuals and firms specialize in a single sector, although some vertically integrated companies span all sectors, and diversified companies are often involved in food related industries besides seafood. The intent of the following section is to examine each component in order to better understand the black sea bass fishery.

8.1.1. Harvesting Sector

8.1.1.1. *Ex-vessel value and price*

Commercial landings of black sea bass decreased approximately 39% from 3.3 million pounds in 1983 to 2.0 million pounds in 1994 (Table 9). Commercial landings in 1994 were 37% below the 1993 level and 40% below the 1983-1994 mean. The commercial ex-vessel value for black sea bass in 1994 was approximately $1.6 million (Table 23). The ex-vessel value for commercial landings in 1994 was about 36% lower than in 1983 (Table 23). The value of commercial landings in 1994 indicated a 52% decrease from the 1993 level and a 54% decrease from the 1983-1994 average. Adjusted average prices (1994 dollars) for black sea bass increased from $0.90 per pound in 1983 to $1.17 per pound in 1994 and ranged from $0.90 per pound to $1.39 per pound for the 1983-1994 period (Table 24).

A record high average price (all sizes) for black sea bass occurred in 1989 in both nominal and inflation adjusted (1994) dollars (Table 24). Price fluctuations were likely associated with supply responses; generally it was found that higher prices corresponded to significant decreases in landings. On a monthly basis, the supply-price relationship was also evident. As expected, an inverse relationship between landings and average ex-vessel prices was found with overall higher prices corresponding to months with lower landings (Table 25).

The value of black sea bass relative to the value of total landings in 1994 varied for each state from less than 1% to about 3.8% of the total value of landings in the state (Table 26).

Prices received for black sea bass harvested in state waters were generally higher than for black sea bass harvested in EEZ waters throughout the year (Table 25). Prices received by fishermen tracked the seasonal supply relationship for black sea bass caught in state waters as well as in EEZ waters. The 1994 coastwide average ex-vessel price per pound for jumbo black sea bass was $3.19, $2.39 for large, $1.35 for medium, $0.52 for small, $0.44 for pins, and $1.49 for unclassified (Table 27). Price differentials in 1994 indicate that the ex-vessel price per pound for large black sea bass was 450% greater than for small, and 540% greater than for pins.

8.1.1.2. *Fishing Vessel Activity*

At the present time there is no annual permit requirement for commercial fishing vessels taking black sea bass within US waters. Without individual logbooks, information on the total number of vessels actually landing black sea bass (or the

extent of dependence on black sea bass) is difficult to assemble. The NMFS weighout system records can be used to estimate the number of vessels landing black sea bass in covered states (NC is not included). However, the data do not constitute a complete census. NMFS weighout files indicate that 574 vessels employing diverse types of gear landed black sea bass in 1994. This statistic provides a lower boundary for the number of commercial vessels involved in the black sea bass commercial fishery. In 1994, there were about 100 vessels that could have participated in the black sea bass fishery in North Carolina (R. Monaghan pers. comm.). Thus, the number of vessels that currently fish for black sea bass could range from 574 to 674 vessels. It is likely that most of the vessels that qualify for black sea bass permits would apply for them in order to maintain flexibility of fishing operations pending the availability of species, or to maintain eligibility given concerns about a potential limited entry program.

In 1992, 340 otter trawl vessels landed black sea bass that were recorded in NMFS weighout records (Table 28). Black sea bass represented 2% of the total pounds landed and 4% of the total ex-vessel value of all otter trawl trips harvesting 100 pounds or more of black sea bass in 1992 (Table 29). The top ten species (by weight) contributed 89% and 90% respectively, of the total pounds and the total value of the harvest of otter trawl vessels landing 100 pounds or more of black sea bass. When considering the value per pound of these species (obtained by dividing total value by total pounds) black sea bass had the third largest ex-vessel value per pound.

Based on trips landing more than 100 pounds of black sea bass, the average ex-vessel black sea bass value per trip was $805 (obtained by dividing ex-vessel value by number of trips in 1992). Otter trawl vessels which land black sea bass also harvest other species throughout the year. This activity categorizes this type of fishery as a mixed fishery, where squid, summer flounder, scup, silver hake, angler and other species are harvested on the basis of availability (opportunistic fishery), or land black sea bass as a bycatch from the involvement in other directed fisheries.

In 1994, black sea bass represented 0.2% of Atlantic coast total commercial landings, and 0.3% of the total value (Table 26). Black sea bass ex-vessel value was highest in New Jersey ($903,000), followed by Virginia ($460,000), Maryland ($251,000), and North Carolina ($223,000). However, when black sea bass value is compared to the total value of all species landed in each state, one finds that black sea bass was most important to Delaware, at 1.2% of the total commercial revenue, followed by New York (0.92%). Delaware and New Jersey accounted for 40% of all black sea bass harvested in 1994 (Table 26).

Activities at the port level indicate that 70% of all black sea bass commercial landings occurred in five ports: Cape May, New Jersey; Hampton Roads, Virginia; Ocean City, Maryland; Montauk, New York; and Point Judith, Rhode Island. The degree of port reliance on black sea bass is low throughout the region. Black sea bass landed value as a percent of total port landed value was: 2.02% for Cape May; 1.66% for Hampton Roads; 4.69% for Ocean City; 0.62% for Montauk; and 0.35% for Point Judith (Finlayson and McCay 1994).

8.1.1.3. *Fishing Costs*

Vessel costs are composed of ownership costs and operating costs. Ownership costs are incurred once the durable goods are purchased. These are added costs whether or not the assets (equipment/materials) are used in the production process, that is they remain constant regardless of the output level. Ownership costs are frequently referred to as "fixed costs." They include depreciation, debt, insurance, routine maintenance, and insurance, among others. Operating costs are incurred when the production process occurs. These costs are commonly known as "variable costs." They include fuel, oil, maintenance, wages, food, sale and unloading fees, among others.

Vessel variable costs are proportionate to the hours traveling and fishing (operating maintenance, fuel, ice) and the quantity of fish landed (wages, sales and unloading fees, ice). Costs vary in different locations and the cost components have changed over the years. Due to the variation in vessels landing black sea bass (home port, tonnage class, directed fishery, etc.), exact cost information is difficult to obtain and generally applicable only to a hypothetical "average" vessel.

Wages are almost always in the form of a share or "lay" system. The captain, crew, and vessel owner split the net revenue based on a predetermined, set ratio. Ratios are in many instances set according to what is traditional in that port. The particular ratio of the lay system utilized varies between vessels. Often certain expenses such as fuel, ice and in some cases food are deducted from the gross revenues with the remainder divided about 60-40 between the vessel owner and the captain and crew (A. Kitts pers. comm.). When one or the other of the parties is responsible for additional costs, the share split normally reflects this.

Fuel costs vary among ports. As of May 1994, diesel fuel costs for selected ports in the Mid and North Atlantic ranged from about $.60 per gallon to $1.10 per gallon, with an average of $.75 per gallon (A. Kitts pers. comm.). Total vessel fuel costs are directly proportional to the amount of time spent steaming and fishing as well as the size and drag of the fishing gear used.

Ice costs also vary among ports. On a per-ton basis, ice costs $50 in Boston, MA; $35 in Gloucester, MA; $75 in Montauk, NY; and $40 in Cape May, NJ. Typically ice costs will range from $40 to $70 coastwide (A. Kitts pers. comm.). Ice costs are related to the amount of fish expected to be caught, the expected trip length, and the type and size of storage system utilized on board.

Variable maintenance costs are related to the number of hours the engines, fishing gear, etc. are used and the weather conditions. Much of the minor repair work is conducted by crew members and, on larger vessels, by an engineer. Since these crew members perform this labor as part of their normal responsibilities, there is no added labor cost (Crutchfield 1986). However, most major engine, electronics, and gear repairs are contracted to specialists.

Selling costs consist of lumpers (unloaders) fees, transportation costs, etc. Lumpers fees are variable among ports. In Point Judith, RI the cost is $6 per 1,000 lbs (McCauley pers. comm.), $3 per 1,000 in Cape May, NJ (C. Bergman pers. comm.) and $5 per 1,000 lbs in Newport, RI (A. Kitts pers. comm.). In Montauk (NY) lumpers fees are not applicable, since the fish are boxed at sea (A. Kitts pers. comm.). The market charges $.10 per pound for unloading and packaging in Cape May, with transportation charges between $.06 to $.07 per pound (C. Bergman pers. comm.). In Point Judith unloading charges will depend on the value of the fish unloaded. Costs associated with washing, sorting, and packing black sea bass in a carton with ice (including labor) are between $.08 to $.10 per pound. Transportation charges range from $.05 and $.07 per pound (J. McCauley pers. comm.).

The New England full-time otter trawl fleet increased 66% between 1976 and 1985, while per-vessel deflated gross revenue decreased 20% (Kurkul and Terrill 1986). This appears to be a result of decreased landings per vessel rather than increased expenses.

Fishing costs for pound nets, fish traps, and hand line operations are much less than costs for otter trawlers (Norton *et al.* 1983). There are no studies addressing black sea bass fishing costs by type of gear. Fishing costs of commercial striped bass harvesters using fish traps and hook and line gear were developed by Norton *et al.* (1983). The design of floating traps allows for the harvesting of species such as scup, butterfish, squid and fluke. Fish trap fishermen typically use 70 ft vessels with major expenditures for wages (41%) followed by nets (15%) and taxes (14%). Hook and line fishermen typically use a small boat (17 ft average), have major expenses of wages (35%), fuel (16%), and tackle (16%) (Norton *et al.* 1983).

Estimates of vessel costs based on sea sampling data of otter trawl vessels landing mackerel from Maine to Virginia were developed by Walden (1993). In Walden's study, costs were broken down into trip costs or variable costs (fuel, ice and food, etc.) and yearly costs or fixed costs (insurance, engine and gear repair, electronic equipment expenses, etc.). Labor costs were not included in the analysis because labor is generally paid as a percentage of the total revenue after certain expenses are subtracted. Table 30 summarizes estimated average cost data for otter trawlers that operated in the mackerel fishery developed in Walden's study. Otter trawl vessels involved in the squid and black sea bass fishery may generally have similar equipment to the otter trawl vessels in the mackerel fishery. The cost data results developed by Walden might be used to an extent when analyzing cost data for otter trawl vessels in the black sea bass fishery. Vessels that participate in mixed fisheries have their fixed costs distributed over various activities. Utilization of such fixed costs to evaluate the financial performance of a vessel in only one fishery would yield inappropriate results.

An analysis by Buss and Kitts (1994) utilized three data sources (Capital Construction Fund files, Northeast Fisheries Science Center Weighout Files and Northeast Fisheries Science Center Master Vessel Files) to compile a data base containing information regarding revenues, landings, and expenditures for vessels operating in the US Northeast Atlantic coast for the period 1983-1992. Preliminary results from Buss and Kitts' (1994) work indicated that costs as a percent of total gross revenues (from tax return files) for trawlers in the following categories were: trip costs (fuel, oil, ice, water, food, etc.) 18.3%; other variable operating expenses (gear, supplies, freight, payment to lumpers, auction fee, etc.) 5.9%; indivisible operating expenses (insurance, licenses and permits, office expenses, taxes (not income), utilities (telephone), etc.) 16.8%; insurance cost 7.7%; crew share 36.9%; salary (payment to officers) 6.2%; and employee benefits 6%. Since expenses are recorded by individuals differently in tax forms, missing information was treated as missing values, therefore the above percentages do not add up to 100. The economic interpretations of the data provided by Buss and Kitts have limitations. Two significant drawbacks are: 1) data are based on tax returns and techniques dealing with different aspects of the return can vary significantly from one return to the next and 2) the data set does not fully represent the population of Northeast fishing vessels and results in the analysis are probably more applicable to more profitable vessels or "highliners" (Buss and Kitts 1994).

8.1.2. Processing Sector, Marketing and Consumption

Most black sea bass are sold fresh (R. Boragine and R. Ross pers. Comm.). The catch is generally refrigerated or iced during long trips and might or might not be iced during short trips. When the catch arrives at the dock, it is sorted, washed, weighed, and boxed and iced for shipment. Black sea bass might be frozen for future marketing when demand is low or when the market is glutted. When black sea bass is frozen, processing is minimal, mainly consisting of handling and freezing. Boxes containing black sea bass for shipment typically weigh 100 pounds, however, higher value black sea bass may be boxed in 60 pound cartons (J. McCauley pers. comm.).

Black sea bass are generally transported to market by truck. Black sea bass is carried as a specialty item in the Fulton Fish Market in New York City, with supplies peaking during the spring and fall months, then decreasing during the summer and reaching yearly lows during the winter months (Finlayson and McCay 1994).

Finlayson and McCay (1994) reported that "black sea bass dealers in the Fulton Market would pay and charge the highest prices for hook and line-caught fish, somewhat less for pot-caught fish, and the least for dragger-caught fish." This price differential appears to be associated with the quality and appearance of the product.

The greatest proportion of small black sea bass go to dealers in Philadelphia, Washington, Baltimore and points south (Finlayson and McCay 1994).

8.1.3. Economic Impact of the Commercial Fishery

The economic impact of the commercial black sea bass fishery as it relates to employment and wages is difficult to determine given the nature of the fishery. Since, black sea bass represents 0.2% of the total landings and 0.3% of the total value of all finfish and shellfish from North Carolina to Maine, it can be assumed that only a small amount of the region's fishing vessel employment, wages and sales is dependent on black sea bass.

8.2. RECREATIONAL FISHERY

Recreational fishing contributes to the general well being of participants by affording them opportunities for relaxation, experiencing nature, and socializing with friends. The potential to catch and ultimately consume fish is an integral part of the recreational experience, though studies have shown that non-catch related aspects of the experience are often as highly regarded by anglers as the number and size of fish caught. Since equipment purchase and travel related expenditures by marine recreational anglers have a profound affect on local economies, the maintenance of healthy fish stocks and development of access sites is as important to fishery managers as the status of commercial fisheries.

8.2.1. Recreational Fishing Activity

The participation of black sea bass anglers by region and mode indicates that from 1983 to 1992, 43% of black sea bass (by number) were caught from party or charter vessels (Table 21). Anglers expenditures in the party boat industry will benefit the party boat industry as well as other businesses in the coastal communities.

In addition to party and charter vessels, 12% of black sea bass were caught from shore, and 46% from private/rental boats (Table 21). Ownership of a private vessel involves sizable investment and maintenance costs, thus contributing greatly to measures of economic impact. Private vessels are also used for non-fishing purposes, however, and are used to fish for many different species. Expenditure and cost data must be prorated for black sea bass trips to account for multipurpose use.

At the present time, annual permit requirements for party and charter boats (vessels for hire) which take anglers to fish for black sea bass within the US EEZ do not exist. Without individual logbooks, the total number of party and charter vessels actually directing trips on scup is difficult to determine.

In 1985, a total of 454 party and 1,626 charter boats operated out of Atlantic coast ports from Maine through North Carolina (Table 31). These vessels generated revenues of $101 million in 1985. Estimates of party and charter boat trips directed at black sea bass are lacking for specific regions along the coast.

In 1993, a random sample of 821 New Jersey marine recreational fishermen (regardless of mode) indicated that black sea bass was targeted by 3% of the recreational fishermen (B. Brown pers. comm.). Strand *et al.* (1991) estimated that in the latter half of the eighties, black sea bass was the second most popular bottomfish targeted by anglers intercepted in New Jersey.

The National Marine Fisheries Service estimated that in 1991, a total of 15,903,000 trips were taken by marine recreational anglers in the Mid-Atlantic region (USDC 1992). Intercept surveys show that 1.85% of the anglers interviewed indicated that they preferred or sought black sea bass as the primary species targeted in the Mid-Atlantic. That is, an estimated 294,206 angler trips (all modes) were nominally directed at black sea bass in the Mid-Atlantic region in 1991.

8.2.2. Economic Impact of the Recreational Fishery

In 1985, direct sales related to marine recreational fishing for all species from North Carolina to Maine amounted to over $1.8 billion. Angler purchases or expenditures generate and sustain employment and personal income in the production and marketing of goods and services bought. These sales and services required an estimated 30 thousand person-years of labor and generated wages of $370 million (SFI 1988). These estimates correspond to all marine recreational fishing and help to illustrate the relative importance of the recreational fishery. Unfortunately, estimates of the economic activity specifically associated with black sea bass were not provided separately, but were combined with other species. Furthermore, the fact that fishermen may target more than one species or may incidentally encounter other fish creates difficulty when addressing the direct economic impact associated with a single species.

8.2.3. Value of Black Sea Bass to Anglers

Estimates of aggregate economic value for black sea bass are not currently available. The value that anglers place on the recreational fishing experience can be divided into actual expenditures and non-monetary benefits associated with satisfaction (consumer surplus). Anglers incur expenses for fishing (purchase of gear, bait, boats, fuel, etc.), but do not pay for the fish they catch or retain nor for the enjoyment of many other attributes of the fishing experience (socializing with friends, contact with nature, etc.). Despite the obvious value of these fish and other attributes of the experience to anglers, no direct expenditures are made for them, hence the term "non-monetary" benefits.

A demand curve for recreational fishing trips for black sea bass is not available. The demand for recreational fishing trips would be determined by travel expenditures, catch rates, costs of equipment and supplies, accessibility of fishing sites, social experience, weather and a variety of other factors affecting angler enjoyment. A decrease in the catch rate or retention rate holding all other factors constant (e.g weather, travel costs, etc.) would move the demand curve to the left. On the other hand, an increase in the catch or retention rate (assuming everything else constant) would shift the demand curve to the right. Each move will have an associated decrease, increase in angler expenditures and total benefits, respectively.

Economic estimates of total expenditures made for fishing are useful for economic impact analysis. In order to estimate the total value (willingness to pay) of black sea bass, an estimate of the marginal value per trip would be required. However, as already mentioned above, in the case of black sea bass, as with many recreational sought species, an aggregate demand curve is not available.

Estimates of the value of a recreational fishing day for salt water angling have been made in several studies. A recent study by Strand *et al.* (1991) provides information about marine recreational fishing in the Middle and South Atlantic. Table 32 presents estimated total cost (travel and services) or estimated value for a recreational fishing day for selected states. The range of average values were $36.00 to $137.00 for party vessels, $59.88 to $222.81 for charter vessels and $40.33 to $53.03 for private vessels.

Other studies have estimated the value of a recreational fishing day for saltwater angling along the Atlantic coast. Value per trip for marine recreational fishing for nine sites in Delaware was estimated by Rockland (1983). The travel cost method with a variety of estimation approaches was employed. On average, the values for boat fishing sites ranged from $20.58 to $39.90 per day, while the range for shore fishing was $37.47 to $62.53 per day. Norton *et al.* (1983) estimated $39 to $169 per day in a study of the recreational striped bass fishery on the Atlantic coast. Bell *et al.* (1982) estimated values from $18.97 to $57.99 per day for all marine species in the state of Florida. It is important to note that the average cost of a black sea bass trip or fishing day is not equivalent to the marginal value of a recreationally caught black sea bass. Attributes of a recreational fishing day other than catching fish are valued by anglers, so all expenditures are not dependent on black sea bass. The marginal value of black sea bass catch must be estimated, and as with any normal good, marginal value declines with increasing quantity.

An estimate of the total expenditures made fishing for black sea bass can be made by multiplying the number of trips taken by an estimate of average cost per day. However, it is not possible to address the non-monetary benefit derived from fishing without more sophisticated statistical techniques enabling an estimate of the marginal value per trip.

The National Marine Fisheries Service recognizes the importance of the proper valuation of fish stock resources by commercial and recreational fisheries. Currently, a survey is being conducted to collect socio-economic data on the people who participate in marine recreational fishing in the Northeast region, which will in turn be employed to estimate statistical models of the demand for marine recreational fishing for eight important recreational species (bluefish, striped bass, summer flounder, Atlantic cod, black sea bass, tautog, scup, and weakfish) (R. Roe pers. comm.).

8.2.4. 1990 Survey of Charter and Party Boats

The charter and party boat industry is important in several states in the management unit of this FMP. On average for the 1983-1992 period, 62% of the black sea bass (in numbers) landed by anglers off the Atlantic coast were caught from party or charter boats (Table 21).

To provide additional information on this segment of the industry, the Council conducted a survey of charter and party boat owners in the summer of 1990 with the purpose of acquiring information in support of management efforts for the summer flounder, scup, and black sea bass fisheries. A mailing list was compiled from the NMFS vessel permit files, including all vessels which indicated they were involved in party and charter activities (permit Category 2). The list included 402 vessels.

Consultation with Council members yielded concerns that a number of vessels did not hold Federal permits, and would not be included in the survey. Representatives from New Jersey, New York, and Virginia supplied the Council with lists supplementing the NMFS permit files, and an additional 190 questionnaires were mailed.

A total of 592 surveys were sent out to 13 east coast states (Table 33). Massachusetts, New York, New Jersey, and Virginia were most heavily represented, together accounting for 80% of survey mailings.

A total of 202 surveys were returned to the Council, 172 of which were usable. The 30 returns which could not be used were inappropriate mailings that fell into the following general categories: did not charter/fish in 1989; private boat, not for hire; dive boat, primarily after lobsters; returned as undeliverable by Post Office; or sold boat. Usable returns equaled 29% of total mailings, with the percentage ranging from approximately 20% - 50% for individual states.

Some of the analyses conducted on the survey divided the responses into "Party boat" versus "Charter boat" categories. Typically, charter vessels are thought of as hiring out for a day's fishing to a small number of individuals at a cost of over $100 per person. They provide a high level of personal attention to the passengers and will make special efforts to find the particular species of interest to their clients.

"Party boats" are generally larger vessels which run on a fixed schedule and carry from 10 to 100 passengers, averaging around 20. They offer fewer options and less attention to passengers, yet charge much lower fares than charter boats (in the $20 - $40 range).

In order to have the ability to differentiate between these two groups, the data were partitioned based on the reported number of passengers each vessel could carry. Examination of the data showed a logical division between those vessels which reported carrying 8 or fewer passengers, and those able to carry more than 8. The average fee charged per person dropped significantly for those vessels carrying more than 8 passengers. For purposes of this analysis, then, "charter boats" are defined as those boats carrying 8 or fewer passengers, and "party boats" those which may carry 9 and above. It is recognized that charter boats are generally licensed for six passengers and, in fact, responses to another question indicated that the average charter boat carried 6 passengers (SD = 0.4), while the average party boat carried 53 (SD = 32), so it is quite likely that the respondents which indicated they owned a charter boat that carried eight people were including the captain and mate whereas in the subsequent question they were referring to the six paying passengers.

The first question on the survey attempted to gauge the interest or demand which party and charter boat customers exhibited for common species (or species groups). Given a five point scale, owners were asked to rank each species as being: 1 = Low, 2 = Somewhat Low, 3 = Moderate, 4 = Somewhat High, or 5 = High in interest to their customers. Calculating mean values of responses allows comparison of the different species using a single number for each.

Spot ranked as the most desirable fish for party boats (mean interest = 4.7), illustrating its importance to the well-represented boats of Virginia (Table 34). It was followed by bluefish (4.6), then summer flounder (3.6), Atlantic mackerel (3.5), and striped bass (3.5). The top four fish which party boats reported catching were: bluefish (4.0), Atlantic mackerel (3.5), spot (3.4), and black sea bass (2.9).

For party boats, summer flounder ranked as the fish anglers were least successful in catching (mean success = 1.5). It was followed by weakfish and striped bass (1.7), and sharks (other than dogfish) (1.9).
An additional perspective can be gained on the situation by creating what might be termed a "frustration index," or simply the difference between fishermen's interest in catching a particular species and their success in doing so. Summer flounder stands out by having the largest difference between interest and success values for party boat fishermen (2.1), followed by striped bass and weakfish. Black sea bass showed one of the smallest differences between interest and success value for party boat fishermen (0.3).

Charter boat owners reported a preference ordering similar to that of party boats for their customers, with the exception that large pelagics took the second ranked spot along with bluefish (Table 34). The top five species were: spot (4.6), large pelagics (3.9), bluefish (3.9), striped bass (3.7), and summer flounder (3.2). The preference for black sea bass for charter boat owners was 2.1.

In 1989, the average party boat customer traveled 67 miles, with a standard deviation (SD) of 43 miles. The farthest party boat customer traveled 695 miles (SD = 1,125 mi.). In 1989, the average charter boat customer traveled 123 miles (SD = 194 mi.). The farthest charter boat customer traveled 727 miles (SD = 914 mi.).

Charter boat respondents indicated that 38% of their customers were more interested in a particular species, 15% were more interested in fishing enjoyment, and 46% were about equally interested in each. For party boats, the responses were 43% for a particular species, 12% for the fishing experience, and 45% equally for each.

For charter boats, 89% of the respondents were both owner and operator (7% just owner, 5% just captain). The party boat responses were 94% owner and captain, 2% just owner, and 4% just captain. Only 14% of the charter boats were used year round (86% seasonally), while 18% of the party boats were used year round (82% seasonally). The average charter boat carried 6 passengers (SD = 0.4), while the average party boat carried 53 (SD = 32).

Thirty six percent of the charter boat respondents indicated that they fished commercially in 1989, with 91% of those fishing commercially from the charter boat and 9% from another boat. For party boats, 26% of the respondents indicated they had fished commercially in 1989, with 69% of those fishing commercially from the party boat and 31% from another boat.

On a scale of 1 (almost none) to 5 (almost all), respondents were asked what part of their personal earnings in 1989 came from party and charter boat fishing, commercial fishing, or other sources. For charter boat respondents the mean answers were: charter or party boat fishing, 2.2; commercial fishing 1.5; and other sources, 4.0. For party boat respondents the mean answers were: charter or party boat fishing, 3.2; commercial fishing 1.3; and other sources, 2.4.
Respondents were also asked what their perception of fishing success was for 1989 and what they thought their customers' perceptions of 1989 fishing success was. Ranking was on a scale of 1 (good) through 3 (bad). For charter boats, the operators reported a mean of 2.1 (SD = 0.7) for their own view and 1.9 (SD = 0.7) for their customers. For party boat operators, their own perception was 2.2 (SD = 0.6), while they thought their customers would rate the season at 2.0 (SD = 0.6).

The survey included a series of questions to determine how the respondents felt business was in 1989 compared to 1985. Both charter and party boats made slightly fewer trips in 1989 compared to 1985 (Table 35). The days per trip and/or trips per day were essentially unchanged. They operated fewer days per week, on average, and carried slightly fewer customers. The average price per trip increased from $121.80 to $149.50 for charter boats and $26.20 to $29.20 for party boats. The average number of fish taken per customer for charter boats fell from 10.9 to 8.3 for charter boats and from 15.2 to 9.9 for party boats between 1985 and 1989. The number of crew members stayed relatively constant. The average cost per trip rose from $96.10 to $131.10 for charter boats and from $113.30 to $146.60 for party boats during the period.

8.3. INTERNATIONAL TRADE

Black sea bass occur primarily on the continental shelf of the north-west Atlantic, and there are no imports of this species into the US. International trade of black sea bass is relatively limited. In 1991 about 6,000 pounds valued at $14,377 were exported to Mexico, and in 1992 about 5,000 pounds valued at $11,766 were exported to Mexico, the Netherlands and Switzerland (R. Ross pers. comm.). These figures represent minimum export values. Given the export classification codes employed by the NMFS, it is possible that some black sea bass were exported under the "unclassified" species category.

9. FISHERY MANAGEMENT PROGRAM

9.1. MEASURES TO ATTAIN MANAGEMENT OBJECTIVES

9.1.1. Specifications: OY, DAH, DAP, JVP, TALFF, Overfishing Definition, and Fishing Mortality Rate Reduction Strategy

Section 303(a)(3) of the MFCMA requires that FMPs assess and specify the OY from the fishery and include a summary of the information utilized in making such specification. OY is to be based on MSY, or on MSY as it may be adjusted for social, economic, or ecological reasons. The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing.

OY is all black sea bass harvested pursuant to this FMP. OY cannot be specified as a quantity because it will change as the fishing mortality rate target varies and is dependent on the level of recruitment.

The Council has concluded that US vessels have the capacity to, and will, harvest the OY on an annual basis, so DAH equals OY. The Council has also concluded that US fish processors, on an annual basis, will process that portion of the OY that will be harvested by US commercial fishing vessels, so DAP equals DAH and JVP equals zero. Since US fishing vessels have the capacity and intent to harvest the entire OY, there is no portion of the OY that can be made available for foreign fishing, so TALFF also equals zero.

Overfishing for black sea bass is defined as fishing in excess of the F_{max} level. F_{max} is a biological reference point that corresponds to the level of fishing mortality (F) that produces the maximum yield per recruit. Based on current conditions in the fishery, F_{max} is 0.29.

Stock assessment information indicates that black sea bass stocks are overfished. Results of a virtual population analysis indicate that the current fishing mortality rate (F) is 1.05 (an annual exploitation rate of 60%).

The Council and the ASMFC Management Board approved a recovery strategy that reduces overfishing on black sea bass over an 8 year time frame. The recovery strategy calls for minimum fish sizes and commercial gear regulations in year 1 (1996) and 2. In years 3 to 5, target exploitation rates would be 48% for black sea bass. In years 6 and 7, the target exploitation rates would be 37% and in year 8 and subsequent years, the target exploitation rate would be based on F_{max}. Based on current conditions in the fishery, F_{max} is 0.29 and the associated exploitation rate is 23%. The recovery schedule is as follows:

	Exploitation Rates
Current	60%
Year 3	48%
Year 6	37%
Year 8	23%

9.1.2. Specification of Adopted Management Measures

9.1.2.1. *Permits and fees*

9.1.2.1.1. Vessel permits and fees

9.1.2.1.1.1. General

Any owner of a vessel desiring to fish for black sea bass within the US EEZ for sale, or transport or deliver for sale, any black sea bass taken within the EEZ, must obtain a moratorium permit from NMFS for that purpose. The vessel must meet the criteria set forth in 9.1.2.1.1.2 in order to qualify for the moratorium permit.

The owner of a party and charter boat (vessel for hire) must obtain a party or charter boat permit.

A recreational vessel, other than a party or charter boat (vessel for hire), is exempt from the permitting requirement if it catches no more than the recreational possession limit, multiplied by the number of persons on board, of black sea bass per trip.

A party or charter boat may have both a party or charter boat permit and a commercial moratorium permit to catch and sell if the vessel meets the commercial vessel qualification requirements set forth in 9.1.2.1.1.2. However, such a vessel may not fish under the commercial rules if it is carrying passengers for a fee. When a party or charter boat is operating as a commercial vessel, the crew size must not be more than 5 when it is operating as a party boat and not more than 3 when it is operating as a charter boat.

9.1.2.1.1.2. Moratorium on entry to the commercial fishery

There will be a moratorium on entry of additional commercial vessels into the black sea bass fishery in the EEZ. Each state is encouraged to adopt complementary moratorium measures for those participating in the commercial fishery. Vessels with documented landings of black sea bass for sale between 26 January 1988 and 26 January 1993 qualify for a moratorium permit to land and sell black sea bass under this moratorium program. Under the moratorium, vessels and moratorium permits together may be bought and sold with the approval of the Regional Director. Vessels may be replaced with vessels of the same or less Gross Registered Tonnage (GRT) and overall registered length as the original vessel being replaced. Permits may not be combined to create larger replacement vessels. The moratorium may be terminated or replaced at any time by FMP amendment establishing an alternative limited entry system.

A vessel is eligible for a moratorium permit if it meets any of the following criteria:

1. The owner or operator of the vessel landed and sold black sea bass in the management unit for black sea bass between 26 January 1988 and 26 January 1993; or

2. The vessel was under construction for, or was being rerigged for, use in the directed fishery for black sea bass on 26 January 1993 and provided the vessel has landed black sea bass for sale prior to 26 January 1994. For the purpose of this paragraph, "under construction" means that the keel has been laid, and "being rerigged" means physical alteration of the vessel or its gear had begun to transform the vessel into one capable of fishing commercially for black sea bass; or

3. The vessel is replacing a vessel of substantially similar harvesting capacity and both the entering and replaced vessels are owned by the same person. "Substantially similar harvesting capacity" means the same or less GRT and vessel registered length for commercial vessels.

Eligibility must be established during the first year of the FMP. In other words, the moratorium permit may not be applied for more than twelve months following the effective date of the final regulations or if a vessel is retired from the fishery. This does not affect annual permit renewals.

Vessel permits issued to vessels that leave the fishery may not be combined to create larger replacement vessels.

Applicants for moratorium permits shall provide information with the application sufficient for the Regional Director to determine if the vessel meets the eligibility requirements. Sales receipts or dealer weighout forms signed by the dealer will be considered acceptable forms of proof.

9.1.2.1.1.3. Permit application

The owner or operator of a qualified US vessel may obtain the appropriate Federal permit by furnishing on the form provided by NMFS at least the following information, and any other information required by the Regional Director: vessel name; owner name, mailing address, and telephone number; U.S. Coast Guard documentation number and a copy of the vessel's U.S. Coast Guard documentation or, if undocumented, the vessel's state registration number and a copy of the state registration; home port and principal port of landing; length; gross tonnage; net tonnage; engine horsepower; year the vessel was built; type of construction and type of propulsion; approximate fish hold capacity; type of fishing gear used by the vessel; number of crew; permit category; if owner is a corporation, a copy of the Certificate of Incorporation, and the names and addresses of all shareholders owning 25 percent or more of the corporation's shares; if the owner is a partnership, a copy of the Partnership Agreement and the names and addresses of all partners; if there is more than one owner, names of all owners having owned more than a 25-percent interest; the name and signature of the owner or the owner's authorized representative; permit number of any current or, if expired, previous Federal fishery permit issued to the vessel; and a copy of charter/party boat license and number of passengers the vessel is licensed to carry (charter and party boats). Operators of commercial vessels must also supply information required to establish that the vessels qualify for a permit pursuant to the moratorium. The Regional Director will notify the applicant of any deficiency in the application. If the applicant fails to correct the deficiency within 15 days following the date of notification, the application will be considered abandoned.

Applicants for a permit under this FMP must agree, as a condition of issuance of the permit, to fish in accordance with Federal rules whether they are fishing in the EEZ or state waters.

Permits expire: (1) when the owner or operator retires the vessel from the fishery, or (2) on a date specified by the Regional Director, or (3) when the ownership of the vessel changes; however, the Regional Director may authorize continuation of a vessel permit for the black sea bass fishery if the new owner so requests. Applications for continuation of a permit must be addressed to the Regional Director. An owner or operator retires a vessel from the fishery by voluntarily delivering the vessel's moratorium permit to the Regional Director.

The permit must be carried, at all times, on board the vessel for which it is issued, and must be maintained in legible condition. The permit, the vessel, its gear and catch shall be subject to inspection upon request by any authorized official.

The Federal costs of implementing an annual permit system for the sale of black sea bass may be charged to permit holders as authorized by section 303(b) (1) of the Magnuson Act. In establishing the annual fee, the Regional Director will ensure that the fee does not exceed the administrative costs incurred in issuing the permit, as required by section 304(d) of the Magnuson Act. Proper accounting for administrative costs may include labor costs (salary and benefits of permitting officers plus prorated share of secretarial support and supervision at both the NMFS regional and headquarters levels), computer costs for creating and maintaining permit files (prorated capital costs, time share and expendable supplies), cost of forms and mailers (purchase, preparation, printing and reproduction), and postage costs for application forms and permits.

9.1.2.1.2. Dealer permits and fees

Any dealer of black sea bass must have a permit. A dealer of black sea bass is defined as a person or firm that receives black sea bass for a commercial purpose from the owner or operator or a vessel issued a moratorium permit pursuant to this FMP for other than transport.

An applicant must apply for a dealer permit in writing to the Regional Director. The application must be signed by the applicant and submitted to the Regional Director at least 30 days before the date upon which the applicant desires to have the permit made effective. Applications must contain at least the name, principal place of business, mailing address and telephone number of the applicant. The Regional Director will notify the applicant of any deficiency in the application. If the applicant fails to correct the deficiency within 15 days following the date of notification, the application will be considered abandoned. Except as provided in Subpart D of 15 CFR Part 904, the Regional Director will issue a permit within 30 days of the receipt of a completed application.

A permit expires on a date specified by the Regional Director or if the ownership or the dealer changes. Any permit issued under this section remains valid until it expires, is suspended, is revoked, or ownership changes. Any permit which is altered, erased, or mutilated is invalid. The Regional Director may issue replacement permits. Any application for a replacement permit shall be considered a new permit.

A permit is not transferable or assignable. It is valid only for the dealer to whom it is issued.

The permit must be displayed for inspection upon request by an authorized officer or any employee of NMFS designated by the Regional Director.

The Regional Director may suspend, revoke, or modify, any permit issued or sought under this section. Procedures governing permit sanctions or denials are found at Subpart D of 15 CFR Part 904. The Regional Director may, after publication of a notice in the *Federal Register*, charge a permit fee. Within 15 days after the change in the information contained in an application submitted under this section, the dealer issued the permit must report the change in writing to the Regional Director.

9.1.2.1.3. Operator permit and fees

An operator of a vessel with permit issued pursuant to this FMP (either a moratorium permit or a party/charter boat permit) must have an Operator's Permit issued by NMFS. Any vessel fishing commercially for black sea bass under a moratorium permit or recreationally with a party/charter boat permit must have on board at least one operator who holds a permit. That operator may be held accountable for violations of the fishing regulations and may be subject to a permit sanction. During the permit sanction period, the individual operator may not work in any capacity aboard a federally permitted fishing vessel.

The permit program has the following requirements:

1. Any operator of a vessel fishing for black sea bass must have an operator's permit issued by the NMFS Regional Director.

2. An operator is defined as the master or other individual on board a vessel who is in charge of that vessel (see 50 CFR 620.2).

3. The operator is required to submit an application, supplied by the Regional Director, for an operator's Permit. The permit will be issued for a period specified by the Regional Director. That period is currently three years.

4. The applicant would provide at least his/her name, mailing address, telephone number, date of birth and physical characteristics (height, weight, hair and eye color, etc.) on the application, and would be requested to provide his/her social security number. In addition to this information, the applicant must provide two passport-size color photos.

5. The permit is not transferable.

6. Permit holders would be required to carry their permit aboard the fishing vessel during fishing and off-loading operations and must have it available for inspection upon request by an authorized officer.

7. The Regional Director may, after publication in the *Federal Register*, charge a permit fee.

9.1.2.2. *Black Sea Bass FMP Monitoring Committee*

The Black Seabass Monitoring Committee is a joint committee of the MAFMC and ASMFC made up of staff representatives of the Mid-Atlantic, New England, and South Atlantic Fishery Management Councils, the Northeast Regional Office, the Northeast Fisheries Center, and ASMFC representatives. The ASMFC is represented by the Back Seabass Plan Review Team as established per section 5(e) of the ASMFC Interstate Fisheries Management Program Charter. The MAFMC Executive Director or his designee will chair the Committee.

The Black Seabass Monitoring Committee will annually review the best available data including, but not limited to, commercial and recreational catch/landing statistics, current estimates of fishing mortality, stock status, the most recent estimates of recruitment, VPA results, target mortality levels, beneficial impacts of size/mesh regulations, as well as the level of noncompliance by fishermen or states and recommend to the Council Committee and ASMFC Black Seabass Management Board commercial (annual quota, minimum fish size, minimum mesh size, and vent requirements) and recreational (possession and size limits and seasonal closures) measures designed to assure that the target mortality level for black seabass is not exceeded. The Committee will also review state regulatory programs for consistency with the FMP. The Committee will also review the gear used to catch black seabass to determine whether additional gears need to be regulated to help assure attainment of the fishing mortality rate target and propose such regulations as appropriate.

The Council and the Black Seabass Management Board will receive the report of the Committee as well as appropriate public input. The Council and Management Board will consider this information and jointly determine the quota and framework adjustments for the following year. Next, the Council will make recommendations to the Regional Administrator and the Board will determine the final state quota and other state management measures for the year. The Regional Administrator will receive the report of the Council and publish a report in the *Federal Register* for public comment by the date specified in the regulations which provides states sufficient time to implement quotas and other management measures. Following the review period, the Regional Administrator will set the final federal quota and other management measure adjustments for the year.

In summary, the steps from the Monitoring Committee to action by the ASMFC and the Regional Administrator are:

1. The Monitoring Committee reviews the data and makes recommendations to the Demersal Species Committee and ASMFC Black Seabass Management Board.

2. The ASMFC and Council Citizens Advisory Panels present recommendations to the Committee and Board.

3. The Demersal Species Committee and Black Seabass Management Board consider the recommendations of the Monitoring Committee, Advisors, and other public input in jointly determining the annual quota and framework adjustments.

4. The Black Seabass Management Board makes final decisions on the quota and framework adjustments for state waters, establishing compliance criteria and dates.

5. The Demersal Species Committee makes recommendations to the Council.

6. The Council considers the recommendations of the Coastal Migratory Committee and makes recommendations to the Regional Administrator.

7. The Regional Administrator considers the recommendations of the Council and the ASMFC Black Seabass Management Board's decision and publishes proposed measures in the *Federal Register*.

9.1.2.3. *Commercial management measures*

9.1.2.3.1. Commercial fish size limitations

It is illegal for owners or operators of vessels issued moratorium permits to possess black sea bass less than 9" total length (TL). It is also illegal to possess parts of black sea bass less than 9" to the point of landing. If black sea bass are filleted at sea, the skin would be required to be left on the fillet for purposes of identification.

Vessels with commercial moratorium permits issued pursuant to this FMP are required to fish and land pursuant to the provisions of this FMP unless the vessels land in states with larger minimum fish sizes than those provided in the FMP, in which case the minimum fish size would be required to meet the state limits. States with minimum sizes larger than those in the FMP are encouraged to maintain them.

The minimum fish size may be changed annually, if appropriate, following the Black Sea Bass FMP Monitoring Committee process set forth in 9.1.2.2.

9.1.2.3.2. Minimum mesh requirement

Owners or operators of otter trawl vessels possessing 100 lbs or more of black sea bass, may only fish with nets that have a minimum mesh size of 4.0" diamond (3.5" square) mesh, inside measure, applied throughout the codend for at least 75 continuous meshes forward of the terminus of the net, or, if the net is not long enough for such a measurement, the terminal 1/3 of the net, measured from the terminus of the codend to the head rope.

Mesh would be allowed to be larger than the minimum size, but it could be no smaller than the minimum size. If the fish are landed in a state that has a more stringent net mesh regulation, the state regulation would prevail. States with minimum mesh regulations larger than those established in this FMP are encouraged to maintain them.

Owners or operators of otter trawl vessels possessing 100 lbs or more of black sea bass may not have available for immediate use any net, or any piece of net not meeting the minimum mesh size requirements, or mesh that is rigged in a manner that is inconsistent with the minimum mesh size. A net that conforms to one of the following specifications and that can be shown not to have been in recent use is considered to be not "available for immediate use":

(1) A net stowed below deck, provided:

(I) it is located below the main working deck from which the net is deployed and retrieved;

(ii) the towing wires, including the "leg" wires, are detached from the net; and

(iii) it is fan-folded (flaked) and bound around its circumference.

(2) A net stowed and lashed down on deck, provided:

(I) it is fan-folded (flaked) and bound around its circumference;

(ii) it is securely fastened to the deck or rail of the vessel; and

(iii) the towing wires, including the leg wires, are detached from the net.

(3) A net that is on a reel and is covered and secured, provided:

(I) the entire surface of the net is covered with canvas or other similar material that is securely bound;

(ii) the towing wires, including the leg wires, are detached from the net; and

(iii) the codend is removed from the net and stored below deck.

(4) Nets that are secured in a manner approved by the Regional Director, provided that the Regional Director has reviewed the alternative manner of securing nets and has published that alternative in the *Federal Register*.

Any combination of mesh or liners that effectively decreases the mesh below the minimum size is prohibited.

The owner or operator of a fishing vessel shall not use any device, gear, or material, including, but not limited to, nets, net strengtheners, ropes, lines, or chaffing gear, on the top of the regulated portion of a trawl net; except that, one splitting strap and one bull rope (if present), consisting of line or rope no more than 2" in diameter, may be used if such splitting strap and/or bull rope does not constrict in any manner the top of the regulated portion of the net; and one rope no greater than 0.75 inches in diameter extending the length of the net from the belly to the terminus of the codend along each of the following: the top, bottom, and each side of the net. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net which (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor. For the purpose of this paragraph, head ropes shall not be considered part of the top of the regulated portion of a trawl net.

Since it will be difficult to detect a violation of the minimum mesh net regulation, the penalty for individuals detected of such a violation must be sufficient to provide an adequate deterrent. Therefore, it is recommended that the penalty for the first offense be a six month loss of moratorium permit and the penalty for a second offense be a one year loss of permit. After imposition and expiration of such a penalty, if the individual fishes without penalty for three consecutive years, the earlier offenses would be expunged from the record.

The minimum net mesh size and the threshold could be changed annually, if appropriate, following the Black Sea Bass FMP Monitoring Committee process set forth in 9.1.2.2. Minimum mesh could be specified for the entire net as well as just the codend portion of the net.

Based on the recommendations of the Black Sea Bass Monitoring Committee and Council, the Regional Director, by regulatory amendment, shall implement regulations on gear other than otter trawls to achieve discards of black sea bass equivalent to the discards with otter trawls given the minimum net mesh requirements. This provision is intended to address the problem that could develop if gear currently not in significant use in the black sea bass fishery are developed as a way of avoiding the minimum otter trawl mesh rule.

9.1.2.3.3. Maximum roller diameter

It would be illegal for owners or operators of vessels issued moratorium permits to use roller rig trawl gear equipped with rollers greater than 18" in diameter.

9.1.2.3.4. Minimum escape vent requirement

Black sea bass pots and traps would be required to have a minimum escape vent of 1 1/8" x 5 3/4" or 2.0" in diameter or 1.5" square (inside measure). Vents would be required to be placed in a lower corner of the parlor portion of the pot or trap. Pots or traps constructed with wooden lathes would be required to have the spacing between one set of lathes in the parlor portion of the trap 1 1/8" or greater. The escape vent provision would be implemented at the start of the first calendar year following FMP approval so that fishermen would not be required to pull their pots and add vents in the middle of the season.

A black sea bass pot or trap would be defined as any pot or trap used by a fishermen to catch and retain black sea bass. The definition and the minimum escape vent requirements would apply to pots fished in both state and federal waters.

9.1.2.3.5. Degradable fasteners in traps and pots

Black sea bass pots and traps would be required to have hinges and fasteners on one panel or door made of one of the following degradable materials:

a. untreated hemp, jute, or cotton string of 3/16" (4.8 mm) diameter or smaller;

b. magnesium alloy, timed float releases (pop-up devices) or similar magnesium alloy fasteners; or

c. ungalvanized or uncoated iron wire of 0.094" (2.4 mm) diameter or smaller.

The rectangular opening in a pot or trap covered by a panel affixed with degradable fasteners would be required to be at least 3" x 6" .

9.1.2.3.6. Commercial quota

The quota setting process is specified in 9.1.2.2. Beginning in year 3, a quota would be allocated to the commercial fishery to control fishing mortality. The quota would be based on projected stock size estimates for that year as derived from the latest stock assessment information. Estimates of stock size coupled with the target fishing mortality rate would allow for a calculation of total allowable landings. Based on 1983-1992 data on commercial and recreational landings, 49% of the total allowable landings would be allocated to the commercial fishery.

During the first and second year of the FMP, a system to distribute and manage the annual commercial quota will be developed by the Council and Commission. Coastwide, regional and state by state quotas will be considered in combination with different fractions of the fishing year, e.g., bimonthly quotas.

If a system is not designed in the second year, a coastwide quota system allocated by quarterly periods will be implemented beginning in year 3. Quarterly allocations will be based on commercial landings data from 1988-1992. The allocation periods and the associated percent of the total quota will be January-March (38.64%), April-June (29.26%), July-September (12.33%), and October-December (19.77%).

Trip limits will be implemented for each quarterly period. The trip limit will remain the same throughout the period. Trip limits will remain in effect until the fishery is closed by NMFS based on projections that the quota would be taken.

The coastal states are working with NMFS to administer the quotas and coordinate coastwide closures. As such, vessels with moratorium permits could only land black sea bass caught in the EEZ north of Cape Hatteras in coastal stats from Maine to North Carolina.

Any landings in excess of the quota that occurred during a quarter will be subtracted from the following year's quota for that quarter. For example, if the quota was exceeded by 10,000 pounds in the first quarter of 1998, 10,000 pounds would be subtracted from the quota for that quarter in 1999.

All landings by any vessel that has a commercial moratorium permit (permit to sell) counts against the quota, whether the black sea bass are caught with an otter trawl, a fish pot, hook and line, or any other gear. If the vessel does not have a commercial moratorium permit, the fish caught in the EEZ may not be sold and the recreational rules on size, possession, and season apply.

Using data collected through this FMP, NMFS will monitor the fishery to determine when a quota will be reached. It is intended that states will assist NMFS with data collection.

If the quarterly quota has been met, landings of black sea bass by all vessels will be prohibited. The Regional Director will close the EEZ to possession of black sea bass by commercial vessels with a moratorium permit when the quota has been landed. States will have the responsibility for closure in their state.

When the fishery is closed for a quarter, no commercial vessel can possess black sea bass north of Cape Hatteras. Vessels with moratorium permits can not possess black sea bass north or south of Cape Hatteras during a closure.

Because separate stocks of black sea bass exist north and south of Cape Hatteras, the state of North Carolina is affected by regulations implemented by Amendment 9 (north of Hatteras) and the Snapper Grouper FMP and its amendments (south of Hatteras). As such, the following regulations, as stated in the preceding paragraphs, will apply to vessels fishing for black sea bass from the northern stock and landing in North Carolina. Specifically, a moratorium permit will be required for any vessel possession black sea bass in the EEZ north of Cape Hatteras. Any black sea bass landed by moratorium vessels will count against the quota. Vessels without moratorium permits and fishing exclusively in state waters north of Cape Hatteras can catch and sell black sea bass. All landings by these vessels will also count against the quota. When the fishery is closed for a quarter, no commercial vessel can possess black sea bass north of Cape Hatteras. Vessels with moratorium permits can not possess black sea bass north or south of Cape Hatteras during a closure.

If an owner of a vessel possess both a Black Sea Bass Moratorium Permit and a Snapper/Grouper Permit, the owner can surrender his/her Black Sea Bass Moratorium Permit and fish for and possess black sea bass in the EEZ south of Cape Hatteras during a northern closure. After a minimum 6 month period, the vessel can reapply for a Black Sea Bass Moratorium Permit.

The annual commercial quota will be set at a range of between 0 and the commercial share of the maximum allowed by the adopted fishing mortality rate reduction strategy. The commercial quota includes all landings for sale by *any* gear. The annual commercial quota and trip limits would be based on the recommendations of the Black Sea Bass FMP Monitoring Committee to the Council and ASMFC Board. The Council and ASMFC will consider those recommendations. The ASMFC Board will set the commercial quota for the state waters annually. The Council will submit recommendations to the Regional Director. The Regional Director will set the commercial quota annually.

9.1.2.4. *Recreational Fishery Measures*

9.1.2.4.1. Recreational Size, Possession, and Seasonal Limits

Beginning in year 1 of the management program, it would be illegal for recreational fishermen to possess whole black sea bass or parts of black sea bass less than 9" total length (TL). Parts of black sea bass could be less than the minimum size if the party/charter vessel had a permit from the state of landing that allowed smaller parts to be landed. If black sea bass are filleted at sea, the skin would be required to be left on the fillet for purposes of identification.

Beginning in year 3, the recreational fishery throughout the management unit would be managed through an annual evaluation of a framework system (section 9.1.2.2) of possession limits, size limits, and seasonal closures. Beginning in year 3, recreational landings would be compared to annual target harvest levels established through the FMP Monitoring Committee process to determine if modifications to the recreational possession limit and size limit were required for the following year or if the fishery needed to be closed for certain periods.

The annual recreational possession limit, size limit, and season will be set at a range of between 0 and the maximum allowed by the recreational share of the adopted fishing mortality rate reduction strategy.

On vessels with several passengers, where catches are pooled in one or more containers, the number of black sea bass contained on the vessel may not exceed the possession limit multiplied by the number of people aboard the vessel.

It is the responsibility of each state to assure that it implements measures equivalent with the federal FMP. The Regional Director may prohibit landing black sea bass from the EEZ by recreational vessels (party, charter, and private boats) of any state not in compliance with this FMP (possession limit, size limit, and season). If the inaction of one or more states leads the Regional Director to conclude that the FMP will be adversely affected, he may close the entire EEZ to black sea bass fishing.

9.1.2.4.2. Recreational Harvest Limit

Beginning in year 3, a recreational harvest limit would be allocated to the recreational fishery to reduce exploitation rates on the fully recruited age groups. The harvest limit would be based on projected stock size estimates for that year as derived from the latest stock assessment information. Estimates of stock size coupled with the target fishing mortality rate would allow for a calculation of total allowable landings. Based on the historic proportion of commercial and recreational landings, 51% of the total allowable landings would be allocated to the recreational fishery.

The annual recreational harvest limit will be set at a range of between 0 and the maximum allowed by the recreational share of the adopted fishing mortality rate reduction strategy.

9.1.2.5. *Experimental Fishery*

The Regional Director, in consultation with the Executive Director, may exempt any person or vessel from the requirements of this FMP for the conduct of experimental fishing beneficial to the management of the black sea bass resource or fishery.

The Regional Director may not grant such exemption unless it is determined that the purpose, design, and administration of the exemption is consistent with the objectives of the FMP, the provisions of the Magnuson Act, and other applicable law, and that granting the exemption will not:

1. have a detrimental effect on the black sea bass resource and fishery or cause any quota to be exceeded; or

2. create significant enforcement problems.

Each vessel participating in any exempted experimental fishing activity is subject to all provisions of this FMP except those necessarily relating to the purpose and nature of the exemption. The exemption will be specified in a letter issued by the Regional Director to each vessel participating in the exempted activity. This letter must be carried aboard the vessel seeking the benefit of such exemption.

All experimental activities must be consistent with the fishing mortality rate reduction schedule in the FMP.

It is the Council's intention that experimental fisheries are short-term fisheries to answer specific management questions and are not used to resolve short-comings in existing fishery management plans.

9.1.2.6. *Enforcement recommendations*

It is recommended that violators of the mesh regulations be severely punished. This is necessary to minimize abuses of the flexibility introduced into the management regime that allow for several meshes on board. Examples of possible penalties include permit sanctions and requiring that offenders carry only the legal mesh on board.

9.1.2.7. *Special Management Zones*

Upon request to the Council from a permittee (possessor of a Corps of Engineers permit) for an artificial reef, the modified area and an appropriate surrounding area of an artificial reef or fish attraction device (or other modification of habitat for the purpose of fishing) could be designated as a Special Management Zone (SMZ). The SMZ would prohibit or restrain the use of specific types of fishing gear that are not compatible with the intent of the permittee for the artificial reef or fish attraction device. The establishment of an SMZ would be done by regulatory amendment:

1. A monitoring team (the team will be comprised of members of Council staff, NMFS Northeast Region, and the NMFS Northeast Fisheries Science Center) will evaluate the request in the form of a written report considering the following criteria:
   a. fairness and equity
   b. promote conservation
   c. excessive shares
   d. consistency with the objectives of the FMP, the Magnuson Act, and other applicable law
   e. the natural bottom in and surrounding potential SMZs and impacts on historical uses

2. The Council Chairman may schedule meetings of Industry Advisors and/or Scientific and Statistical Committee (SSC) to review the report and associated documents and to advise the Council. The Council Chairman may also schedule pubic hearings.

3. The Council, following review of the Team's report, supporting data, public comments, and other relevant information, may recommend to the Northeast Regional Director of the National Marine Fisheries Service (RD) that a SMZ be approved. Such a recommendation would be accompanied by all relevant background data.

4. The RD will review the Council's recommendation, and if he concurs in the recommendation, will propose regulations in accordance with the recommendations. He may also reject the recommendation, providing written reasons for rejection.

5. If the RD concurs in the Council's recommendations, he shall publish proposed regulations in the *Federal Register* and shall afford a reasonable period for public comment which is consistent with the urgency of the need to implement the management measure(s).

9.1.2.8. *Other measures*

Only persons with a federal dealer permit may buy black sea bass at the point of first sale landed by a vessel that has a commercial moratorium permit issued pursuant to this FMP.

Owners or operators of vessels with moratorium permits may sell black sea bass at the point of first sale only to a dealer that has a federal dealer permit issued pursuant to this FMP.

Owners or operators of vessels with moratorium permits may not land black sea bass during a period when the Regional Director has determined that the commercial quota has been landed.

All black sea bass on vessels fishing with a mesh smaller than the legal minimum size must have any black sea bass on board boxed in a manner that will facilitate enforcement personnel knowing whether the vessel has 100 lbs or more of black sea bass on board to meet the minimum mesh size criterion. Any unboxed black sea bass on board a vessel fishing with a net smaller than the legal minimum is considered a violation of this FMP. A standard 100 pound tote has a liquid capacity of 18.2 gallons (70 liters), or a volume of not more than 4,320 cubic inches (2.5 cubic feet).

The Regional Director may place sea samplers aboard vessels if he determines a voluntary sea sampling system is not giving a representative sample from the black sea bass fishery.

No foreign fishing vessel shall conduct a fishery for or retain any black sea bass. Foreign nations catching black sea bass shall be subject to the incidental catch regulations set forth in 50 CFR 611.13, 611.14, and 611.50.

No vessel may use a net capable of catching black sea bass in which the bars entering or exiting the knots twist around each other.

No person may assault, resist, oppose, impede, harass, intimidate, or interfere with either a NMFS-approved observer aboard a vessel, or an authorized officer conducting any search, inspection, investigation, or seizure in connection with enforcement of this FMP.

9.1.3. Specification and Sources of Pertinent Fishery Data

9.1.3.1. *Domestic and foreign fishermen*

Section 303(a)(5) of the MFCMA requires at least information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, and number of hauls must be submitted to the Secretary. In order to achieve the objectives of this FMP and to manage the fishery for the maximum benefit of the US, it is necessary that, at a minimum, the Secretary collect on a continuing basis and make available to the Councils: (1) black sea bass catch, effort, and ex-vessel value and the catch and ex-vessel value of those species caught in conjunction with black sea bass for the commercial fishery provided in a form that analysis can be performed at the trip, water area, gear, month, year, principal (normal) landing port, landing port for trip, and State levels of aggregation; (2) catch and effort for the recreational fishery; (3) biological (e.g., length, weight, age, and sex) samples from both the commercial and recreational fisheries; and (4) annual and fully comparable NMFS bottom trawl surveys for analyses of both CPUE and age/size frequency. The Secretary may implement necessary data collection procedures through amendments to the regulations. It is mandatory that these data be collected for the entire management unit, including North Carolina, on a compatible and comparable basis.

Commercial logbooks must be submitted on a monthly basis by Federal moratorium permit holders in order to monitor the fishery.

Operators of party and charter boats with Federal permits issued pursuant to this FMP must submit logbooks monthly showing at least name and permit number of the vessel; total numbers of each species taken; date(s) fished; number of trips; duration of trip; locality fished; crew size; landing port; number of anglers carried on each trip; and discard rate. A sample of party and charter boats may be required to report length frequencies of species caught for a sample of their trips.

States are encouraged to implement equivalent fishery data collection systems for the development of a coordinated statistics gathering effort.

It is intended that the reports required by this section are the same as the reports required by the Summer Flounder FMP, the Northeast Multispecies FMP, and the Atlantic Sea Scallop FMP. That is, fishermen need to submit one logbook report, not one report for each FMP.

Foreign fishermen are subject to the reporting and recordkeeping requirements in 50 CFR 611.

9.1.3.2. *Dealers*

In order to monitor the fishery and enable the Regional Director and the states to forecast when a closure will be needed, dealers with permits issued pursuant to this FMP must submit weekly reports showing at least the quantity of black sea bass purchased (in pounds), and the name and permit number of the vessels from whom the black sea bass was purchased.

Buyers that do not purchase directly from vessels are not required to submit reports under this provision. Dealers should report only those purchases from vessels (fishermen with commercial moratorium permits).

It is intended that the report required by this section is the same as the report required by the Summer Flounder FMP. That is, fishermen need to submit one logbook report, not one report for each FMP.

9.1.3.3. *Processors*

Section 303(a)(5) of the MFCMA requires at least estimated processing capacity of, and the actual processing capacity utilized by US fish processors must be submitted to the Secretary. The Secretary may implement necessary data collection procedures through amendments to the regulations.

9.2. ANALYSIS OF BENEFICIAL AND ADVERSE IMPACTS OF ADOPTED MANAGEMENT MEASURES

9.2.1. The FMP Relative to the National Standards

Section 301(a) of the MFCMA states: "Any fishery management plan prepared, and any regulation promulgated to implement such plan pursuant to this title shall be consistent with the following national standards for fishery conservation and management." The following is a discussion of the standards and how this FMP meets them:

9.2.1.1. *Conservation and management measures shall prevent overfishing while achieving, on a continuous basis, the optimum yield from each fishery*

MSY (section 5.4) has not been specified for black sea bass. OY is all black sea bass harvested pursuant to this FMP.

Overfishing in the Black Sea Bass FMP is defined as fishing in excess of the F_{max} level. F_{max} is a biological reference point derived from yield per recruit analysis that corresponds to the level of fishing mortality (F) that produces the maximum yield per recruit. The Council has adopted an overfishing definition for black sea bass based on an estimate of F_{max}. Best available information indicates that F_{max} is 0.29 for black sea bass based on current conditions in the fishery.

Recent stock assessment information indicates that black sea bass stocks are overfished (NEFSC 1995). Results of a virtual population analysis indicate that the current fishing mortality rate (F) is 1.05 (an annual exploitation rate of 60%). Based on this mortality estimate, exploitation rates would have to be reduced 62% to achieve an F_{max} of 0.29.

The Council and the ASMFC Management Board approved a recovery strategy that reduces overfishing on black sea bass over an 8 year time frame. The recovery strategy calls for minimum fish sizes and commercial gear regulations in year 1 and 2. In years 3 to 5, target exploitation rates would be 48% for black sea bass. In years 6 and 7, the target exploitation rates would be 37% and in year 8 and subsequent years, the target exploitation rate would be based on F_{max}. Based on current conditions in the fishery, F_{max} is 0.29 and the associated exploitation rate is 23%.

This eight-year strategy reflects the pressure now being placed on fishermen by other FMPs. Although the black sea bass resource should be rebuilt as quickly as possible, black sea bass management measures can be implemented over an eight-year time frame to minimize the short term economic burden placed on fishermen and still reduce the overfished condition of the stocks.

9.2.1.2. *Conservation and management measures shall be based upon the best scientific information available*

This FMP is based on the best and most recent scientific information available. Future black sea bass research should be devoted toward both data collection and analysis in order to evaluate the effectiveness of this FMP. This species should be reviewed annually by the NEFSC Stock Assessment Workshop process.

9.2.1.3. *To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination*

The FMP's management unit is black sea bass throughout their range on the Atlantic coast from Maine through Cape Hatteras, North Carolina, including the EEZ, territorial sea, and internal waters. This specification is considered to be consistent with National Standard 3. Black sea bass south of Cape Hatteras are part of a southern stock and are managed by regulations implemented by the South Atlantic Fishery Management Council's Snapper/Grouper FMP.

> 9.2.1.4. *Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges*

The FMP does not discriminate among residents of different states. It does not differentiate among US citizens, nationals, resident aliens, or corporations on the basis of their state of residence. It does not incorporate or rely on a state statute or regulation that discriminates against residents of another state.

This FMP would establish a commercial fishery quota system for black sea bass, based on historical landings data. This allocation, based on traditional landings patterns, would ensure that fishermen from each state received a fair and equitable share of the resource.

Commercial regulations would be applied coastwide. The minimum sizes for the recreational fishery, are also the same throughout the management unit.

The commercial minimum fish size, minimum net provisions, and commercial quota and the recreational size limits, possession limits, and season are all specified so that they may be adjusted annually following procedures set forth in the FMP to assure that the fishing mortality reductions strategy is followed. These provisions are, therefore, "reasonably calculated to promote conservation."

The moratorium is fair and equitable. The Council voted to establish 26 January 1990 as a control date for limiting entry into the fishery at its February 1990 meeting. The Federal Register notice of this date was published 7 June 1990. The moratorium was part of the preferred alternative in the public hearing draft of this FMP. The long time period for establishing eligibility (26 January 1988 through 26 January 1993) assures that the largest possible number of fishermen can qualify under the moratorium.

Vessels with any documented landings (i.e., greater than 0 lbs) of black sea bass between 26 January 1988 and 26 January 1993 would qualify for a moratorium permit. Thus, any vessel which actively fished for and landed any amount of black sea bass between these dates would be guaranteed access to the fishery.

The only vessels excluded by the moratorium provisions of the FMP would be those that landed black sea bass prior to 1988 or after 26 January 1993. Unpublished NMFS weighout data (Maine-Virginia) indicates that between 1983 and 1987, 920 vessels landed 15.3 million pounds of black sea bass. Forty-one percent of these vessels (380) landed 1.4 million pounds (9.2%) of the total black sea bass landed commercially during the 1983-1987 period, but did not land black sea bass during the moratorium period (1988-1992). These vessels may have switched to fishing for other species or discontinued fishing for black sea bass due to retirement from the fishery.

In 1993, 2.8 million pounds of black sea bass were landed by 485 vessels. Sixty-eight of these vessels landed 38 thousand pounds (1.3%) of the total black sea bass commercially landed in 1993, but did not participate in the black sea bass commercial fishery during the 1988-1992 period. Taking into consideration the limited degree of participation by these vessels in the black sea bass fishery in 1993, and the fact that they did not land any black sea bass between 1988-1992, it is likely that these vessels did not participate in a directed fishery for black sea bass in 1993 but retained black sea bass as a bycatch when fishing for other species. In addition, vessels entering the fishery after 26 January 1993 would have known that a control date for black sea bass had been published on 26 January 1990. Thus, it is likely that few individuals would have made large investments to participate in a directed fishery for black sea bass after this date.

Unpublished NMFS weighout data indicates that a total of 836 vessels participated in the fishery between 1988 and 1992. An additional 100 vessels from North Carolina could have participated in the black sea bass fishery between 1988 and 1992 (R. Monaghan pers. comm.). Thus, it is likely that approximately 936 vessel owners would apply for commercial moratorium permits.

> 9.2.1.5. *Conservation and management measures shall, where practicable, promote efficiency in the utilization of the fishery resources; except that no such measure shall have economic allocation as its sole purpose*

The management regime is intended to allow the fishery to operate at the lowest possible cost (e.g., fishing effort, administration, and enforcement) given the FMP's objectives. The objectives focus on the issue of administrative and enforcement costs by encouraging compatibility between federal and state regulations since a substantial portion of the fishery occurs in state waters. The FMP places no restrictions on processing, or marketing and no unnecessary restrictions on the use of efficient techniques of harvesting.

9.2.1.6. *Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches*

The management regime was developed to be compatible with and reinforce the management efforts of the states and ASMFC. The minimum size regulations were developed with the recognition that the commercial and recreational fisheries have traditionally harvested similar sizes of black sea bass.

The commercial minimum size regulations, mesh regulations, and pot requirements were designed to reduce the discarding of small black sea bass by commercial vessels, increase yields, and allow more black sea bass to reach sexual maturity and spawn. Monitoring of the fishery will indicate if discards are reduced and whether modifications in gear regulations or minimum sizes should be implemented during any year of the management program.

The commercial minimum fish size, gear regulations, and commercial quota and the recreational size limits, possession limits, and season are all specified so that they may be adjusted annually following procedures set forth in the FMP to assure that the fishing mortality reductions strategy is followed.

9.2.1.7. *Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication*

The management regime was developed to be compatible with and reinforce the management efforts of the states and ASMFC. The minimum size limits, gear regulations, quotas, possession limits, and, to some extent, closed seasons, can be enforced on shore, thus eliminating the need for high cost at sea enforcement. The provisions of this FMP have already been adopted by the ASMFC.

9.2.2. Cost/Benefit Analysis

9.2.2.1. *Implications of overfishing definitions and need to reduce fishing mortality rate*

The cost/benefit analysis must be considered with regard to the guidelines established in 50 *CFR* 611, which require that a Council define overfishing for the managed species, determine whether the species is in an overfished condition, and, if it is, develop a strategy for ending the overfished condition. The Council has adopted an overfishing definition for black sea bass. The Council has also determined that black sea bass are currently overfished and has adopted an eight year strategy to reduce fishing mortality to prescribed levels in order to end the overfished condition.

This eight-year strategy reflects the pressure now being placed on fishermen by other FMPs. Although the black sea bass resource should be rebuilt as quickly as possible, black sea bass management measures can be implemented over an eight-year time frame to minimize the short term economic burden placed on fishermen and still reduce the overfished condition of the stocks.

The excessive take of black sea bass will cease when fishing mortality is at the F_{max} level, which current analyses indicate is F = 0.29. The current fishing mortality rates is 1.05. Thus, there is at least a four fold difference between the F_{max} and the current F. In order to achieve F_{max}, current exploitation rates would have to be reduced by 62%.

An immediate reduction to an F_{max} level was seen as having an unnecessarily negative impact on the industry, so the Council and ASMFC Board adopted the following strategy. The recovery strategy calls for minimum fish sizes and commercial gear regulations in year 1 and 2. In years 3 to 5, target exploitation rates would be 48% for black sea bass. In years 6 and 7, the target exploitation rates would be 37% and in year 8 and subsequent years, the target exploitation rate would be based on F_{max}. Based on current conditions in the fishery, F_{max} is 0.29 and the associated exploitation rate is 23%.

The recovery schedule is as follows:

	Exploitation Rates
Current	60%
Year 3	48%
Year 6	37%
Year 8	23%

9.2.2.2. *Commercial Fishery*

9.2.2.2.1. Moratorium on commercial vessels

The MFCMA allows the Council to limit entry into a fishery if the Council considers the factors set forth in section 303(b)(6) of the Act: "establish a system for limiting access to the fishery in order to achieve optimum yield if, in developing such system, the Council and the Secretary take into account (A) present participation in the fishery, (B) historical fishing practices in, and dependence on, the fishery, (C) the economics of the fishery, (D) the capability of

fishing vessels used in the fishery to engage in other fisheries, (E) the cultural and social framework relevant to the fishery, and (F) any other relevant considerations;"

Present participation in the black sea bass commercial fishery is estimated to range between 574 and 674 vessels.

In addition to black sea bass, these vessels land *Loligo* squid, Atlantic mackerel, silver hake, summer flounder, scup, and other species. Most of the marketable species caught in the mixed trawl and pot fisheries are depleted, if not technically overfished. A moratorium exists for vessels in the summer flounder fishery. The Mid-Atlantic Council has already determined that scup are overfished, and has proposed a moratorium for vessels in this fishery. The New England Council has approved moratoria for the Northeast Multispecies FMP and the Scallop FMP.

The measures proposed in this FMP will significantly impact fishermen. They are considered to be the most reasonable and fair given the need to dramatically reduce fishing mortality. The real issue is that, if the measures proposed in this FMP are not implemented, the negative impact on the fishermen will be even greater.

Given the likely number of vessels operating in this fishery and the level of probable quotas beginning in year 3 of the management program, not controlling the number of vessels could lead to a significant waste of capital resources as the ever decreasing probability of profits are dissipated over more operating units.

The FMP proposes a moratorium on new entrants to the commercial black sea bass fishery. The main purpose of this provision is simply to cap entry so that any future gains in productivity and profitability which may occur in the fishery will not be dissipated by future entrants. In this way, the individuals who make sacrifices today will be able to share in the benefits of future stock recovery, rather than others who experienced none of the hardship.

The initial impacts of this provision are purely administrative. Vessel owners or operators will be asked to provide evidence that they harvested black sea bass between 26 January 1988 and 26 January 1993.

No license is intended or necessary for those individuals who do not sell the fish that they catch.

There are a number of impacts which will occur in the short term. The very fact that entry into the industry has been curtailed will give vessels with moratorium permits a scarcity value that they would not otherwise possess. Experience in the surf clam fishery has shown that, over time, the value these moratorium permits can accrue is substantial, though the magnitude in the black sea bass fishery will be reduced because thousands will be issued instead of hundreds.

Fishermen will also be impacted by the provision controlling vessel replacement. The current specification of the preferred alternative requires that replacement vessels not have a larger tonnage or registered length than the original. On balance, this limitation is considered necessary to inhibit a large scale increase in the fishing power of the fleet through such replacements.

The MFCMA (Section 303(b)(6)) provides that a fishery management plan may establish a system for limiting access to a managed fishery in order to achieve Optimum Yield if, in developing such a system, the Council and the Secretary take into account six factors. A discussion of those factors and their application to the proposed limited entry program for the black sea bass fishery follows:

A. Present participation in the fishery.

Present participation in the black sea bass commercial fishery is estimated to range between 574 and 674 vessels. The proposed program of limited entry seeks to reduce the size of the fleet gradually through natural attrition. No vessel which was actively fishing for black sea bass between 26 January 1988 and 26 January 1993 would be denied access to the fishery.

B. Historical fishing practices in, and dependence on, the fishery.

Fishermen using otter trawls and pots/traps account for the majority of commercial landings; 56% and 33% respectively, based on 1983 to 1992 data (Table 10). Other important commercial gears include hand lines, lobster pots, and floating traps. Many species are caught in conjunction with black sea bass (Table 29). Economically, black sea bass is an important species in the mixed trawl fishery (Table 29).

C. The economics of the fishery.

Black sea bass are economically important species in the mixed trawl fishery, the predominant species landed by black sea bass pot fishermen, and an important bycatch for some lobster fishermen. The provisions of this FMP, in order to solve the overfishing problem, will impose restrictions on the industry. Limiting entry is the only tool available under the MFCMA to allow vessel owners and operators to recover, at least in part, losses incurred during the rebuilding program. If entry remains open, profits will likely be dissipated among new entrants following recovery.

D. The capability of fishing vessels used in the fishery to engage in other fisheries.

Black sea bass vessels traditionally harvest other species. However, a number of species in the mixed trawl and pot fisheries have also been determined to be overfished. The Mid-Atlantic Council has determined that summer flounder and scup are overfished and is preparing an amendment to the Bluefish FMP to eliminate the overfished nature of that resource. The ASMFC has adopted an Amendment to their Weakfish FMP to eliminate an overfished situation. The Mid-Atlantic Council has prepared an Amendment to the Atlantic Mackerel, Squid, and Butterfish FMP to limit entry into the squid and butterfish fisheries.

The proposed limited entry program will not force operators out of the fishery unless they clearly do not meet a minimum standard of involvement and activity in the fishery. The program is designed to continue over a period long enough to allow the number of operators to seek its own equilibrium level through natural attrition.

E. The cultural and social framework relevant to the fishery.

Many of the vessels in the fishery are owned and operated by independent, individual fishermen who have obtained their position of ownership through individual enterprise. There is a strong tradition of black sea bass fishing within families. Many of the family operated businesses are the most vulnerable to an influx of additional vessels because they are not in a position to survive long periods without revenue, or to operate at significantly lower levels of gross revenue.

F. Any other relevant consideration.

The management program is designed to rebuild the stocks. However, the vessels currently in the fishery will have to sacrifice income opportunity as a part of the rebuilding program. While the net benefits to society from the management program are not in question, the benefits to individual operators who make the sacrifice could quickly be lost or eroded among new entrants. The length of the period of sacrifice is unknown. It would be unfair to dissipate the investment of these operators among a flood of opportunistic new entrants when it begins to appear that the stock is rebuilding. The proposed program of limited entry allows traditional operators to recoup at least a portion of their sacrifice. Such a program will promote resource stability and industry efficiency which is in the best interests of the fishing community and the nation.

9.2.2.2.2. Minimum fish size

Historic commercial length frequencies were used as an estimate of potential short-term impacts of length limits on the commercial black sea bass fisheries (Tables 36 to 39). Specifically, commercial length frequencies from the NMFS Weighout Data and North Carolina DMF from 1982 to 1992 were used to determine potential size limit effects. In general, size frequency data indicated that potential size limit effects increased from north to south, were gear dependent, and varied from one year to the next.

Based on NMFS weighout data, approximately 11% of the measured black sea bass were less than 9" TL for all otter trawl vessels with sampled landings (Table 38). This gear is associated with most of the commercial landings coastwide; otter trawl vessels accounted for over 56% of the coastwide landings based on 1983-1992 General Canvass data (Table 10).

A 9" TL minimum size regulation would have a slightly greater effect on landings from fish pots/traps, the other predominant gear in the black sea bass fishery (this gear accounted for 33% of the landings from 1983-92). Based on NMFS weighout data, almost 26% of the measured fish were less than 9" TL for the 4,592 black sea bass obtained from this gear from 1983 to 1991 combined (Table 38).

Size limit effects varied annually in North Carolina landings from the winter trawl fishery (Table 39). From 1983 to 1992, the amount of measured fish less than 9" TL ranged from 18.3% to 40.7%. North Carolina accounted for 11% of the coastwide commercial landings on average from 1983-1992 (Table 17).

Assuming that undersized fish are not caught and discarded, minimum size regulations have positive impacts on the stock. In general, because minimum sizes increase the size at full recruitment, yields are increased as fishermen catch larger, heavier fish. In addition, minimum size regulations can increase the resilience of the stock to overfishing, i.e., the biological reference points (F_{max}) can increase. Finally, minimum size regulations can increase spawning stock biomass by allowing more fish to spawn. Sexual maturity data for black sea bass indicate that 50% of the black sea bass are mature by a size of 7.7" TL.

9.2.2.2.3. Minimum mesh size

Owners or operators of otter trawl vessels possessing 100 lbs or more of black sea bass would only be allowed to fish with nets that have a minimum mesh size of 4.0" diamond (3.5" square) in the codend. The L_{25} (the length at which 25% of the black sea bass are retained) is 9.3 inches for this mesh size (Table 40).

Mesh selectivity studies have not been conducted for black sea bass. The relationship between body depth and total length as derived by Weber and Briggs (1983) was used to calculate the 50% retention lengths for black sea bass. A selection range of 2 inches (based on selectivity studies conducted on fish of similar shape) was then used to estimate 25% and 75% retention lengths.

Landings of black sea bass represent only a portion of the fishing mortality experienced by the stock. Undersized black sea bass, those less than 9" TL, experience both discard mortality and deaths due to encounters with commercial gear. The amount of fish dying due to these causes can be high with the current mesh sizes now used in the fishery.

Black sea bass are a component of the mixed trawl fishery in Southern New England and the Mid-Atlantic. Although Sea Sampling data indicate that fishermen may differentiate between species on a per tow basis (i.e., target a single species on a tow), fishermen land many different species on a per trip basis. Based on 1992 NMFS weighout data, black sea bass are most frequently landed with *Loligo* squid, silver hake, scup, and flounder. In fact, for trips landing a 100 or more pounds of black sea bass per trip, more *Loligo* squid were landed than black sea bass in 1992 (Table 29).

However, this predominance of *Loligo* may reflect reduced availability of other species in 1992. Based on 1983 to 1987 data, the landings of otter trawl vessels landings 100 lbs or more of black sea bass were composed primarily of scup (29%) and summer flounder (24%) (Table 41). *Loligo* accounted for only 17% of the landings.

The 100 pound threshold would effect 62% of the vessels and 34% of the trips that landed black sea bass in 1992 (Table 42) These trips accounted for 95% of the black sea bass landed by otter trawl vessel in 1992.

Regulations that allow multiple nets onboard would allow fishermen who traditionally targeted multi-species on a trip, to fish for and retain other species with small mesh until the 100 pound threshold of black sea bass was reached. These fishermen would then have to use the 4.0" mesh if they decided to target more black sea bass. Once the threshold was reached fishermen would have to properly stow other codends for the remainder of the trip.

Landings of black sea bass by fishermen targeting *Loligo* squid and scup on the same trip could be effected by these regulations. Based on 1992 NMFS weighout data, 45% of the vessels and 29% of the trips landing 2500 pounds or more of *Loligo* squid, landed over 95% of *Loligo* landed by all *Loligo* otter trawl fishermen (Tables 43 and 44). Based on this 2500 pound threshold, black sea bass comprise slightly less than 0.7% of the total fish landed on these trips (Table 45). However, the total pounds accounted for approximately 41% of all black sea bass landed by otter trawl fishermen in 1992.

Similarly, 52% of the vessels and 28% of the trips landing 1000 pounds or more of scup, landed over 95% of scup landed by scup otter trawl fishermen (Tables 46 and 47). Based on this 1000 pound threshold, black sea bass comprise slightly more than 1.1% of the total fish landed on these trips (Table 48). Because scup and *Loligo* squid are frequently landed on the same trip, the total pounds accounted for approximately the same amount of black sea bass landed by directed *Loligo* squid trips.

In general, these regulations would modify some traditional fishing practices. The fishermen most effected by these regulations would be those fishermen who targeted other species on a trip with small mesh net (squid, scup, or whiting) and had coincidental catches of black sea bass. If a fishermen had 100 lbs of black sea bass on board, and desired to continue fishing with a small mesh net, he would be required to discard any sea bass caught in tows directed to other species. Alternatively, if he desired to continue to fish for black sea bass, he would have to stow his other codends for the remainder of the trip perhaps losing an opportunity to catch and land valuable bycatch (i.e., summer flounder, squid, etc.).

However, these mesh provisions should have minimal effect on bycatch species. Most of the species caught with black sea bass are regulated, or have proposed regulations that require mesh sizes and/or minimum fish sizes that equal or exceed the black sea bass regulations. A 6" minimum mesh size is required for most of the New England groundfish species. The minimum mesh size for summer flounder is 5.5" with a minimum fish size of 13" TL. The proposed minimum size for scup would require that fishermen use a 4.0" tail bag to reduce catch of sublegal fish, i.e. those less than 9" TL. Amendment 5 to the Atlantic Mackerel, Squid, and Butterfish FMP implemented a 1 7/8" minimum mesh size for *Loligo*.

Minimum mesh provisions in conjunction with the minimum fish size will ensure that discards of sub-legal black sea bass will be reduced. Greater gains will accrue to fishermen through protecting black sea bass until they reach legal size. Discard mortality is extremely high for trawl caught fish and the problem is particularly acute when new year classes are abundant. The benefits of the proposed minimum fish size and mesh size regulations will be manifested through a more balanced age structure of the black sea bass stock. Further, waste will be reduced due to (1) lower total discards and (2) lower mortality of net encounter.

9.2.2.2.4. Maximum roller diameter

It would be illegal for owners or operators of vessels issued moratorium permits to use roller rig trawl gear equipped with rollers greater than 18" in diameter. A 18" diameter corresponds to the maximum roller diameter limitation imposed by the state of Massachusetts to regulate this gear in state waters.

Roller diameter is correlated with vessel size and the ability of vessels to fish rough, hard bottom areas. Larger roller sizes require larger engine sizes to pull the net. An engine size with an associated horsepower of 800-900 hp is required to tow a net with 18" to 24" rollers whereas 10" to 12" rollers can be pulled by a boat using a 175-200 hp engine (D. Simpson pers. comm.).

Information is lacking as to the relationship between roller diameter and the size of obstruction that it can clear. In general, 10-12" diameter rollers can be used for fishing over rough bottom that can include ledges and cliffs. Limitations on roller size will make some areas of the ocean inaccessible to trawls by preventing fishermen from trawling in the harder, rough bottom areas. As a result, black sea bass associated with these areas would be protected from harvest allowing more fish to grow to maturity and spawn increasing stock biomass and yields.

9.2.2.2.5. Minimum escape vent requirement

Black sea bass pots are required to have a minimum escape vent of 1 1/8" x 5 3/4" or 2.0" in diameter or 1.5" square (inside measure). For wooden pots, the plan would require that the spacing between one set lathes in the parlor portion of the pot be 1 1/8". The escape vent provision would be implemented at the start of the first calendar year following FMP approval so that fishermen would not be required to pull their pots and add vents in the middle of the season.

During the development of this plan, Council staff proposed that black sea bass pots or traps have escape vents that would allow for the release of undersized fish. Although there were a number of studies that indicated that escape vents release fish from pots and traps, there were a lack of specific studies on black sea bass. MAFMC staff initiated a project in 1994 to determine the size selectivity of traps fitted with vents of various sizes. The objective of the study was to determine the vent size which allowed 50% escapement of black sea bass below the proposed minimum size limits of 9" and 10" TL.

In the study, the catch and size distribution of black sea bass taken in commercial sea bass pots fitted with escape vents was compared to catches from unvented traps. Four strings of 25 traps (100 traps) were fished from May through October, 1994 on commercial fishing grounds in areas offshore from Cape May, NJ to Ocean City, MD. A total of 9 trips were made to haul the traps.

A total of 100 traps were assigned a vent size of 1 1/8" x 6", 1 1/4" x 6", 1 3/8" x 6", 1 1/2" x 6", or no vent (control). The traps with the various vent sizes were randomly placed in groups of five on the four strings. The vents were made from aluminum and were patterned after the vents used in lobster traps. Vents were placed vertically in the door of the trap such that they would allow fish to escape from the lower corner of the parlor portion of the trap. The lower corner location was used as the result of aquarium studies that indicated sea bass almost always tried to escape from a lower corner after they were placed in a trap (G. Shepherd pers. comm.).

Traps were fished under normal commercial fishing conditions. Soak time, the period between hauls, averaged 14 days. The catch from each trap was retained separately and all black sea bass were measured to the nearest half cm TL.

Length frequency distributions were constructed for black sea bass from each of the treatment vent sizes and control. Proportions retained at length were computed as the ratio between the number of fish taken in vented traps and the number taken at that length in the control traps. The length at 50% retention for each vent size was estimated by fitting a logistic curve to the proportion retained at length data for each vent size.

A total of 5574 black sea bass were measured from the 100 traps from April through October. Black sea bass ranged in size from 16.5-36.5 cm. The control traps caught the largest number of sea bass (n=1534) followed in descending order by traps with the experimental vents: 1 1/8" (n=1164), 1 1/4" (n=644) 1 3/8" (n=397) and 1 [?2]" (n=305).

Results indicate that vents do release undersized black sea bass. Length frequency histograms for black sea bass from each vent size compared to the control are presented in Figures 12 - 15. Based on these length frequencies, the L_{50} derived for traps fitted with the 1 1/8" and 1 1/4" vents was 8.7" TL and 10.1" TL, respectively (Table 49). Based on these results, a 1 1/8" x 6" vent would be required for traps when the size limit was 9" TL.

During plan development, the Council and Commission determined that the size of the rectangular vent should be modified to more closely correspond to the dimension of vents required in lobster pots, 1 7/8" x 5 3/4". Specifically, they modified the dimension of the vent to 1 1/8" x 5 3/4". By maintaining the same length as the lobster vent, it will be easier for manufacturers to make black sea bass vents without major modifications to their equipment.

Studies were not conducted to determine the selectivity of traps fitted with circular or square escape vents. A body length/depth relationship (Weber and Briggs 1983) was used to derive the minimum sizes of black sea bass that would be retained by fish traps fitted with these escape vents (Table 50). However, members of industry indicated that the vents sizes based on morphology were too large and demonstrated to the Council and Commission that smaller vent sizes were appropriate for circular and square escape vents. As such, the proposed dimensions for these vents were 2.0" in diameter (circular) or 1.5 " square (inside measure).

Pots and traps accounted for approximately 33% of the total commercial landings for the period 1983-1992 (Table 10). However, in recent years the proportion of the landings attributable to this gear has generally increased. In 1991, this gear accounted for almost 62% of the landings (Table 12). The escape vents will allow for a significant proportion of undersized fish to escape alive. Currently, relatively few sea bass fishermen in the Mid-Atlantic have escape vents in their pots and traps. This gear is fished at varying depths and hauled to the surface quickly with hydraulic or electric pot hauler. As a result, fish may experience internal trauma due to changes in pressure and a significant portion may not survive (Rogers *et al.* 1986). Although many pot fishermen use sorters on deck to release nonmarketable fish, the escape of these fish from the traps before they are hauled will significantly increase survival.

In addition, fishermen are encouraged to use sorting devices that allow for undersized fish to be returned quickly to the water. Combined, the escape vent provisions and sorting devices will significantly reduce the number of undersized fish that are killed by pot fishermen. This reduction in sublegal mortality will increase yields and the amount of mature fish in the stock.

9.2.2.2.6. Degradable fasteners in traps

Black sea bass pots would be required to have hinges and fasteners of one panel or door made of degradable materials. The panel would have to cover an opening of at least 3" x 6". Degradable materials would allow the door or panel of a trap to fall away from an unattended trap. This would prevent lost traps from "ghost fishing", i.e., continuing to catch and retain fish that could not be removed from the trap. Thus black sea bass and other species of fish and invertebrates typically caught by these traps could escape preventing waste and lost yields in a number of fisheries.

9.2.2.2.7. Commercial quota

Beginning in year 3 a quota would be allocated to the commercial fishery to control fishing mortality. The quota would be based on stock assessment information on projected stock size estimates for that year. Estimates of stock size coupled with the target fishing mortality rate would allow for a calculation of total allowable landings. Based on the historic proportions of commercial and recreational landings for 1983 to 1992, 49% of the total target would be allocated to the commercial fishery.

To assess potential impacts of the quota, landings data were used from 1988-1992 to derive average landings for those years (3.275 million lbs). Based on these data, a 20% reduction in exploitation would equate to a commercial quota of 2.6 million lbs (80% x 3.275).

During the first and second year of the FMP, a system to distribute and manage the annual commercial quota will be developed by the Council and Commission. Coastwide, regional and state by state quotas will be considered in combination with different fractions of the fishing year, e.g., bimonthly quotas. The following is an analysis of two possible management systems; a state-by-state and a bimonthly, coastwide system. If a system is not designed in the second year, a state-by-state quota system would be implemented beginning in year 3.

In a state-by-state system, quotas would be distributed to the states based on their percentage share of commercial landings for the period 1988-1992. Assuming a coastwide quota of 2.6 million pounds, quotas would range from 1,184 lbs to 839,707 lbs based on these percentages (Table 51). In a state-by-state system, all black sea bass landed for sale in a state would be applied against the state's annual commercial quota regardless of where the black sea bass were harvested. Any overages of the commercial quota landed in a state would be deducted from that state's annual quota for the following year.

A state-by-state quota system could allow for the most equitable distribution of the commercial quota to fishermen. Specifically, states under this alternative would have the responsibility of managing their quota for the greatest benefit of the commercial black sea bass industry in their state. States could design allocation systems based on trip limits and seasons. States would also have the ability to transfer or combine quota increasing the flexibility of the system to respond to year to year variations in fishing practices or landings patterns.

However, state-by-state allocations would negatively affect fishermen who land in those states that do not have the capability of regulating a quota. Based on the quota system implemented for summer flounder, a few states have not been able to establish trip limit systems that ensure a continuous and steady supply of product over the season for producers and/or a fair an equitable distribution of flounder to all fishermen who have traditionally landed summer flounder in their state. In addition, some states have had problems coordinating their regulations with neighboring states to prevent large scale landings by fishermen in states with the most favorable trip limits. A similar situation could occur if a state-by-state system was implemented for black sea bass.

As one alternative to a state-by-state system, the coastwide quota could be allocated on a bimonthly basis. The Regional Director would be required to prohibit landings by federally permitted vessels when any bimonthly quota had been reached.

The quota must apply throughout the management unit, that is, in both state and federal waters. All commercial landings during a bimonthly period would count toward the quota for that period. When the quota had been landed for a bimonthly period, fishing for and/or landing black sea bass would be prohibited for the remainder of the period.

A bimonthly quota system could allow for an equitable allocation of the commercial quota to northern and southern participants as well as between the smaller day boats and larger offshore vessels. Due to the seasonal nature of the black sea bass fishery, the quota would have to be divided into bimonthly units. To minimize effects on traditional landings patterns, the allocation to each period would be based on past landings instead of a system that divided the quota equally over the six periods. Based on 1988-1992 data, 20.79% would be allocated to period 3 (May-June) and only 8.46% to period 4 (July-August) (Table 52). The bimonthly allocations would range from 219,960 lbs to 687,440 lbs based on a annual quota of 2.6 million lbs (Table 52). Based on state data for those years, fishermen would be able to maintain traditional landings patterns in most states (Tables 53 and 54).

A coastwide system would allow fishermen to land in any port along the coast and all commercial landings during a bimonthly period would count toward that quota for that period. When the quota had been landed for a bimonthly period, fishing for and/or landing black sea bass would be prohibited for the remainder of the period. Landings in excess of the allocation for the period would be subtracted from the following years's quota for the same period. Trip limits would have to be implemented. Bimonthly allocations without trip limits would encourage derby-style fishing practices that would allow the quota to be landed by larger, more mobile vessels at the beginning of each period. As a result, supplies of black sea bass would be discontinuous and smaller boats would be disadvantaged.

Trip limits would be established and modified throughout the two-month period to allow for a continuous supply of product and equitable distribution of black sea bass to fishermen using both small and large vessels. For example, almost all of the landings in period 1 are attributable to fishermen using otter trawl vessels. A 10,000 pound trip limit could be established for the beginning of period 1. The limit would decrease to 5000 lbs when 50% of the allocation was reached, 1000 lbs when 75% of the quota was taken, and 500 lbs when 90% of the landings were reached.

Different trip limit systems could be designed for each period to ensure equitable distribution over each two-month period. Unlike a system where states have the flexibility to design their own systems, NMFS would be responsible for implementing trip limits for each period.

An overall quota for the commercial fishery is important to control mortality on the black sea bass population. The minimum size regulation may reduce discard and escape mortality of undersized black sea bass. However, decreases in mortality would occur only with the smaller fish; reductions in mortality would not occur for black sea bass once they reached the legal size of 9" TL. Essentially the fish that contribute the most to the spawning population, fish 9" TL and larger, would continue to experience high mortality rates; overfishing would not be reduced. The commercial quota will control mortality on fully recruited, older fish.

This management measure will result in a short term reduction in the marketable catch and long term benefits as more fish mature and increase the size of the spawning stock. In addition, a reduction in the mortality of small black sea bass will allow for an increase in yield or harvest as small fish that were previously killed grow larger and add weight to the stock.

Combined, these management measures, the minimum size regulation and the commercial quota, will prevent overfishing and reduce waste. As the stock rebuilds, and exploitation rates remain constant, commercial quotas would increase.

9.2.2.3. *Recreational Fishery*

9.2.2.3.1. Possession limits, minimum size limits, and seasonal closures

The proposed minimum size limits would effect recreational landings of black sea bass in all states with landings of black sea bass. Based on 1983 to 1994 data, almost 100% of the sea bass were landed in states from New York to Virginia (Table 22). In states north of New York, landings were relatively small.

Analysis of 1990-94 intercept data for states from New York through North Carolina indicated that 18 to 34% of the measured sea bass were less than 9" TL (Table 55). On a coastwide basis, Maine to Cape Hatteras, NC approximately 27% of the black sea bass were less than 9" TL. Assuming a post-release mortality of 25%, the percent reduction in the number of black sea bass killed by anglers associated with a 9" TL minimum size limit would be 20% (Table 56).

The assumed level of post-release mortality (hooking and handling mortality) used in the above calculations is based on several studies. Bugley and Shepherd (1991) conducted a hooking mortality study on black sea bass caught by hook and line in Nantucket Sound, MA. They estimated a hooking mortality of 4.7% based on their sample size of 64 fish. However, these fish were caught in water depths of 6-12 m. Rogers *et al.* (1986) found severe trauma in black sea bass

caught by hook and line in relatively deep water (37 m) due to oral protrusions of the swim bladder. Of the 169 black sea bass collected by angling, 45 or 27% had protrusions of the swim bladder. Based on these studies and hooking mortality studies conducted for other fish, the ASMFC technical committee assumed a 25% hooking mortality for black sea bass caught by recreational fishermen.

Based on the fishing mortality reduction schedule adopted by the Council and Commission, exploitation would have to be reduced 20% in year 3 to achieve the target F. MRFSS data for 1990-94 indicate that catch frequencies for black sea bass ranged from 1 to 150 fish per day on a coastwide basis (Table 57). Based on these data, the reductions in exploitation associated with various possession limits for 1 to 50 black sea bass per trip were calculated (Table 58). The coastwide possession limit associated with a 20% reduction in exploitation is 13 fish. The possession limit would increase when combined with size limits and/or seasons.

Analysis of black sea bass recreational data indicated that nearly 37% of the annual landings occurred from September through October for the years 1990 to 1994 combined (Table 59). Seasons based on this MRFSS data could be established on a coastwide basis to reduce exploitation. A season could be combined with the size limit to allow for higher possession limits.

9.2.2.3.2. Evaluation of framework provisions

Based on a recommendation by the Council and the ASMFC Policy Board, the Regional Director and the States in their respective jurisdictions could modify the possession limit to between 0 and 50 black sea bass per angler, the size limit from 9" TL to 12" TL, and open or close the fishing season for the entire year. Recreational limits would be revised according to specific criteria to account for changes in stock abundance and meet the time frame of the fishing mortality reduction strategy.

Short term impacts due to restrictive limits would be outweighed by the long term benefit of conserving the black sea bass stock for future generations of recreational anglers. The possession limit could be as high as 50 black sea bass, the size limit decreased to 9" TL, and the season open throughout the year. However, given a constant level of recreational effort, decreases in restrictions would only occur under circumstances of increased black sea bass abundance. Since the prevailing rate of fishing success would reflect increased stock abundance, the number of anglers catching their limit would be high for overly restrictive limits. Decreasing recreational restrictions by raising the possession limit, decreasing the size limit, or increasing the length of the fishing season would therefore decrease the number of affected anglers and have less adverse impact than the limit in force at the time.

If stock levels are allowed to continue to decline or the amount of effort by recreational anglers increases (more trips or more people) disproportionately to increases in stock size, landing rates for anglers would decline regardless of specific limits. Adverse impacts would therefore be measured against the prevailing rate of fishing success and would not be as great as when black sea bass are abundant or angler effort is less. Although it is not possible to estimate exact impacts for hypothetical levels of black sea bass abundance, it is clear that more restrictive limits than those proposed initially would have substantially less impact than a total fishery closure precipitated by stock collapse.

A zero possession limit or a season closed for the entire year would prohibit retention of black sea bass by recreational fishermen and would have significant impacts, depending on the level of fishing success currently operative and the value anglers place on retention of catch. A 12" TL minimum size, the most restrictive minimum size limit proposed for this framework measure, would have had an associated percent reduction in exploitation of nearly 57% based on 1990-1994 coastwide MRFSS data (Table 56). These severe restrictions would only be implemented in the event that the stock continues to decline and stock collapse becomes imminent.

Reductions associated with these limits assume 100% compliance by recreational fishermen. Levels of noncompliance will be considered in annual reviews when assessing the impact of bag/size limits on the recreational fishery and determining if modification to the possession/size/season limits are necessary. A thorough and consistent enforcement program is required for this or any other FMP to succeed.

9.2.2.3.3. Recreational Harvest Limits

Beginning in year 3, a recreational harvest limit would be allocated to the recreational fishery to control fishing mortality. The harvest limit would be based on projected stock size estimates for that year as derived from the latest stock assessment information. Estimates of stock size coupled with the target fishing mortality rate would allow for a calculation of total allowable landings. Based on the historic proportions of commercial and recreational landings for 1983 to 1992, 51% of the total allowable landings would be allocated to the recreational fishery.

Because stock size has not been projected for 1998, the third year of the management program, landings data were used from 1988-1992 to derive average landings for those years to assess the potential impacts of the harvest limit. Based on these data, a 20% reduction in exploitation would equate to a recreational harvest limit of 2.53 million lbs in the third year of the management program. This harvest limit would be achieved on a coastwide basis through a system of possession limits, size limits, and/or season. Year end total recreational landings would be compared to the harvest limit to ensure that the landings target was not exceeded.

9.2.2.4. *Special Management Zones*

The intent of a SMZ is to enhance management of fishery resources on or around artificial reefs while optimizing fishing opportunities that would not otherwise exist. Artificial reefs are costly and provide benefits that can be easily nullified by the use of certain types of fishing gear. In addition, certain types of gear pose various threats to the reef structure and associated fishery resources, including: a) entanglement of other boating and fishing gear; b) entanglement in the reef structure ("ghost gear"); and c) damage to or movement of reef structure.

Many artificial reefs, including those constructed by state governments, are located in the EEZ. If management measures are needed to control fishing on and around those artificial reefs, they must be developed through a fishery management plan. Providing a process through which the Council can develop these measures on a case by case basis is an efficient way of achieving this control.

However, such a system must be coupled with a process that provides the Council an opportunity to comment, in a timely manner, on the location of artificial reefs before they are constructed. Industry advisors report that on occasion artificial reefs are constructed in existing black sea bass habitat areas, thereby possibly accomplishing a *de facto* allocation of a portion of the fishing grounds from the pot or trawler fishery to the hook and line fishery. While such allocations may be appropriate from time to time, they should be made only after all potentially affected interests are aware of the proposal and have an opportunity to comment.

9.2.2.5. *Administrative, enforcement, and information costs*

Currently, a reporting system is being implemented by the NMFS. This system has been designed to collect information for various fisheries according to their respective FMP's.

The cost of enforcing the black sea bass size limit equals the value of the additional capital and labor resources required to expand current enforcement efforts to encompass the new regulations. Minimum size regulations for black sea bass are currently enforced in various states (Table 60). The additional cost to existing dockside enforcement in these states from the implementation of the minimum size limit alternative is expected to be minimal. In addition, in states with minimum size regulations for other species, additional reporting and enforcement from black sea bass regulations should also be minimal.

It is assumed that most individuals that will potentially apply for black sea bass operator permits already hold operator permits for summer flounder, multispecies, and/or scallops. It is also expected than since most of the vessel's operators already submit logbook reports under the Northeast Multispecies, Scallop, and Summer Flounder FMPs, the implementation of this plan would not affect the reporting process to any significant extent.

9.2.2.6. *Prices to consumers*

In recent years, the exvessel price per pound of black sea bass caught commercially has shown a slight upward trend, indicating that supply and/or demand factors may be shifting. For the period between 1983 to 1992, the highest price for all size categories of black sea bass occurred in 1989. NMFS weighout data for 1992 indicate an average exvessel price of $1.05 per pound coastwide, ranging from $0.42 per pound for pins to $2.76 per pound for jumbos (Tables 24 and 27). Continual increase in the demand of fish and shellfish in general (due to health awareness) could be the cause for increased ex-vessel revenue. However, the effects of this factor on ex-vessel price can not be address quantitatively at the time.

Potential reduction in landings and value attributed to this plan in its early years are not expected to significantly increase overall ex-vessel black sea bass price. Future increases in black sea bass supply due to reduction in mortality, higher harvest weight, and stock stability, should maintain the consumer black sea bass price level (assuming everything else constant).

9.2.2.7. *Redistribution of costs*

The FMP is designed to give fishermen the greatest possible freedom of action in conducting business and pursuing recreational opportunities consistent with the objectives. It is not anticipated that the proposed management measures will redistribute costs between users or from one level of government to another.

9.2.2.8. *Fishery impact statement*

The impacts of the proposed actions on participants in the black sea bass fisheries including analyses of biological, economic, and social impacts are described in section 9.2 (Analysis of Beneficial and Adverse Impacts of Adopted Management Measures), in Appendix 1 (Alternatives to the FMP) and in appendix 2 (Regulatory Impact Review) of the FMP. The Mid-Atlantic Fishery Management Council commissioned two reports to assess the probable socio-economic impacts of management options identified in the draft FMP. The first report titled "Part 2, Phase I, Fishery Impact Statement Project, Mid-Atlantic Fishery Management Council" by McCay *et al.* (1993), described the people and

communities involved in the region's fisheries. The second report titled "Social and Economic Impacts of the Draft Management Plans for Black Sea Bass and Scup" by Finlayson and McCay (1994), assessed the probable socio-economic impacts of management options identified in the draft FMP. This section is intended to further describe the potential effects of the proposed FMP on the people and the communities involved in the black sea bass fisheries throughout the region based on these reports.

The principal approaches employed to compile the information presented in the two reports mentioned above were open-ended phone interviews, port visits, data analysis, and interviews of people involved in different aspects of the fishing industry. It is important to note the potential biases in the comments provided by some of the individuals interviewed. In the second report, Finlayson and McCay (1994) stated that:

"When assessing the claims and opinions of members of the fishing industry cited and quoted in this report, the reader should remain critically aware that in many if not all cases there is an element of self-interest at work. This is particularly true where there is a real or perceived conflict between gear sectors and/or regions in competition for a limited, and declining, resource, and where they fear that draft regulations will result in an unequal, and hence unfair, distribution of economic impacts among the user groups."

The first report (McCay *et al.* 1993), identified ports that appeared in the top 10, in terms of landed value, for any of the species that the Mid-Atlantic Fishery Management Council has full or shared responsibility for the preparation of Fishery Management Plans (tilefish, scup, black sea bass, summer flounder, dogfish, Atlantic mackerel, *Loligo* squid, *Illex* squid, butterfish, weakfish, bluefish, and angler or monkfish). The ports identified as relevant in the first report covered ports from Chatham, Massachusetts, to Wanchese, North Carolina. The second report (Finlayson and McCay 1994), identified ports that met one or both of the following criteria: the port or closely related port group accounted for more than 1 percent by landed value of the total landings of black sea bass or scup, or the landings of black sea bass or scup accounted for more than 1 percent of all commercial landings in that port or port group (Finlayson and McCay 1994). The ports identified as relevant on the second report covered ports from Gloucester, Massachusetts, to Hampton Roads, Virginia.

Landing statistics and values are from the National Marine Fisheries Service weighout data. Information about the ports is from interviews with key informants and from earlier studies conducted by McCay's research team (McCay *et al.* 1993).

In this section, both reports will be used to assess the socio-economic implications of the proposed FMP at the individual and aggregate level as permitted by the available information. For a more through review of the potential socio-economic implications of the FMP, refer to these reports.

Table 61 shows port groups ranked by landed value of black sea bass as a percentage of the value of port landings for all species. In 1992, black sea bass accounted for 4.69% of the value of total port landings in Ocean City; 2.02% in Cape May; 1.66% in Hampton Roads; 0.85% in Freeport/Brooklyn; 0.62% in Montauk; 0.61 in Monmouth; and less than 0.5% for the rest of the ports. Three ports accounted for 60% of all black sea bass landed value in 1992: Cape May, Hampton Roads, and Ocean City (Table 62). Cape May accounted for approximately 27% of the total black sea bass landed value; Hampton Roads 20%; Ocean City 14%; Montauk 6%; Point Judith 5%; Monmouth 2%; and less than 2% for the rest of the ports. Black sea bass landed values are higher for ports located in the southern part of the region (Tables 61 and 62).

The degree of reliance on black sea bass for selected ports from Gloucester, Massachusetts, to Hampton Roads, Virginia, is low. In no instance were the ports (or port group) dependent on black sea bass for 5% or more value from fish and shellfish. One port represented 4.69% of the total landed value of black sea bass (Ocean City), with the rest of the ports having a value somewhere between 0 and 2% (Table 61).

9.2.2.8.1. Port level - Commercial fishery

The port discussion includes a description of the fleet (number of vessels and type of gear employed), a description of the landings (species and value) and a general description of the community and port characteristics as permitted by the available information. The discussion provided in the port description is based on findings by McCay *et al.* (1993). The overall description may vary from port to port due to the confidentiality of data.

9.2.2.8.1.1. Hampton Roads, Virginia

The Hampton Roads area ports include the following ports: Hampton, Newport News, Norfolk, Seaford and Virginia Beach. According to McCay *et al.* (1993), 30 boats are home ported in the Hampton area in the summer and 75 in the winter. The number of boats in the port vary depending on where the boats decide to land. Most of the fish houses in Hampton Roads own boats. The boats work on a regular basis in Virginia. There are over 100 draggers in the Hampton Roads area. This does not include the gill netters, trap fishermen and longliners. According to an informant, there are about 100 of these boats. The Hampton boat fleet is described by an informant as 50-60% full-time scalloping, 30-40% part-time scalloping (in the summer) and part-time fishing (flounder in the winter), and about 10% fish full time doing any kind of dragging.

million. The landed value of the major species landed in 1992 included sea scallops (28%), ocean quahog (11%), *Illex* squid (10%), *Loligo* squid (9%), and surf clams (8%). Black sea bass contributed 2% of the total landed value of all species. Other ports in this area and the statistics that follow include Cold Spring Harbor, near Cape May, and Sea Isle City, located to the north. There are now two tilefish boats, two fish trap (pot) boats and one dragger working out of Sea Isle City. Tilefish and black sea bass are species targeted.

The general outline of Cape May/Wildwood fisheries is described by McCay *et al.* (1993):

"Tilefish are not landed in the Cape May/Wildwood area, except in Sea Isle City. Scup are targeted by draggers. Black sea bass are caught by pot boats and some draggers. Fluke are targeted by draggers. Dogfish are caught by gillnetters in November, December and in the spring at which time they switch from the spiny dogfish to the smooth dogfish. Draggers target dogfish in the early winter months. Some draggers may just catch them if they happen to run into them. Atlantic mackerel are targeted by draggers in the winter. Loligo squid is almost a year round fishery for draggers. But they may be going for either squid on a trip. Illex squid is caught by draggers from May to October. Butterfish are a bycatch of squid and are rarely targeted. Gillnetters catch weakfish but there aren't many doing this any more because of state regulations. So there is a drop in these landings. Draggers also target weakfish. Bluefish are caught by gillnetters and they are a bycatch for draggers."

Bottom fish otter trawling, along with bottom sea scallop trawling accounted for 39% of the total landed value by gear in the Cape May/Wildwood area in 1992. The major species caught by value by bottom fish otter trawl in 1992 were: *Illex* squid (27%), *Loligo* squid (25%), and summer flounder (20%). Black sea bass ranked seventh with 2%.

Scallop dredges landed 28% of the total value landed in Cape May by gear type in 1992. Black sea bass contributed 0.01% of the total landed value for scallop dredgers. Off-shore lobster pots landed 2% of the total landed value landed in Cape May by gear type in 1992. Black sea bass contributed 3% of the total landed value for wire pots, and 9% for plastic pots.

Different species may be targeted at different times of the year by different types of boats or gear. *Loligo* squid is targeted during the winter by freezer trawlers. Once aboard the boat the squid is flash frozen into blocks of ice and kept in cold storage until the boat reaches port. The demand for *Loligo* squid is mostly for an export market in flash frozen squid. To a lesser extent, squid is marketed domestically in the fresh fish markets in New York and Philadelphia. Both the domestic and foreign markets are slowly growing.

Illex squid is the largest summer fishery for freezer trawlers. It is a relatively new fishery because *Illex* is very susceptible to higher temperatures. Recirculating sea water technology is required to handle large volumes of *Illex*. However, flash freezers are desirable in order to ensure a better product. *Illex* is mainly marketed as a flash frozen product in Europe.

Butterfish sometimes is a bycatch of the squid fishery. When butterfish is caught with large amounts of squid, it is unmarketable (sometimes it is consumed by the captain and crew of the vessel). However, if landed in considerably large quantities it can be marketed.

During the winter, scup sometimes is targeted by RSW and normal trawlers. Mixed trawl and porgy nets are employed to fish for scup. The product is marketed in the fresh fish markets.

Cape May is the most southerly town in New Jersey. Cape May has a vibrant tourist and beach economy during the summer. The commercial docks are located along one stretch of the road separated from the rest of the community.

9.2.2.8.1.4. Montauk Area, New York

The Montauk area ports (Montauk, Shinnecock/Hampton Bay, and Greenport) had a total of $28 million in landings of fish and shellfish in 1992. Black sea bass accounted for less than 1% of the total landed value in the area in 1992. The Montauk area is characterized by a high diversity of species and gear types, reflecting the coexistence of estuarine, inshore, and offshore fisheries. An interesting fishing innovation called "double crewing" has developed in Montauk and other ports. The double crew strategy provides the boats and the crew with a greater degree of operational flexibility. According to McCay *et al.* (1993):

"Boats that double crew have two sets of captains and crews. In a double crewing situation one set of captain and crew comes in and unloads the boat and then the other captain and crew comes on board and takes the boat out for another trip. "They are willing to spend money, they are making money, and they are doing it by making the boat work harder," said one informant regarding double crewing. This same person commented that one of the reasons they are working the boats harder today in 1993 than fifteen years ago are the large mortgages that are on these vessels that they did not have before."

There are between 20 and 35 draggers in Montauk. The major gear types, in terms of percentage of landed value in 1992 were: bottom dragging (finfish) 40%, tilefish longlining (25%), and pelagic longlining (swordfish and tuna) 18%. Handlining (scup, black sea bass, and Atlantic mackerel) accounts for 6% of the total landed value.

Loligo squid is the main target of the Montauk fishing fleet. The contribution of black sea bass to the total landed value per species for bottom draggers is minimal. The typical dragger in Montauk is owner operated, and vessels might have a second captain and a double crew.

There are approximately fifty-five commercial fishing boats operating in the Shinnecock/Hampton Bays area. Most of these boats are draggers. Otter trawlers and dredgers (scallop/ocean quahog) accounted for 66% and 24% of the total landed value for all species in these ports in 1992, respectively.

The top four species in landed value in 1992 in this area were: *Loligo* squid, silver hake, ocean quahog, and surf clam. They contributed for about 68% of the total landed value. *Loligo* accounted for 27% of the total landed value (97% caught by trawlers). Black sea bass ranked twenty-six, with 0.18% of the total landed value by species for the same period.

Loligo squid and whiting are the major targeted species for draggers from the Shinnecock/Hampton Bays area, representing 66% of the total landed value for all species in 1992. Black sea bass ranked nineteen with 0.17% of the total landed value. *Loligo* squid and whiting are both targeted all year round. Scup is targeted for about three to four weeks as they migrate through the Hampton area.

Sink gill netting and inshore lobster potting were the third and fifth fisheries in terms of total landed value in 1992, (5% and 1%, respectively). However, they do not target black sea bass.

Pound nets represented 0.13% of the total value for all species in 1992. *Loligo* squid accounted for approximately 34% of the total landed value for pound nets in 1992, scup for 16%, winter flounder for 14% and butterfish for 10%. Black sea bass is not targeted by this type of gear.

Based on McCay *et al.* (1993), fishery trends and changes in Shinnecock indicate that:

"Whiting has always been targeted but more so in the last six months (July-December 1993) because of a new market for juvenile whiting. Within the last year (1993), very small whiting has become a big export item to Spain. The Spanish want the really small whiting; it is prepared by putting the tail in the mouth like a donut and frying it. There are about a half a dozen boats targeting small whiting as of December 1993. There is an export operation in Greenport for these small whiting."

"According to informants, whiting and squid are plentiful right now, (December 1993). Scup are becoming harder and harder to get every year. The species caught by Shinnecock boats depends on availability and the market. If whiting is in big demand, the fishermen go for that."

Ninety-five percent of the fish (except squid, swordfish, and tuna) in Shinnecock goes to Fulton Market in New York. Swordfish and tuna are sold by the vessel owner. Squid is usually sent to New Jersey for processing.

The social nature of the Shinnecock fishing community indicates that most boats are owner operated. Many fishermen in Shinnecock have families in the commercial fishing industry. It is also evident that father-son operations are more common in this community than in Montauk.

The crews are mostly integrated by local men that are not usually family members. Crews are paid using the share system. Most crew members in Shinnecock are white males with about 60-70% of them having a high school education.

At the present time, there are no women fishing in Shinnecock. However, fishermen's wives have been very active in pushing for the maintenance of the Shinnecock Inlet.

In addition to a stable year-round population, Hampton Bays has a large tourist community. Numerous businesses such as bars, banks, liquor stores and restaurants cater to the tourist. The growth of the service industry in the area provides additional opportunities of summer employment in the community. Overall, construction, fishing and tourism are the largest sources of employment.

In Shinnecock a small number of support businesses to the fishing industry exist. There is one craftsman who does boat work exclusively. Welders and wood workers can do wood work as well as other types of work. Their electronic repairmen in the community are very specialized in marine electronics.

Three principal types of fishing are done by Greenport vessels: bottom dragging, offshore and inshore potting, pound netting and gillnetting. Between ten and twenty otter trawlers are home ported in Greenport. These bring about 60% of the total landed fish value. Offshore and inshore potting accounted for more than 25% of the landed value by gear in 1992. There are ten boats in the pound net fishery, which account for about 6% of the total landed value by gear in 1992. The five major species caught as a percent of the total landed value by all gear in 1992 were: lobster (28%), *Loligo* squid (13%), silver hake (12%), scup (9%), and summer flounder (7%). Black sea bass is not considered a major species in the Greenport area.

Loligo squid, whiting, scup, winter flounder, and summer flounder were the top five species by landed value for Greenport otter trawlers in 1992, with 21%, 20%, 14%, 10%, and 10% of the total landed value of otter trawlers, respectively. Black sea bass accounted for less than one percent of the total landed value of otter trawlers. Black sea bass are not rarely caught by otter trawlers because their stocks are down and the draggers do not target them. None of the boats target black sea bass specifically but they are a bycatch in the summer months. Scup is typically targeted in the late fall and early winter. *Loligo* squid is targeted in the spring and fall and it is also a bycatch with whiting. Summer flounder are targeted during the summer and through the fall.

Lobster potting is the second most important fishery in Greenport in terms of landed value. Black sea bass contributed 0.24% of the total landed value by species for inshore lobster pots.

Pound-net fishing accounts for a small percentage of the total landed value in Greenport. In 1992, black sea bass accounted for 0.06% of the total landed value for pound-netters.

The number of boats engaged in fishing activities in Greenport has been increasing in the last two to six years. This has created an upward trend in the importance of ancillary services such as ice and fuel. Other support businesses include a local welding business and Greenport Yacht and Shipping. These last two businesses are diversified and serve both commercial and recreational boats.

There are three packing facilities in Greenport. Most of the fish either go to Fulton market in New York or are exported (juvenile whiting).

To an extent, family is important in commercial fishing in Greenport. About half of the boats may have a family member (primarily a son) working on the boats. During the summer a number of high school students may work aboard a relative's boat.
The crews are full-time, local men. Most fishermen are high school or college graduates. The average age of the crew members and captains is between 25 and 35, and 40 to 60 years of age, respectively. The crews are typically paid using the share system.

There are no women working as part of the crews or the packing staff. However, some wives may be involved in other support aspects of the fishing operations.

The ethnic background of the fishing community in Greenport is quite diverse. There are African-Americans, Puerto Ricans, Russians and Poles working either as crews or as packing staff.

9.2.2.8.1.5. Freeport/Brooklyn Area, New York

According to McCay *et al.* (1993), there is a total of 71 permitted commercial fishing vessels in Freeport and 33 in Brooklyn. The average length, gross tonnage and horse power are slightly larger in the Brooklyn vessels than in the Freeport vessels.

The total value of all species landed in the area was about $4 million in 1992. Surf calms represented the most important fisheries in terms of landed value (45%), followed by *Loligo* (13%), summer flounder (11%), scup (10%), lobster (6%), winter flounder (2%), and black sea bass (1%). In 1992, the majority of the landed value by gear type corresponded to bottom otter trawls with 48%, and surf clam dredges with 45%. The four major species targeted by otter trawlers in the Freeport area are whiting, winter flounder, summer flounder and squid.

There are three lobster boats working out of Freeport. Some fishermen have unsuccessfully tried potting for scup and black sea bass, and according to some Freeport fishermen, no one in Nassau County fishes with traps (McCay *et al.* 1993). Inshore and offshore lobster potting accounted for about 6% of the total landed value by gear in the area in 1992.

The otter trawl boats pay on the share system, and most boats use a captain and a crew member. The dredgers are all owner operated and mostly day boats.

The level of tourism in the Freeport area is substantial. Freeport is located near Jones Beach and has a number of charter boats.

9.2.2.8.2. Individual level - Commercial fishery

The possibility of significant impacts of the management actions may be expected to be quite different at the individual level than at the "global" or "port level." That is, the proposed management actions may significantly affect a specific group of fishermen employing specific gear types that depend or mainly target the species being managed. The purpose of this section is to address the potential effects at the individual level of the proposed management actions.

Table 63 shows the degree of specialization in the black sea bass fishery by gear type for selected ports from Gloucester, Massachusetts, to Hampton Roads, Virginia. The hook and line fishery in Hampton Roads, Virginia is an example of specialization or "reliance" on the fishery. Even though only 6% of the value of black sea bass throughout the region

A survey of charter and party boats conducted in 1990, indicates that for "party boats", the relative customer interest for black sea bass ranked sixth after summer flounder and stripe bass. For "charter boats", the relative customer interest for black sea bass, along with hakes ranked last (Table 34) Overall, the proposed management alternatives in the FMP are likely to have minimal impacts on the recreational fishery.

9.2.2.8.4. Summary

According to the 1992 landings statistics, black sea bass is not of critical importance to the commercial fishery industry in the ports addressed above. Given the degree of port reliance on black sea bass, it can be expected that the proposed regulatory measures will have a minimal effect on the communities and local economies of these ports. The effects of proposed regulations on individual commercial fishermen and recreational fishermen are also expected to be minimal.

The adopted management measures are considered the most reasonable to achieve the fishing mortality rate reduction target available at this time. The moratorium is included to increase probability of compliance with the management program in the near term. It will also provide a mechanism for participants to share in the recovery of the resource rather than having the dividend of recovery dissipated over additional vessels that could enter the fishery as soon as the resource has recovered. This technique was used to great success with the surf clam fishery.

In terms of the consultative requirement of this provision of the Magnuson Act, since the management unit of the FMP is black sea bass in US waters in the western Atlantic Ocean from Cape Hatteras, North Carolina northward to the US - Canadian border, the South Atlantic and New England Councils were invited and did designate members of their Councils to the Mid-Atlantic Council's Demersal Species Committee, the oversight committee for this FMP. Additionally, both Councils were invited to appoint industry advisors to the Mid-Atlantic Council Black Sea Bass Advisory Panel.

9.3. RELATION OF RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

9.3.1. FMPs

This FMP is related to other plans to the extent that all fisheries of the northwest Atlantic are part of the same general geophysical, biological, social, and economic setting. US fishermen often are active in more than a single fishery. Thus regulations implemented to govern harvesting of one species or a group of related species may impact on other fisheries by causing transfers of fishing effort.

Many fisheries of the northwest Atlantic can cause significant nontarget species fishing mortality on other stocks. In addition, black sea bass are food items for many commercially and recreationally important fish species. Black sea bass also utilize many finfish and invertebrate species as food items.

9.3.2. Treaties or international agreements

No treaties or international agreements, other than GIFAs entered into pursuant to the MFCMA, relate to this fishery.

9.3.3. Federal law and policies

9.3.3.1. *Marine Mammals and Endangered Species*

Numerous species of marine mammals and sea turtles occur in the northwest Atlantic Ocean. The most recent comprehensive survey in this region was done from 1979-1982 by the Cetacean and Turtle Assessment Program (CETAP), at the University of Rhode Island (University of Rhode Island 1982), under contract to the Minerals Management Service (MMS), Department of the Interior. The following is a summary of the information gathered in that study, which covered the area from Cape Sable, Nova Scotia, to Cape Hatteras, North Carolina, from the coastline to 5 nautical miles seaward of the 1000 fathom isobath.

Four hundred and seventy one large whale sightings, 1547 small whale sightings and 1172 sea turtles were encountered in the surveys (Table 64). The "estimated minimum population number" for each mammal and turtle in the area, as well as those species currently included under the Endangered Species Act, were also tabulated.

CETAP concluded that both large and small cetaceans were widely distributed throughout the study area in all four seasons, and grouped the 13 most commonly seen species into three categories, based on geographical distribution. The first group contained only the harbor porpoise, which is distributed only over the shelf and throughout the Gulf of Maine, Cape Cod, and Georges Bank, but probably not southwest of Nantucket. The second group contained the most frequently encountered baleen whales (fin, humpback, minke, and right whales) and the white-sided dolphin. These were found in the same areas as the harbor porpoise, and also occasionally over the shelf at least to Cape Hatteras or out to the shelf edge. The third group indicated a "strong tendency for association with the shelf edge" and included the grampus, striped, spotted, saddleback, and bottlenose dolphins, and the sperm and pilot whales.

Loggerhead turtles were found throughout the study area, but appeared to migrate north to about Massachusetts in summer and south in winter. Leatherbacks appeared to have had a more northerly distribution. CETAP hypothesized a

fishing operations. Correspondence for this sanctuary should be addressed to: Monitor NMS, NOAA, Building 1519, Fort Ousts, VA 23604.

NOAA/NOS issued a proposed rule on 8 February 1991 (56 FR 5282) proposing designation under MPRSA of the Stellwagen Bank National Marine Sanctuary, in Federal waters between Cape Cod and Cape May, Massachusetts. On 4 November 1992, the Sanctuary was Congressionally designated. Implementing regulations (15 CFR 940) will became effective March 1994. Commercial fishing is not specifically regulated by Stellwagen Bank regulations. The regulations do however call for consultation between Federal agencies and the Secretary of Commerce on proposed agency actions in the vicinity of the Sanctuary that "may affect" sanctuary resources. The process for consultation is currently (late 1995) being worked out between the Regional office of NMFS, the Sanctuary, and NEFMC for Amendment 7 to groundfish. Correspondence for this sanctuary should be addressed to: Stellwagen Bank NMS, 14 Union Street, Plymouth, MA. 02360.

Details on sanctuary regulations may be obtained from the Chief, Sanctuaries and Reserves Division (SSMC4) Office of Ocean and Coastal Resource Management, NOAA, 1305 East-West Highway, Silver Spring, MD 20910.

9.3.3.3. *Indian treaty fishing rights*

No Indian treaty fishing rights are known to exist in the fishery.

9.3.3.4. *Oil, Gas, Mineral, and Deep Water Port Development*

While Outer Continental Shelf (OCS) development plans may involve areas overlapping those contemplated for offshore fishery management, no major conflicts have been identified to date. The Councils, through involvement in the Intergovernmental Planning Program of the MMS, monitor OCS activities and have opportunity to comment and to advise MMS of the Councils' activities. Certainly, the potential for conflict exists if communication between interests is not maintained or appreciation of each other's efforts is lacking. Potential conflicts include, from a fishery management position: (1) exclusion areas, (2) adverse impacts to sensitive biologically important areas, (3) oil contamination, (4) substrate hazards to conventional fishing gear, and (5) competition for crews and harbor space. The Councils are unaware of pending deep water port plans which would directly impact offshore fishery management goals in the areas under consideration, and are unaware of potential effects of offshore FMPs upon future development of deep water port facilities.

9.3.3.5. *Vessel Safety*

Section 303(a)(6) of the MFCMA requires that FMPs consider access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of vessels. The proposed management measures of this FMP do not limit the times or places when or where vessels may fish. Therefore, the Council has concluded that the proposed FMP will not impact or effect the safety of vessels fishing in this fishery.

9.3.4. State, Local, and Other Applicable Law and Policies

9.3.4.1. *State management activities*

Several states have minimum size limits pertaining to the possession of black sea bass. Massachusetts has the largest size limit (12" TL), which applies to both the commercial and recreational fisheries. The Rhode Island (10" TL) and Connecticut (8" TL) minimum size limits also apply to all fisheries. New York and New Jersey have 8" TL minimum size limits for black sea bass which apply to the commercial fisheries only. North Carolina has an 8" TL minimum size limit which applies to both commercial and recreational fisheries from Cape Hatteras and south. None of the remaining states in the management unit (ME, NH, DE, MD, VA) regulate the minimum size of black sea bass. Some states have minimum mesh size requirements, but none pertain directly to black sea bass. Minimum mesh requirements vary by state, area, and season. Massachusetts requires a special moratorium permit for black sea bass pots. In addition, many of the states have season, area and gear restrictions which may affect fishing for black sea bass. No state has a recreational possession limit pertaining to black sea bass.

State regulations for black sea bass are summarized in Table 60.

9.3.4.2. *Impact of Federal regulations on State management activities*

The management measures of this FMP complement or are identical to those proposed by ASMFC for the coastal States.

9.3.4.3. *Coastal Zone Management Program Consistency*

The CZM Act of 1972, as amended, provides measures for ensuring stability of productive fishery habitat while striving to balance development pressures with social, economic, cultural, and other impacts on the coastal zone. It is recognized that responsible management of both coastal zones and fish stocks must involve mutually supportive goals.

The Council must determine whether the FMP will affect a state's coastal zone. If it will, the FMP must be evaluated relative to the state's approved CZM program to determine whether it is consistent to the maximum extent practicable. The states have 45 days in which to agree or disagree with the Councils' evaluation. If a state fails to respond within 45 days, the state's agreement may be presumed. If a state disagrees, the issue may be resolved through negotiation or, if that fails, by the Secretary.

The FMP was reviewed relative to CZM programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. Letters were sent to all of the States listed. The letters to all of the States except New Hampshire and Pennsylvania stated that the Council concluded that the FMP would affect the State's coastal zone and was consistent to the maximum extent practicable with the State's CZM program as understood by the Council.

9.4. REVIEW AND MONITORING OF THE FMP

9.4.1. Monitoring

The Councils and ASMFC will monitor the fishery using the best available data, including that specified in section 9.1.3. The commercial, recreational, biological, and survey data specified in section 9.1.3 are critical to the evaluation of the management measures adjustment mechanism. It is necessary that NMFS incorporate all of the above data types from North Carolina black sea bass fisheries into the overall NEFC data bases. Additionally, improved stock assessments are necessary for FMP monitoring. As a result of that monitoring, the Councils and ASMFC will determine whether it is necessary to amend the FMP.

The primary organization in the review and monitoring process will be the Black Sea Bass FMP Monitoring Committee (section 9.1.2.2).

The ASMFC will review the Black Seabass FMP annually as specified in the ISFMP Charter. The Black Seabass Plan Review Team is responsible for conducting a review of the stock status and states' compliance with the Black Seabass FMP. The Plan Review Team will report its findings to the Management Board, which will then review states' compliance with the FMP.

9.4.2. Research and Data Needs [pursuant to MFCMA 303(a)(8)]

Estimates of discarded black sea bass will be very important for monitoring the effectiveness of the minimum size and gear regulations and adjusting the overall quota in order to meet the target mortality levels. It is, therefore, important that levels of sea sampling effort be sufficient and representative of the fisheries that contribute to black sea bass fishing mortality to accurately describe the level of discard. It must be recognized that this sea sampling will likely involve some vessels not in the directed black sea bass fishery, but vessels in the squid and groundfish fisheries, for example, where large quantities of black sea bass are caught and possibly discarded.

10. BLACK SEA BASS COMPLIANCE

This section outlines the specific regulatory, monitoring, and research requirements that each state must implement in order to comply with the Black Sea Bass FMP. The relative burden of the Plan's conservation program and management measures may vary from state to state relative to the importance of the fishery in that state as compared to other states throughout the range.

This plan will apply to all states from North Carolina to Massachusetts. This includes Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Potomac River Fisheries Commission, Virginia, and North Carolina.

10.1 MANDATORY COMPLIANCE ELEMENTS FOR STATES

10.1.1 Mandatory Elements of State Programs

A state will be found out of compliance if;

its regulatory and management programs for black sea bass have not been approved by the Management Board, it fails to meet any implementation schedule established for this FMP or any addendum prepared under adaptive management, it has failed to implement a change to its program when determined necessary by the Management Board; or it fails to adequately enforce any aspect of its regulatory and management programs.

10.1.1.1 *Regulatory Requirements*

All state programs must include a regime of restrictions on recreational and commercial fisheries consistent with the requirements of Chapter 9.

States must comply with the following commercial measures: minimum size restriction, minimum mesh and threshold, roller diameter restriction, pot and trap escape vent requirements, pot and trap degradable fastener provisions, reporting of landings from state waters, and closures when quotas are reached.

States must comply with the following recreational measures: minimum size restriction, possession limit, seasonal closure.

States must submit an annual compliance report as specified below (10.1.3), and as may be specified in a quota management addendum.

10.1.1.2 *Monitoring Requirements*

Section 9.1.3.1 outlines specific monitoring requirements of the NMFS regarding black sea bass commercial fisheries. Recreational fisheries are monitored through the MRFSS. States are required to report all landings from state waters to the NMFS.

10.1.1.3 *Research Requirements*

This Plan does not specify any mandatory research requirements.

10.1.2 Compliance Schedule

The following list indicates the dates by which states must implement specific measures or have specific abilities to implement the management measures of this FMP.

<u>Measures requiring compliance by January 1 1997</u>:

Commercial Fishery:

- 9" minimum size (9.1.2.3.1)
- Mesh requirement and threshold provisions (9.1.2.3.2):
  - 4" minimum mesh
  - 100 pound threshold
- 18" maximum roller diameter on roller rig trawl (9.1.2.3.3)
- Pot and trap escape vent requirements (9.1.2.3.4):
  - 2" diameter round
  - 1 1/2" x 1 1/2" square
  - 1 1/8" x 5 3/4" rectangular
- Pot and trap degradable fastener provisions (9.1.2.3.5):

The hinges or fasteners on one panel, door, or a 3"x 6" panel must be made of one of the following:
1. Untreated hemp, jute, or cotton strong of 3/16" (4.8 mm) or less.
2. Magnesium alloy, timed float releases (pop-up devices), or similar magnesium alloy fasteners
3. Ungalvanized, uncoated iron wire of 0.094" (2.4 mm).

Recreational Fishery:
9" minimum size

Measures requiring compliance by January 1 1998:

COMMERCIAL FISHERY

10" minimum size of possession for the commercial fishery

Quota Management System:

A quota management system will be developed by the Council and Commission during year 1 and 2 (Section 9.1.2.3.6). If a system is not designed in the second year, a quarterly quota system would be implemented beginning in year 3. States are required to report all landings from states water for counting against the quota. States will have the responsibility for closure in their waters when a quota has been met.

10.1.3 Compliance Reporting Contents and Schedules

Each state must submit an annual report concerning its black sea bass fisheries and management program on or before June 1 each year, beginning June 1 1997. The report shall cover:

A) the previous calendar year's fishery and management program including activity and results of monitoring, regulations which were in effect and harvest information that is available, including estimates of non-harvest losses if available, and

B) the planned management program for the current calendar year summarizing regulations that will be in effect and monitoring programs that will be performed, highlighting any changes from the previous year.

10.2 PROCEDURES FOR DETERMINING COMPLIANCE

Procedures for determining a state's compliance with the provisions of a fisheries management plan are contained in Section 7 of the Interstate Fisheries Management Program Charter (ASMFC 1995). The following represents compliance determination procedures as applied to this plan:

The Plan Review Team will continually review the status of state implementation, and advise the Management Board at any time that a question arises concerning state compliance. The PRT will review state reports submitted under sections 10.1.3 and prepare a report by August 1 for the Management Board summarizing the status of the resource and the fishery and the status of compliance on a state-by -state basis.

Upon review of a report from the Plan Review Team, or at any time by request from a member of the Management Board, the Management Board will review the status of an individual state's compliance. If the Management Board finds that a state's approved regulatory and management program fails to meet the requirements of this section, it may recommend that the state be found out of compliance. The recommendation must include a specific list of the state's deficiencies in implementing and enforcing the FMP and the actions that the state must take in order to come back into compliance.

If the Management Board recommends that a state be found out of compliance as referred to in the preceding paragraph, it shall report that recommendation to the ISFMP Policy Board for further review according to the Commission's Charter for the Interstate Fisheries Management Program.

The state that is out of compliance or subject to a recommendation by the Management Board under the preceding subsection may request at any time that the Management Board reevaluate its program. The state shall provide a written statement concerning its actions which justify a reevaluation. The Management Board shall promptly conduct such reevaluation, and if it agrees with the state, shall recommend to the ISFMP Policy Board that the determination of noncompliance be withdrawn. The ISFMP Policy Board and the Commission shall deal with the Management Boards recommendation according to the Commissions Charter for the Interstate Fisheries Management Program.

10.3 MANAGEMENT MEASURES SUBJECT TO CHANGE

The Management Board may vary the requirements specified in this FMP to achieve the goals and objectives specified, as part of adaptive management or "framework provisions" and as outlined in section 6(b)(1)(E) of the Commission's

ISFMP Charter. These changes will follow the procedure outlined in section 9.1.2.2, and the Board may request reviews of proposed changes by the Plan Review Team, Technical Monitoring Committee, Technical Committee, and the Black Sea Bass Advisory Panel.

The following measures may change annually under framework provisions:

Commercial and recreational minimum sizes
Commercial mesh restriction and threshold
Minimum mesh restriction may be applied throughout the net
Roller diameter restriction
Pot and trap escape vent size
Pot and trap degradable fastener requirements
Commercial quota and recreational TAC
Recreational possession limits may be implemented
Seasonal and area closures may be implemented

During the first and second year of the FMP, the Management Board may implement an alternative commercial quota management system through the FMP Addenda process as specified in Section 6(b)(1)(E) of the ISFMP Charter. Coastwide, regional, and state by state quotas will be considered in combination with different fractions of the fishing year, e.g., bimonthly quotas.

10.4 RECOMMENDED (NON-MANDATORY) MANAGEMENT MEASURES

States having regulations which are more stringent than the requirements of this Plan should maintain their existing regulations to enhance stock conservation. States are encouraged to adopt entry moratorium regulations complementing the EEZ regulations in section 9.1.2.1.1.2. States are encouraged to implement fishery data collections systems to complement the NMFS system (section 9.1.3.1) and provide a coordinated statistics gathering effort.

10.5 RECOMMENDATIONS FOR THE EXCLUSIVE ECONOMIC ZONE

This plan was developed jointly by the ASMFC and the Mid-Atlantic Fisheries Management Council, therefore, management measures for both the EEZ and state waters are contained in chapter 9. For the EEZ, the ASMFC recommends that the Secretary adopt the management measures contained in chapter 9.

10.5 ANALYSIS OF ENFORCEABILITY OF PROPOSED MEASURES

All states are responsible for adequately enforcing the measures contained in this FMP. Realized enforcement is dependent on many factors. These include, but are not limited to, budgetary concerns affecting manpower and equipment availability, the nature of the fishery, the degree of regulatory consistency over time and among states and fisheries, and participant awareness of regulations. The provisions in this plan are shared with many other management programs, and therefore should not present additional enforcement difficulties. Enforcement benefits when measures are compatible with regulations in existing plans, as in the case of the degradable pot and trap fasteners provisions in this plan which are consistent with other ASMFC and MAFMC FMP's, including Lobster, Tautog, and Scup.

11. REFERENCES

Able, K.W., M.P. Fahay, and G.R. Shepherd. 1995. Early life history of black sea bass *Centropristis striata* in the Mid-Atlantic Bight and a New Jersey estuary. Fish. Bull. 93: 429-445.

Alaska Sea Grant. 1993. Is it food? Addressing marine mammal and seabird declines. University of Alaska. Fairbanks, AK. 59 p.

American Fisheries Society. 1980. A list of common and scientific names of fishes from the United States and Canada. AFS Spec. Pub. 12. 174 p.

Anderson, L.G. 1986. The economics of fisheries management. The Johns Hopkins Univ. Press, Baltimore, MD. 269 p.

Arve, J. 1960. Preliminary report on attracting fish by oyster-shell plantings in Chincoteague Bay, Maryland. Chesapeake Sci. 1: 58-65.

Atlantic Biodiversity Center. 1994. The Comprehensive Conservation and Management Plan for Delaware's Inland Bays. Nassau, DE. 15p.

Atlantic States Marine Fisheries Commission (ASMFC). 1992. Reef material criteria handbook. Washington, DC. 71 p.

Bell, F., P.E. Sorensen, and V.R. Leeworthy. 1982. The economic impact and valuation of saltwater recreational fisheries in Florida. Fla. Sea Grant Rept. No.47.

Bergman, C. 1994. Personal communication. Axelsson & Johnson Fish Company, Cape May, N.J.

Boehm, P.D. 1983. Chemical contaminants in northeast United States marine sediments. NOAA Tech. Rept. No. 99.

Boehm, P.D. and P. Hirtzer. 1982. Gulf and Atlantic survey for selected organic pollutants in finfish. NOAA Tech. Mem. NMFS- F/NEC-13. 111 p.

Bohnsack, J.A. 1989. Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference? Bull. Mar. Science. 44(2): 631-645.

Bonzek, C.F., P. Geer, J. Colvocoresses and R. Harris. 1991. Juvenile Finfish and Blue Crab Stock Assessment Program Bottom Trawl Survey Annual Report Series - Volume 1990, Virginia Institute of Marine Science Sp. Sci. Rpt. No. 124, Volume 1990, 206 p.

_____. 1992. Juvenile Finfish and Blue Crab Stock Assessment Program Bottom Trawl Survey Annual Report Series - Volume 1991, Virginia Institute of Marine Science Sp. Sci. Rpt. No. 124, Volume 1991, 213 p.

_____. 1993. Juvenile Finfish and Blue Crab Stock Assessment Program Bottom Trawl Survey Annual Report Series - Volume 1992, Virginia Institute of Marine Science Sp. Sci. Rpt. No. 124, Volume 1992, 217 p.

Boragine, R. 1994. Personal communication. American Seafood Institute, Wakefield, RI.

Boyd, D. 1994. Personal communication. VA. Marine Resources Commission Newport News, VA.

Brouha, P. 1994. Population growth: the real problem. Fisheries. Vol 19(9): 4.

Brown, B. 1994. Personal communication. N.J. Div. of Env. Prot. Division of Fish Game and Wildlife, Trenton, N.J.

Bugley, K and G. Shepherd. 1991. Effect of catch-and-release angling on the survival of black sea bass. N. A. J. Fish. Manage. 11: 468-471.

Buss, A. and A. Kitts. 1994. Documentation for the cost-earnings data base for the northeast United States commercial fishing vessels. Working paper in progress. NMFS.

Butowski, N. 1994. Personal communication. MD. Dept. of Nat. Res., Ocean City, MD.

Casey, J. F. 1994. Personal communication. MD. Dept. of Nat. Res., Ocean City, MD.

Clark, J.R. 1962. The 1960 salt-water angling survey. U.S. Fish and Wildl. Serv. Circ. 153, 36 p.

Cochran, and Grier. 1991. Regulation of sexual succession in the protogynous black sea bass, *Cetropristis striata (Osteichthyes: Serranidae)*. J. Comp. Endocrinology. 82(1): 69-77.

Cole, R. 1994. Personal communication. DE. Dept. of Nat. Res. and Env. Control, Dover, DE.

Collette, B.B. and K.E. Hartel. 1988. An annotated list of the fishes of Massachusetts Bay. NOAA Tech. Memo. NMFS-F/NEC-51. 70 p.

Collings, W.S., C. Cooper-Sheehan, S. Hughes, and J.L. Buckley. 1981. The Effects of Power Generation on some of the Living Marine Resources of the Cape Cod Canal and Approaches. Massachusetts Department of Fisheries, Wildlife and Recreational Vehicles Department of Marine Fisheries. 212 pp.

Congressional Office of Technology Assessment. 1987. Wastes in marine environments. OTA-O-334. U.S. Govt. Printing Office. Washington, D.C. 313 p.

Council on Environmental Quality (CEQ). 1993. Incorporating biodiversity considerations into environmental impact analysis under the National Environmental Policy Act. Executive Office of the President. Washington. 29 p.

Crutchfield, J.A. 1986. Pacific coast trawl vessels: depreciation, maintenance, costs and capital values. NOAA, NMFS, SWC Adm. Rep. LJ-86-03C.

Cupka, D.M., R.K. Dias, and J. Tucker. 1973. Biology of the black sea bass, *Centropristis striata (Pisces: Serranidae)*, from South Carolina waters. S.C. Wildl. Mar. Resour. Dep. Unpubl. MS. 93 pp.
Currier, T.P. 1990. Personal Communication. MA. Div. of Mar. Fish., Sandwich, MA.

Deuel, D.G. 1973. 1970 salt-water angling survey. NOAA/NMFS, Curr. Fish. Stat. No. 6200: 53 p.

Deuel, D.G. and J.R. Clark. 1968. The 1965 salt-water angling survey. U.S. Dept. of Int., U.S. Fish Wildl. Serv., Res. Publ. 67: 55 p.

D'Amico, M. Personal communication. Wild Earth. Lewes, DE.

Ehrlich, P. 1990. The population explosion. Simon & Schuster. N.Y.

Eklund, A.M. and T.E. Targett. 1991. Seasonality of fish catch rates and species composition from the hard bottom trap fishery in the Middle Atlantic Bight (US east coast). Fisheries Research. 12(1): 1-22.

Finlayson, A.C. and B.J. McCay. 1994. Social and economic impacts of the draft management plans for black sea bass and scup. Report to the MAFMC. Dept. of Human Ecology, Rutgers Univ., New Brunswick, N.J. 79 p.

Goode, G.B. 1884. Natural history of useful aquatic animals. Fish and Fish. Industries U.S. Sect. 1: 386-93.

Gray, C.L. 1994. Personal communication. R.I. Div Fish, Wildlife and Estuarine Res., Wickford, R.I.

Grout, T. 1994. Personal communication. N.H. Fish and Game, Durham, N.H.

Hales, L.S. and K.W. Able. 1994. Habitat fidelity, movements, and growth of juvenile black sea bass at a polyhaline site in Great Bay Estuary, New Jersey. Abstract from the Spring 1994 Atlantic Estuarine Society meeting.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. U.S. Bur. Fish. Bull. 43: 261-5.

Hoff, F.H., Jr. 1970. Artificial spawning of black sea bass, *Centropristis striatus melanus* Ginsburg, aided by chorionic gonadotrophic hormones. Fla. Dep. Nat. Res. Mar. Res. Lab. Spec. Sci. Rep. No. 25. 17 pp.

Hutchins, E. 1994. Personal Communication NMFS, Narragansett, RI.

Jeffries, P., S. Hale, and A. Keller. 1988. Historical data assessment of finfishes of Narragansett Bay area. Current Report to the Narragansett Bay Project: NBP-89-15.

Kendall, A.W., Jr. 1972. Description of black sea bass, *Centropristis striata (Linnaeus)*, larvae and their occurrences north of Cape Lookout, North Carolina, in 1966. U.S. Natl. Mar. Fish. Ser. Fish. Bull. 70(4): 1243-1260.

Kendall, A.W., Jr. 1977. Biological and fisheries data on black sea bass, *Centropristis striata (Linnaeus)*. Natl. Mar. Fish. Serv., NEFC Sandy Hook Lab., Tech. Ser. Rep. No. 7. 29 pp.

Kitts, A. 1994. Personal communication. NMFS, Woods Hole, MA.

Kurkul, P.A. and J.G. Terril. 1986. New England otter trawl and scallop industry financial trends 1976-1985. NOAA, NMFS, NER. 74 p.

Langton, R. 1994. Personal communication. ME. Dept. Marine Resources, West Boothbay Harbor, ME.

Link, G. W., Jr. 1980. Age, growth, reproduction, feeding and ecological observations on the three species of *Centropristis (Pisces: Serranidae)* in North Carolina waters. Ph.D. thesis. University of North Carolina, Chapel Hill. 277 pp.

Linton, E. 1901. Fish parasites collected at Woods Hole in 1898. Bull. U.S. Fish Comm. (1899). 19: 267-304.

Lynch, T.R. 1994. Personal communication. R.I. Div Fish, Wildlife and Estuarine Res., Wickford, R.I.

Makowski, W. 1994. Personal communication. NMFS, Cape May, N.J.

Mason, J.M. 1990. Personal communication. N.Y. Dept. of Env. Cons., Stony Brook, N.Y.

McCauley, J. 1994. Personal communication. Point Judith Fishermen's Co-op., Narragansett, R.I.

McCay, B.J., B. Blinkoff, R. Blinkoff, and D. Bart. 1993. Report, part 2, phase I, fishery impact management project, to the MAFMC. Dept. of Human Ecology, Cook College, Rutgers Univ., New Brunswick, N.J. 179 p.

Mercer, L.P. 1978. The reproductive biology and population dynamics of black sea bass, *Centropristis striata*. Ph.D. thesis. The College of William and Mary, Williamsburg, VA. 196 pp.

_____. 1979. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Atlantic) - Black Sea Bass. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.99). U.S. Army Corps of Engineers, TR EL-82-4. 16 pp.

Mid-Atlantic Fishery Management Council. 1987. Habitat policy. Dover, DE, 2 p.

Mid-Atlantic Fishery Management Council. 1991. Amendment 2 to the fishery management plan for the summer flounder fishery. Dover, DE.

Mid-Atlantic Regional Marine Research Program (MARMPP). 1994. Mid-Atlantic Research Plan. University of MD. College Park, MD. 163 p.

Miller, R.J. 1959. A review of the sea basses of the genus *Centropristes (Serranidae)*. Tulane Stud. Zool. 7(2): 35-68.

Monaghan, R. 1994. Personal communication. N.C. Div. of Marine Fisheries, Morehead City, NC.

Musick, J. 1990. Personal communication. VIMS, Gloucester Pt., VA.

Musik, J. A., and L.P. Mercer. 1977. Seasonal distribution of black sea bass, *Centropristis striata*, in the Mid-Atlantic Bight with comments on the ecology and fisheries of the species. Trans. Am. Fish. Soc. 106 (1): 12-25.

National Marine Fisheries Service. 1994. Appendix 2.d.: Guidelines on regulatory analysis of fishery management actions. Revised version. In operational guidelines for fishery management plan process. NMFS, Silver Spring, Maryland.

National Marine Sanctuary Program. 1993. Marine Sanctuary. Vol. 1. No. 1. 20p.

National Research Council (NRC). 1993. Managing Wastewater in coastal Urban Areas. National Academy Press. Washington, D.C. 477 p.

_____. 1994a. Restoring and protecting marine habitat. The role of engineering and technology. National Academy Press. Washington, D.C. 193 p.

_____. 1994b. Improving the Management of U.S. Marine Fisheries. National Academy Press. Washington, D.C. 82 p.

Northeast Fisheries Science Center (NEFSC). 1992. Report of the Thirteenth Northeast Regional Stock Assessment Workshop (13th SAW). 183 pp.

_____. 1993. Status of Fishery Resources off the Northeastern United States. NOAA Tech. Mem. NMFS-F/NEC-101. 140 p.

_____. 1995. Report of the Twentieth Northeast Regional Stock Assessment Workshop (20th SAW). 237 pp.

Norton, V., T. Smith, and I. Strand (eds). 1983. Stripers: the economic value of the Atlantic coast commercial and recreational striped bass fisheries. Univ. of MD. Sea Grant Pub. No. UM-SG-TS-83-12. 57 p.

Pearce, J.B. 1979. Raritan Bay - a highly polluted estuarine system. ICES. Mar. Env. Qual. Comm. C. M. 1979/ E:45.

Peterson, A.E. 1994. Personal communication. NEFSC, Woods Hole, MA.

Postel, S. 1994. Carrying capacity: earth's bottom line. in: State of the World 1993. W.W. Norton. N.Y.

Powell, J.C. 1992. Marine Sport Fishery Investigations - Juvenile Fish Survey. R.I. Division Fish and Wildlife Report, F-26-R-27, 51 p.

Reid, R.N., J.E. O'Reilly, and V.S. Zdanowicz. 1982. Contaminants in New York Bight and Long Island Sound sediments and demersal species, and contaminant effects on benthos, summer 1980. NOAA Tech. Mem. NMFS-F/NEC-16. 97 p.

Rockland, D. B. 1983. An economic analysis of Delaware's recreational/commercial fisheries conflict. Ph.D. Dissertation, Univ. of Delaware, Newark, DE.

Roe, R. 1994. Personal communication. NMFS, Silver Spring, MD.

Rogers, S.G. , H.T. Langston, and T.E. Targett. 1986. Anatomical trauma to sponge-coral reef fishes captured by trawling and angling. Fish. Bull. 84(3): 697-704.

Ross, J. 1990. Personal communication. N.C. Dept. of Nat. Res. and Comm. Dev., Manteo, N.C.

Ross, R. 1994. Personal communication. NMFS, Gloucester, MA.

Safina, C. 1994. Personal communication. National Audubon Society. Islip, NY.

Safina, C. 1987. Ecological interactions among prey fish, bluefish, and common terns, in a coastal Atlantic system. Ph.D. dissertation. Rutgers University. 198 p.

Safina, C., J. Burger, M. Gochfeld, and R.H. Wagner. 1988. Evidence for prey limitation of common and Roseate tern reproduction. The Condor. 90: 852-859.

Safina, C., R.H. Wagner, D.A. Witting, and K.J. Smith. 1990. Prey delivered to Roseate and common tern chicks; composition and temporal variability. J. Field Ornithol. 61(3): 331-338.

Scarlett, P.G. 1990. Personal communication. N.J. Dept. of Env. Prot., Absecon, N.J.

Scherer, M.D. 1984. The Ichthyoplankton of Cape Cod Bay. *In:* Observations of the Ecology and Biology of Western Cape Cod Bay, Massachusetts, Springer-Verlag, Berlin, 289 pp.

Shepherd, G.R. 1991. Meristic and morphometric variations in black sea bass north of Cape Hatteras, North Carolina. North Amer. J. Fish. Manag. 11(2): 139-148.

Shepherd, G.R. 1994. Personal Communication. NEFSC, Woods Hole, MA.

Shepherd, G.R. 1995. Personal Communication. NEFSC, Woods Hole, MA.

Simpson, D. 1994. Personal communication. CT. DEP Marine Fisheries, Old Lyme, CT.

Sport Fishing Institute (SFI). 1988. Economic activity associated with marine recreational fishing in 1985. Vol. II-State-level and species-level estimates. Washington, DC. 122 p.

Steimle, F. 1994. Personal communication. NMFS, Sandy Hook, N.J.

Steimle, F. In press. Structure-oriented (reef) fish. *In* Delaware Estuary Program's Habitat Requirements Document.

Steimle, F.W., Jr., and L. Ogren. 1982. Food of fish collected on artificial reefs in the New York Bight and off Charleston, South Carolina. U.S. Natl. Mar. Fish. Serv. Mar. Fish. Rev. 44 (6-7): 49-52.

Steimle, F. and W. Figley. 1996. The importance of artificial reef epifauna to black sea bass diets in the Middle Atlantic Bight. North Amer. J. Fish. Manag. 16: 433-439.

Steimle, F., V. Zdanowicz, S. Cunneff, and R. Terranova. 1994. Trace metal concentrations in common benthic macrofaunal prey from the New York Bight apex. Marine Pollution Bulletin. Vol 28. pages 760-765.

Strand, I.E., K.E. McConnell, N.E. Bockstael and D.G. Swartz. 1991. Marine recreational fishing in the middle and south Atlantic: a descriptive study. Department of Agriculture and Resource Economics. Univ. of Maryland. 226 p.

The Conservation Foundation. 1988. Protecting America's wetlands: an action agenda. Washington, D.C. 69 p.

Tiner, R.W. 1987. Mid-Atlantic wetlands. A disappearing natural treasure. U. S. Fish and Wildlife Service. Newton Corner, MA. 28 p.

Turek, J.G., T.E. Goodger, T.E. Bigford, and J.S. Nichols. 1987. Influence of freshwater inflows on estuarine productivity. NOAA Tech. Memo. NMFS-F/NEC-46. 26 p.

Turgeon, D.D., B.W. Gottholm, K.D. McMahon, and A. Robertson. 1989. Toxic contaminants in Long Island Sound. Dept. of Commerce. Washington, D.C. 14 p.

University of Rhode Island. 1982. A characterization of marine mammals and turtles in the Mid-and North-Atlantic areas of the US outer continental shelf. Final report. Prepared for USDI, under contract #AA551-CT8-48.

U.S. Dept. of Comm. (U.S.D.C.). 1985. Regional action plan: northeast regional office and northeast fisheries center. NOAA. NMFS. Tech. memo. F/NEC-37. 20 p.

_____ . 1986. National Artificial Reef Plan. NOAA Tech. Memo. NMFS OF-6. 39 p.

_____ . 1987. National status and trends program for marine environmental quality. Progress Report. NOAA. Office of Oceanography and Marine Assessment. 81 p.

_____ . 1989. The national status and trends program. NOAA. Office of Oceanography and Marine Assessment. 13 p.

_____ . 1992. Marine recreational fishery statistics survey, Atlantic and Gulf coasts 1990-1991. NOAA, NMFS. 275 p.

_____. 1993. Our living oceans. NOAA Tech. Memo. NMFS-F/SPO-15. 156 p.

_____. 1994a. Distribution and abundance of fishes and invertebrates in the Mid-Atlantic estuaries. NOAA, ELMR. Report No. 12. 280 pp.

_____. 1994b. Fisheries of the United States 1993. NOAA. NMFS. Current Fishery Statistics No. 9300. 121 p.

Van Dolah, R.F., P.H. Wendt and N. Nicholson. 1987. Effects of a research trawl on a hard-bottom assemblage of sponges and corals. Fish. Res. 5: 39-54.

Walden, J.B. 1993. A brief description of the harvest sector for Atlantic mackerel in the United States. NMFS, NFSC, Woods Hole, MA. 18 p.

Weber, A.M., and P.T. Briggs. 1983. Retention of black sea bass (*Centropristis striata*) in vented and unvented lobster (*Homarus americanus*) traps. NY Fish Game J. 30(1): 67-77.

Wenner, C.A., W.A. Roumillat, and C.W. Waltz. 1986. Contributions to the life history of black sea bass, Centropristis striata, off the Southeastern United States. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 84 (3): 723-741.

Wilson, H.V. 1891. The embryology of the sea bass (*Serranus atrarius*). U.S. Fish. Comm. Bull. for 1889, 9: 209-277.

Zdanowicz, V.S. and D. Gadbois. 1990. Contaminants in sediment and fish tissue from estuarine and coastal sites of the northeastern United States: data summary for the baseline phase of the national status and trends program benthic surveillance project, 1984-1986. Dept. of Comm. NOAA Tech. Mem. NMFS-F/NEC-79. 138 p.

Zero Population Growth Reporter. 1994b. April issue. Washington, D.C.

Zero Population Growth Reporter. 1994a. June issue. Washington, D.C.

Table 1. The NEFSC autumn inshore survey index (stratified mean number per tow) for black sea bass pre-recruits and the spring offshore survey index (stratified mean number per tow) for black sea bass recruits.

Year	Pre-recruit No/tow	Recruit No/tow
1972	0.02	0.49
1973	0.45	0.87
1974	0.33	2.36
1975	3.95	2.02
1976	0.93	1.62
1977	15.87	6.09
1978	0.08	2.94
1979	0.91	5.21
1980	0.60	1.41
1981	0.10	0.89
1982	11.63	0.20
1983	1.42	0.67
1984	0.61	0.25
1985	2.90	0.39
1986	6.66	2.06
1987	0.34	1.17
1988	0.26	0.68
1989	2.17	0.76
1990	0.46	1.00
1991	0.74	1.13
1992	0.45	1.99
1993	0.03	0.87
1994	5.60	0.28
Average	2.35	1.54

Source: NEFSC 1995.

Table 2. The probability that a female black sea bass will transform to a male by size.

SL (cm)	TL (in)	Probability of Transition
7	2.7	0.000
8	3.3	0.010
9	3.8	0.015
10	4.4	0.025
11	4.9	0.050
12	5.5	0.072
13	6.1	0.100
14	6.6	0.125
15	7.2	0.145
16	7.7	0.150
17	8.3	0.151
18	8.9	0.152
19	9.4	0.152
20	10.0	0.150
21	10.5	0.140
22	11.1	0.130
23	11.7	0.120
24	12.2	0.110
25	12.8	0.095
26	13.3	0.080
27	13.9	0.060
28	14.5	0.045
29	15.0	0.035
30	15.6	0.030
31	16.1	0.025
32	16.7	0.020
33	17.3	0.015
34	17.8	0.010
35	18.4	0.005
36	18.9	0.002
37	19.5	0.001
38	20.0	0.000

Source: Gary Shepherd pers. comm.

Table 3. The mean back-calculated lengths (TL inches) at age for black sea bass collected from the Mid-Atlantic, 1973-75.

		AGE								
	N	1	2	3	4	5	6	7	8	9
male	972	3.7	8.0	10.6	12.4	14.2	16.4	18.2	19.2	20.3
female	1797	3.8	7.9	10.2	12.0	13.4	14.4	17.6		
combined	2905	3.7	8.0	10.4	12.2	13.9	15.7	18.2	19.2	20.3

Table 4. Estimates of fishing mortality (F) and corresponding exploitation rates (Exp) for black sea bass based on the results of virtual population analysis.

Year	F	Exp (%)
1984	1.16	63.4
1985	1.32	67.8
1986	1.57	73.6
1987	1.17	63.7
1988	1.45	71.0
1989	1.09	61.2
1990	1.13	62.5
1991	2.03	81.2
1992	1.89	79.2
1993	1.05	59.9

Source: NEFSC 1995.

Table 5. Spatial distribution and relative abundance of black sea bass in the Mid-Atlantic Estuaries.

Species/Life Stage		Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
		•	M	S	•	M	S	T	M	S	T	M	S	T	M	•	•	M	S
Black sea bass	A			√		√	○		√	○		√	√					√	○
	S						○												
Centropristis striata	J			√		√	○		√	○		√	○					√	○
	L						○			√									
	E						○												

Species/Life Stage		Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
		•	M	S	T	M	S	T	M	S	T	M	S	T	M	S	•	M	S
Black sea bass	A			○		√	√		○	◉		○	◉		√	○			√
	S																		
Centropristis striata	J					√	√		○	◉		○	◉		○	○		○	○
	L									√									
	E																		

Species/Life Stage		Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
		•	•	S	T	M	S	T	M	•	T	M	•	T	M	•	T	M	•
Black sea bass	A			○		○	○		√			√			√			√	
	S																		
Centropristis striata	J			○		○	○		√			√			√			√	
	L																		
	E																		

Species/Life Stage		Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
		•	M	•	T	M	•	T	M	•	T	M	•
Black sea bass	A		○			√			√			○	
	S												
Centropristis striata	J		○			√			√			○	
	L												
	E												

Relative Abundance

●	Highly Abundant
◉	Abundant
○	Common
√	Rare
Blank	Not Present

Salinity Zone

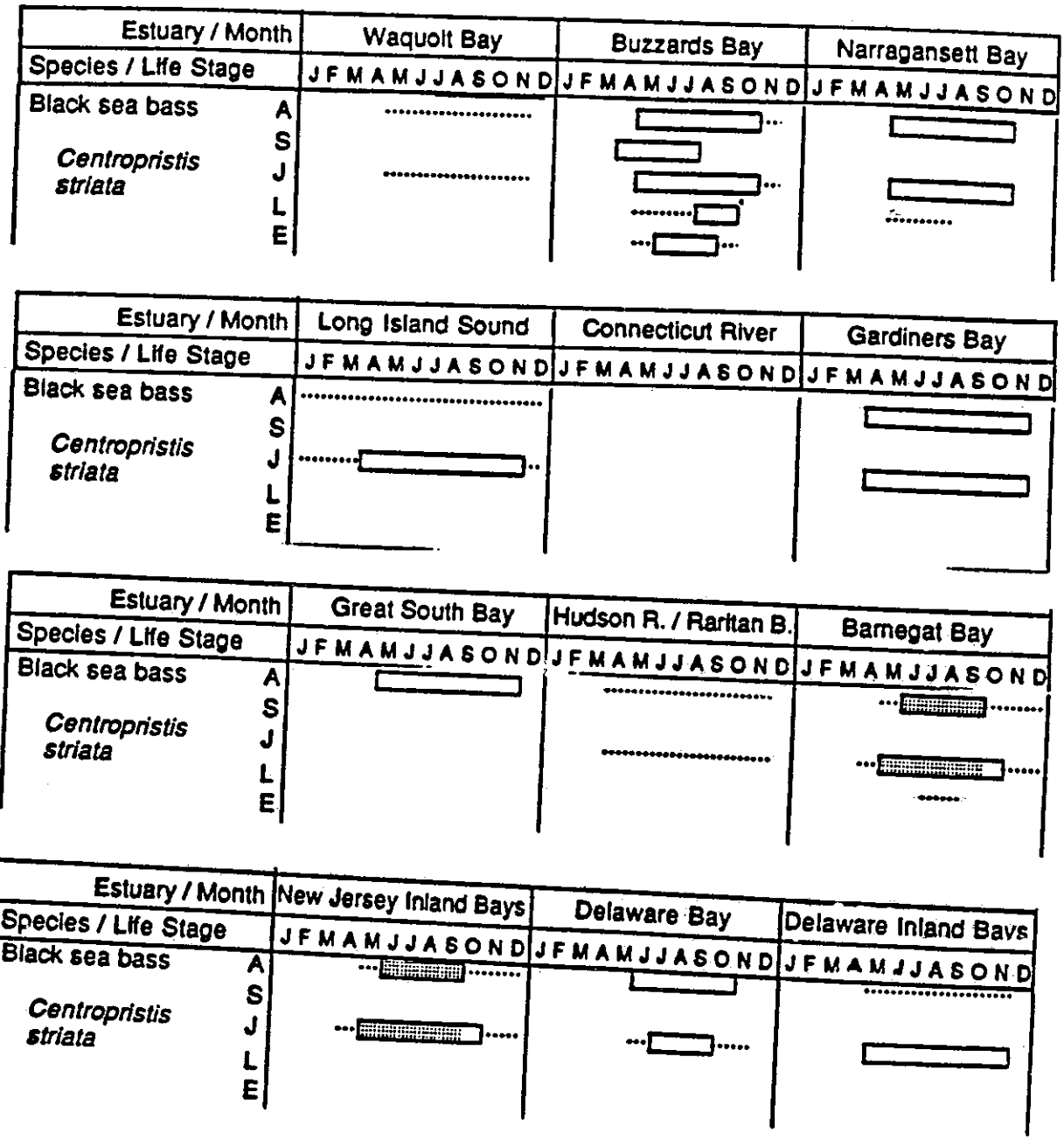
- T - Tidal Fresh
- M - Mixing
- S - Seawater
- • - Salinity zone not present

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Source: USDC 1994a.

Table 6. Temporal distribution of black sea bass in Cape Cod through Delaware Inland Bays.



Relative Abundance

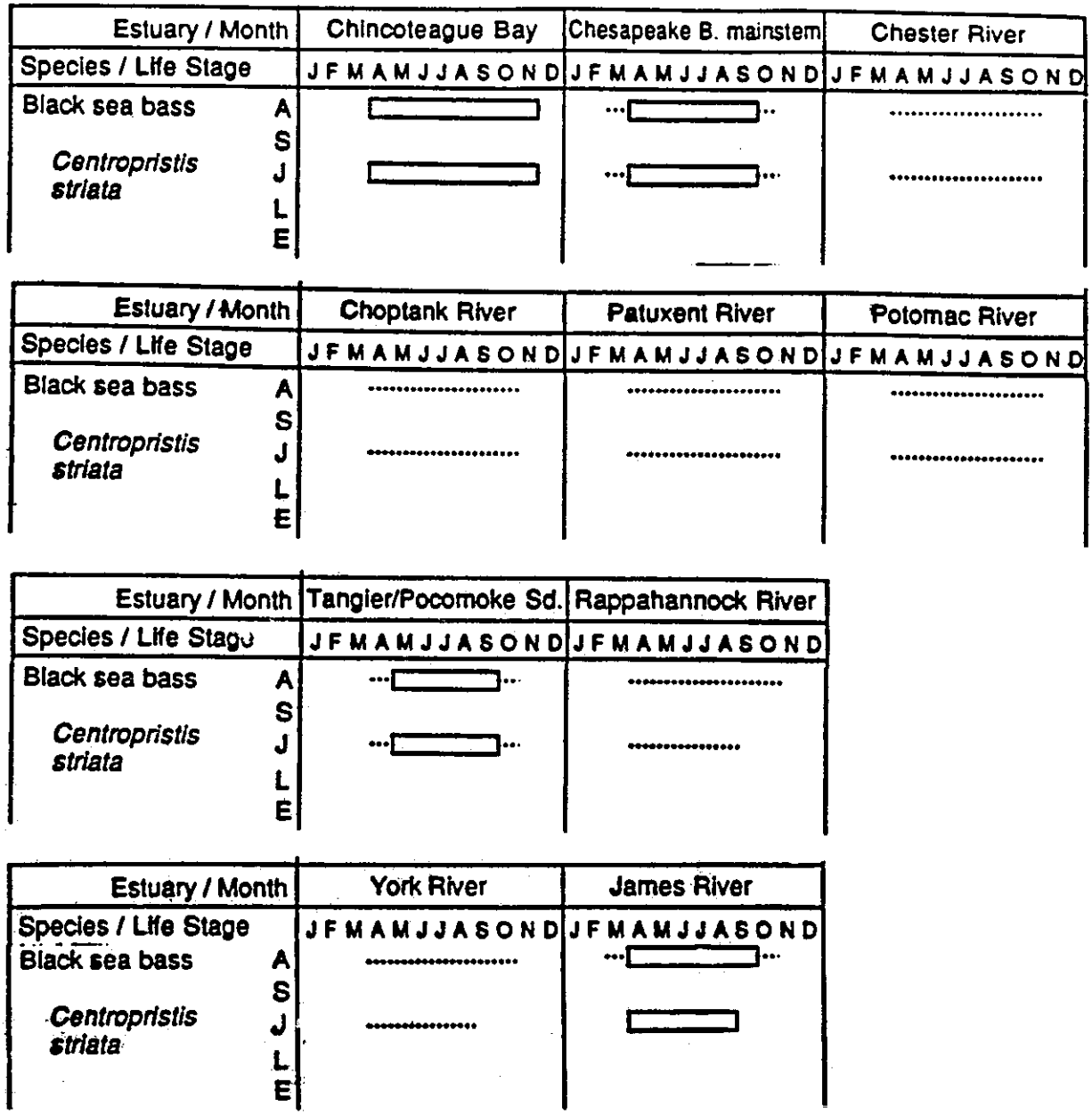
- Highly Abundant
- Abundant
- Common
- Rare
- Blank — Not Present
- na — No Data Available

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Source: USDC 1994a.

Table 7. Temporal distribution of black sea bass in Maryland and Virginia Estuaries.



Relative Abundance

- Highly Abundant
- Abundant
- Common
- Rare
- Blank — Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Source: USDC 1994a.

Table 8. Preliminary ranking of major threats to living marine resources and habitats in the Northeast.

1.	Urban and port development *
2.	Ocean Disposal #
3.	Dams
4.	Agricultural Practices •
5.	Industrial Waste Discharges @
6.	Domestic Waste Discharges @
7.	OCS Oil and Gas Development
8.	Insect Control
9.	Water Division
10.	Sand and Gravel Mining
11.	Power Generation

* Includes dredge and fill and construction activities covered by Section 10/104 permits, as well as point source pollution covered by NPDES permits and nonpoint source pollution.

\# Includes dredged material disposal in State waters, as well as actual ocean dumping of dredged material, sewage sludge, etc., covered by Section 103 permits.

• Includes nonpoint source pollution (fertilizers, animal wastes, biocides, sediments, heavy metals, etc.) that affects coastal aquatic areas.

@ Point source pollution covered by NPDES permits.

Source: USDC, 1985.

Table 9. Commercial and recreational landings (thousands of pounds) of black sea bass.

Year	Comm	Rec	Total	% Comm	% Rec
1983	3336	4079	7416	45	55
1984	4332	1446	5779	75	25
1985	3420	2097	5517	62	38
1986	4191	12391	16583	25	75
1987	4168	1924	6092	68	32
1988	4143	2868	7012	59	41
1989	2918	3288	6207	47	53
1990	3504	2760	6265	56	44
1991	2806	4186	6992	40	60
1992	3008	2705	5713	53	47
1993	3225	4841	8066	40	60
1994	2039	2948	4987	41	59
Avg 83-92	3583	3774	7358	49	51
Avg 83-94	3424	3794	7219	47	53

Source: NMFS General Canvass and MRFSS data.

Table 10. Black sea bass commercial landings by gear, Maine to Cape Hatteras, North Carolina, 1983 - 1992 combined.

GEAR	1000 Lbs	Percent
Haul Seines, Beach	0	*
Haul Seines, Long	0	*
Haul Seines, Long(Danish)	0	*
Stop Nets	0	*
Otter Trawl Bottom, Fish	20,403	56
Otter Trawl Bottom, Lobster	6	*
Otter Trawl Bottom, Scallop	30	*
Otter Trawl Bottom, Shrimp	0	*
Trawl Midwater, Paired	82	*
Trawl Bottom, Paired	5	*
Scottish Seine	0	*
Pound Nets, Fish	77	*
Pound Nets, Other	2	*
Floating Traps (Shallow)	401	1
Fyke And Hoop Nets, Fish	0	*
Pots And Traps, Conch	0	*
Pots And Traps, Crab, Blue	28	*
Pots And Traps, Fish	11,936	33
Pots And Traps, Lobster Inshore	483	1
Pots And Traps, Lobster Offshore	153	*
Pots And Traps, Other	1	*
Gill Nets, Other	29	*
Gill Nets, Drift, Other	13	*
Gill Nets, Drift, Runaround	5	*
Gill Nets, Stake	0	*
Trammel Nets	0	*
Lines Hand, Other	2,113	5
Lines Troll, Other	14	*
Lines Long Set With Hooks	11	*
Spears	0	*
Dredges Scallop, Sea	22	*
Unknown Gears	0	*
All Gear	35,827	100

Source: Unpublished NMFS General Canvass data.

Table 11. Black sea bass commercial landings by state and gear type, 1983 - 1992 combined.

GEAR	State									
	ME % of Total	MA % of Total	RI % of Total	CT % of Total	NY % of Total	NJ % of Total	DE % of Total	MD % of Total	VA % of Total	NC % of Total
Haul Seines, Beach	.	.	.	.	.	.	0.0	.	.	.
Haul Seines, Long	.	.	.	.	.	.	.	.	.	0.0
Haul Seines, Long(Danish)	.	0.0	.	.	.	.	.	.	.	.
Stop Nets	.	.	0.0	.	.	.	.	.	.	.
Otter Trawl Bottom, Fish	58.0	17.9	84.8	65.0	70.8	50.9	.	8.9	81.6	82.2
Otter Trawl Bottom, Lobster	.	.	.	.	0.0	.	.	.	0.1	.
Otter Trawl Bottom, Scallop	.	.	.	.	.	0.0	.	0.1	0.3	0.0
Otter Trawl Bottom, Shrimp	.	.	0.0	.	.	.	.	.	.	0.0
Trawl Midwater, Paired	.	2.5	0.0	.	.	.	.	.	.	.
Trawl Bottom, Paired	.	.	0.2	.	0.0	.	.	.	.	.
Scottish Seine	.	0.0	0.0	.	.	.	.	.	.	.
Pound Nets, Fish	.	2.1	.	.	0.4	0.0	.	0.0	0.0	0.0
Pound Nets, Other	.	0.1	.	.	.	.	.	.	.	.
Floating Traps (Shallow)	.	.	10.8	.	.	.	.	.	.	.
Fyke And Hoop Nets, Fish	.	.	.	.	.	.	.	0.0	.	.
Pots And Traps, Conch	.	.	.	.	.	.	.	0.0	.	.
Pots And Traps, Crab, Blue	.	.	.	.	.	0.0	.	.	0.3	.
Pots And Traps, Fish	.	67.0	0.8	29.8	0.0	45.5	97.0	89.8	7.4	1.5
Pots And Traps, Lobster Inshore	.	0.1	1.7	2.2	18.1	1.9	.	.	.	.
Pots And Traps, Lobster Offshore	.	.	0.3	.	2.4	0.7	2.0	0.3	0.0	.
Pots And Traps, Other	.	0.0	0.0	.	.	.	.	0.0	0.0	.
Gill Nets, Other	42.0	0.0	0.2	.	0.2	0.0	.	0.0	0.1	0.0
Gill Nets, Drift, Other	.	.	.	0.1	0.2	0.0	0.0	0.1	0.1	.
Gill Nets, Drift, Runaround	.	.	.	.	.	0.1	.	.	.	.
Gill Nets, Stake	.	.	.	0.1	.	.	.	.	.	.
Trammel Nets	.	.	.	.	.	0.0	.	.	.	.
Lines Hand, Other	.	10.1	0.8	2.8	7.8	0.8	0.9	0.8	9.9	16.3
Lines Troll, Other	.	.	0.4	.	.	.	.	.	.	.
Lines Long Set With Hooks	.	0.2	.	.	0.0	0.0	.	.	0.0	.
Spears	.	.	0.0	.	.	.	.	.	.	.
Dredges Scallop, Sea	.	0.0	0.0	.	.	0.1	.	0.0	0.2	0.0
Unknown Gears	.	.	.	.	.	.	.	.	0.0	.
All Gear	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Unpublished NMFS General Canvass data.

Table 12. Black sea bass commercial landings by year and gear type, Maine to Cape Hatteras, North Carolina.

	YEAR									
	83	84	85	86	87	88	89	90	91	92
	% of	% of	% of	% of	% of	% of	% of	% of	% of	% of
GEAR	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Haul Seines, Beach	.	.	0.0	.	.	.	.	.	.	.
Haul Seines, Long	.	.	0.0	.	.	0.0	0.0	.	.	.
Haul Seines, Long (Danish)	.	.	0.0	.	0.0	.	.	.	.	.
Stop Nets	.	.	.	.	.	.	0.0	.	.	.
Otter Trawl Bottom, Fish	67.7	75.6	66.9	60.7	61.5	59.1	51.9	48.7	24.6	37.0
Otter Trawl Bottom, Lobster	.	0.1	0.0	.	.	.	.	.	.	.
Otter Trawl Bottom, Scallop	.	.	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2
Otter Trawl Bottom, Shrimp	.	.	.	.	.	0.0	0.0	.	.	.
Trawl Midwater, Paired	0.3	0.4	0.0	0.3	0.2	0.3	0.5	0.2	0.0	0.0
Trawl Bottom, Paired	.	.	0.0	0.1	.	0.0	.	.	0.0	.
Scottish Seine	.	0.0	.	.	.	.	.	.	.	0.0
Pound Nets, Fish	0.2	0.4	0.1	1.0	0.1	0.1	0.0	.	0.1	0.0
Pound Nets, Other	.	.	.	.	.	.	0.0	0.0	.	0.0
Floating Traps (Shallow)	1.3	1.1	5.7	1.1	0.3	0.5	0.4	0.3	0.2	0.3
Fyke And Hoop Nets, Fish	.	.	.	.	.	.	0.0	.	.	.
Pots And Traps, Conch	.	.	.	.	.	.	.	.	0.0	0.0
Pots And Traps, Crab, Blue	0.0	.	.	0.1	0.1	0.0	0.1	0.0	0.1	0.5
Pots And Traps, Fish	22.8	16.7	17.0	28.5	32.6	33.5	39.4	43.2	61.9	50.8
Pots And Traps, Lobster Inshore	2.6	2.0	2.5	1.3	1.4	0.8	0.5	0.4	0.5	1.4
Pots And Traps, Lobster Offshore	0.1	0.4	0.7	0.5	0.1	0.2	0.2	0.6	1.3	0.5
Pots And Traps, Other	.	.	.	.	.	0.0	0.0	.	0.0	0.0
Gill Nets, Other	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.2	0.2
Gill Nets, Drift, Other	.	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
Gill Nets, Drift, Runaround	0.0	0.0	0.0	0.0	.	0.0	.	0.0	0.1	0.0
Gill Nets, Stake	.	.	.	.	.	.	0.0	.	.	.
Trammel Nets	.	.	.	.	.	.	.	.	0.0	.
Lines Hand, Other	4.7	3.0	7.0	6.3	3.5	5.2	6.6	6.2	10.7	8.5
Lines Troll, Other	0.0	.	.	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Lines Long Set With Hooks	0.0	0.2	.	.	0.0	0.1	.	0.0	0.0	0.0
Spears	.	.	.	.	.	.	.	.	.	0.0
Dredges Scallop, Sea	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.4
Unknown Gears	.	.	.	.	.	.	.	.	.	0.0
All Gear	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Unpublished NMFS General Canvass data.

Table 13. Black sea bass commercial landings by year and water area, Maine to Cape Hatteras, North Carolina, all gears combined.

Year	State<3 mi 1000 Lbs	State<3 mi % of Total	EEZ>3 mi 1000 Lbs	EEZ>3 mi % of Total	Total 1000 Lbs	Total % of Total
83	595	17	2,741	82	3,336	100
84	665	15	3,666	84	4,332	100
85	650	19	2,769	80	3,420	100
86	743	17	3,448	82	4,191	100
87	526	12	3,641	87	4,168	100
88	571	13	3,571	86	4,143	100
89	457	15	2,461	84	2,918	100
90	636	18	2,866	81	3,502	100
91	511	18	2,293	81	2,805	100
92	347	11	2,660	88	3,007	100
93	426	13	2,798	86	3,224	100
94*	162	12	1,182	87	1,344	100
Average 83-94	523	15	2,841	84	3,365	100

* Does not include commercial landings for unknown water areas.
Source: Unpublished NMFS General Canvass data.

Table 14. Black sea bass commercial landings by year.

REGION/AREA		Year 83	84	85	86	87	88	89	90	91	92
New England											
State	1000 Lbs	402	474	547	552	410	497	379	473	261	66
(<3 mi)	%REG	42	47	54	53	54	65	66	72	79	35
	%CST	67	71	84	74	78	87	83	74	51	19
EEZ	1000 Lbs	542	520	448	477	347	261	194	175	65	122
(>3 mi)	%REG	57	52	45	46	45	34	33	27	20	64
	%CST	19	14	16	13	9	7	7	6	2	4
All	1000 Lbs	945	994	996	1,029	758	758	574	649	327	188
	%REG	100	100	100	100	100	100	100	100	100	100
	%CST	28	22	29	24	18	18	19	18	11	6
Mid-Atlantic											
State	1000 Lbs	191	190	98	187	115	73	77	38	231	280
(<3 mi)	%REG	8	7	5	7	3	2	3	1	10	10
	%CST	32	28	15	25	21	12	16	6	45	80
EEZ	1000 Lbs	2,031	2,517	1,594	2,476	3,134	2,586	1,916	2,400	2,062	2,317
(>3 mi)	%REG	91	92	94	92	96	97	96	98	89	89
	%CST	74	68	57	71	86	72	77	83	89	87
All	1000 Lbs	2,222	2,707	1,693	2,664	3,249	2,659	1,993	2,438	2,293	2,598
	%REG	100	100	100	100	100	100	100	100	100	100
	%CST	66	62	49	63	77	64	68	69	81	86
North Carolina											
State	1000 Lbs	1	1	4	2	0	0	0	124	18	0
(<3 mi)	%REG	0	*	0	0	*	*	*	29	10	*
	%CST	*	*	0	*	*	*	*	19	3	*
EEZ	1000 Lbs	168	628	726	495	160	724	349	290	165	220
(3> mi)	%REG	99	99	99	99	99	99	99	70	89	99
	%CST	6	17	26	14	4	20	14	10	7	8
All	1000 Lbs	169	629	731	498	160	724	350	414	183	220
	%REG	100	100	100	100	100	100	100	100	100	100
	%CST	5	14	21	11	3	17	12	11	6	7
All											
State	1000 Lbs	595	665	650	743	526	571	457	636	511	347
(<3 mi)	%REG	17	15	19	17	12	13	15	18	18	11
	%CST	100	100	100	100	100	100	100	100	100	100
EEZ	1000 Lbs	2,741	3,666	2,769	3,448	3,641	3,571	2,461	2,866	2,293	2,660
(>3 mi)	%REG	82	84	80	82	87	86	84	81	81	88
	%CST	100	100	100	100	100	100	100	100	100	100
All	1000 Lbs	3,336	4,332	3,420	4,191	4,168	4,143	2,918	3,502	2,805	3,007
	%REG	100	100	100	100	100	100	100	100	100	100
	%CST	100	100	100	100	100	100	100	100	100	100

% REG = area % of regional total, % CST = area % of coastwide area total

Source: Unpublished NMFS General Canvass data.

Table 15. Average ex-vessel commercial landings of black sea bass by month, Maine to Cape Hatteras, North Carolina, 1983 - 1992.

	Water Area		
	State (<3 mi)	EEZ (>3 mi)	All
Month	1000 Lbs	1000 Lbs	1000 Lbs
JAN	10	357	367
FEB	0	500	501
MAR	3	468	471
APR	9	342	352
MAY	125	290	416
JUN	90	218	309
JUL	44	118	162
AUG	27	88	115
SEP	26	84	110
OCT	43	131	175
NOV	18	148	167
DEC	4	146	151
All	406	2,895	3,301

Source: Unpublished NMFS General Canvass data.

Table 16. Black sea bass commercial landings by year, Maine to Cape Hatteras, North Carolina.

	Year											
State	83 1000 Lbs	84 1000 Lbs	85 1000 Lbs	86 1000 Lbs	87 1000 Lbs	88 1000 Lbs	89 1000 Lbs	90 1000 Lbs	91 1000 Lbs	92 1000 Lbs	93 1000 Lbs	94 1000 Lbs
ME	6	.	.	.	.	1	3	1	.	.	.	.
MA	254	419	311	417	323	476	351	435	243	43	39	21
RI	674	562	671	607	358	220	208	197	74	140	222	87
CT	10	12	12	4	77	59	10	14	9	4	3	4
NY	76	160	131	208	245	121	77	71	91	111	125	122
NJ	855	826	642	798	1,109	1,180	840	989	1,033	1,244	1,381	957
DE	70	84	92	178	196	171	132	149	189	193	172	70
MD	180	244	220	435	492	394	295	342	481	468	362	220
VA	1,038	1,391	605	1,044	1,205	792	648	885	497	580	744	390
NC	169	629	731	498	160	724	350	414	183	220	178	169

Source: Unpublished NMFS General Canvass data.

Table 17. Average annual commercial landings of black sea bass by state, 1983 - 1992.

State	10 Year Average Landings 1000 Lbs	Percent
ME	1	*
MA	327	9
RI	371	10
CT	21	0
NY	129	3
NJ	952	26
DE	145	4
MD	355	9
VA	868	24
NC	408	11
All states	3,582	100

Source: Unpublished NMFS General Canvass data.

Table 18. The number ('000) of black sea bass caught and landed by recreational anglers by year.

	Catch	Landings	% Catch released
1983	7561	4537	40
1984	3428	1780	48
1985	6047	3388	44
1986	28945	21742	25
1987	5052	2883	43
1988	8186	3088	62
1989	6427	4239	34
1990	9135	3881	58
1991	10829	5269	51
1992	7722	3592	53
1993	9023	6007	33
1994	7155	3418	52
Average	9126	5319	45

Source: Unpublished MRFSS data.

Table 19. Recreational landings ('000 lbs) of black sea bass by year and region, Maine to Cape Hatteras, North Carolina.

	Weight		
	NA	MA	NC*
1983	294	3760	26
1984	66	1165	216
1985	48	2036	13
1986	639	11746	7
1987	141	1777	6
1988	245	2610	14
1989	98	3182	9
1990	47	2705	9
1991	63	4071	53
1992	30	2570	106
1993	49	4776	17
1994	37	2886	22
Average	146	3607	46

* North of Cape Hatteras.
Source: Unpublished MRFSS data.

Table 20. The percent of total weight of black sea bass landed by marine recreational fishermen from state waters and the EEZ in each Atlantic coast subregion, Maine to Cape Hatteras, North Carolina.

Subregion	Year	State	EEZ
North Atlantic			
	1983	53	47
	1984	36	64
	1985	64	36
	1986	65	35
	1987	55	45
	1988	58	42
	1989	82	18
	1990	64	36
	1991	95	5
	1992	77	23
	1993	81	19
	1994	87	13
	Average	68	32
Mid-Atlantic			
	1983	11	89
	1984	41	59
	1985	37	63
	1986	55	45
	1987	58	42
	1988	23	77
	1989	43	57
	1990	25	75
	1991	28	72
	1992	36	64
	1993	48	52
	1994	14	86
	Average	35	65
North Carolina			
	1983	48	52
	1984	0	100
	1985	100	0
	1986	100	0
	1987	88	12
	1988	63	37
	1989	22	78
	1990	58	42
	1991	61	39
	1992	50	50
	1993	29	71
	1994	26	74
	Average	54	46

Source: Unpublished MRFSS data.

Table 21. The proportion (%) of black sea bass caught and landed by recreational fishermen for each mode, Maine to Cape Hatteras, North Carolina 1983-1992.

Mode	Catch (Number)	Landing (Number)	Landing (Weight)	
Shore	12	4	3	
Party/Charter		43	62	60
Private/Rental		46	34	37

Source: Unpublished MRFSS data.

Table 22. The average annual recreational landings of black sea bass by state, 1983-1992.

State	1,000 lbs	%
ME	-	-
NH	1	0.00
MA	1,391	3.69
RI	189	0.50
CT	88	0.23
NY	3,241	8.59
NJ	19,862	52.61
DE	921	2.44
MD	3,507	9.29
VA	8,090	21.43
NC*	460	1.22

* Includes landings north of Cape Hatteras.

Source: Unpublished MRFSS data.

Table 23. Ex-vessel value of black sea bass commercial landings by year and water area, Maine to Cape Hatteras, North Carolina, all gears combined.

	State<3 mi		EEZ>3 mi		Total	
Year	1000 $	% of Total	1000 $	% of Total	1000 $	% of Total
83	635	25	1,826	74	2,462	100
84	740	21	2,635	78	3,376	100
85	764	23	2,503	76	3,268	100
86	1,067	25	3,071	74	4,138	100
87	785	18	3,479	81	4,264	100
88	1,005	22	3,417	77	4,423	100
89	909	24	2,780	75	3,690	100
90	960	24	2,975	75	3,936	100
91	973	27	2,538	72	3,511	100
92	472	14	2,684	85	3,157	100
93	591	17	2,695	82	3,286	100
94*	270	17	1,301	82	1,571	100
Average 83-94	764	22	2,658	77	3,423	100

* Does not include commercial ex-vessel value for landings in unknown water areas.

Source: Unpublished NMFS General Canvass data.

Table 24. Ex-vessel value of black sea bass commercial landings by year, Maine to Cape Hatteras, North Carolina.

Year	Nominal Value 1000 $	Nominal Price Mean	Mean Price in constant 1994 $
83	2,462	0.74	0.90
84	3,376	0.78	0.93
85	3,268	0.96	1.14
86	4,138	0.99	1.20
87	4,264	1.02	1.21
88	4,423	1.07	1.24
89	3,690	1.26	1.39
90	3,936	1.12	1.17
91	3,511	1.25	1.28
92	3,157	1.05	1.06
93	3,287	1.02	1.02
94	2,387	1.17	1.17

Prices adjusted with PPI (1982=100)

Source: Unpublished NMFS General Canvass data.

Table 25. Average ex-vessel landings of black sea bass, value and price by month, Maine to Cape Hatteras, North Carolina, 1983 - 1992.

	Water Area								
	State(<3mi)			EEZ(>3mi)			All		
MONTH	1000 Lbs	Value in constant 1992 $ ('000)	Mean price in constant 1992 $	1000 Lbs	Value in constant 1992 $ ('000)	Mean price in constant 1992 $	1000 Lbs	Value in constant 1992 $ ('000)	Mean price in constant 1992 $
JAN	10	9	0.90	357	363	1.02	367	372	1.01
FEB	0	1	1.27	500	417	0.83	501	418	0.84
MAR	3	6	1.76	468	443	0.95	471	449	0.95
APR	9	14	1.53	342	355	1.04	352	370	1.05
MAY	125	174	1.39	290	260	0.90	416	434	1.04
JUN	90	118	1.30	218	169	0.77	309	287	0.93
JUL	44	70	1.59	118	141	1.20	162	212	1.30
AUG	27	56	2.05	88	126	1.43	115	182	1.58
SEP	26	51	1.94	84	109	1.30	110	160	1.45
OCT	43	86	1.97	131	147	1.12	175	234	1.34
NOV	18	34	1.85	148	188	1.27	167	223	1.33
DEC	4	7	1.72	146	189	1.29	151	196	1.30
All	406	630	1.55	2,895	2,911	1.01	3,301	3,542	1.07

Prices adjusted with PPI (1982=100)
Source: Unpublished NMFS General Canvass data.

Table 26. Total landings and ex-vessel value for all U.S. domestic landings, total landings and value for black sea bass, and black sea bass percent of total U.S. domestic landings and value by state, 1994.

	U.S. Domestic Landings		Black Sea Bass		Black Sea Bass %	
	Total Landing (1,000 lbs)	Total Value ($1,000)	Total Landing (1,000 lbs)	Total Value ($1,000)	Total Landing	Total Value
ME	231,035	243,360	0	0	*	*
NH	12,099	12,746	0	0	0.0	0.0
MA	183,307	205,939	21	56	*	*
RI	111,808	76,807	87	167	*	0.2
CT	19,797	44,376	4	8	*	*
NY	44,721	42,817	122	243	0.3	0.6
NJ	201,598	99,866	957	903	0.5	0.9
DE	6,988	6,118	70	75	1.0	1.2
MD	67,512	60,503	220	251	0.3	0.4
VA	580,930	102,245	390	460	*	0.4
NC	196,853	97,892	706[a,b]	460[c,d]	0.4	0.8
Total	1,656,648	992,669	2,577	2,936	0.2	0.3

* less than 0.1%
[a] Includes all black sea bass landings in the state.
[b] Total black sea bass landings north of Cape Hatteras, were 168,903 lbs.
[c] Includes all black sea bass value in the state.
[d] Total black sea bass value north of Cape Hatteras was $222,523 dollars.

Source: Fisheries of the United States 1994c.
Unpublished NMFS General Canvass data.

Table 27. Landings, ex-vessel value and price of black sea bass by size category for 1994, Maine to Cape Hatteras, North Carolina, all gear combined.

Size Category	Landings (1,000 lbs)	Value ($ 1,000)	Price ($ /lb)
Jumbo	44	140	3.19
Large	251	600	2.39
Medium	427	588	1.35
Small	902	467	0.52
Pins	16	7	0.44
Unclassified	399	594	1.49

Parameters associated with size categories are determined by dealers and vary among ports. For example, in Cape May (NJ), black sea bass in classified as follows: small 8" to 0.75 lb; medium 0.75 lbs; large 1.25 lbs to 1.75 lbs; and jumbo > 1.75 lbs (W. Makowski pers. comm.). In Point Judith (RI), black sea bass is classified as follows: pins 8" to 0.74 lb; small 0.75 lbs to 0.9 lbs; medium 1.0 lbs to 1.24 lbs; large 1.25 lbs to 1.99 lbs; and jumbo > 2.0 lbs (E. Hutchins pers. comm.).

Table 28. The number of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of black sea bass landings.

Threshold Pounds	Vessels	Trips	Pounds
>=1	340	3327	1009746
>=100	212	1132	955795
>=200	182	784	907088
>=300	159	592	860274
>=400	144	477	820235
>=500	123	393	783196
>=600	108	338	753507
>=800	88	243	687765
>=1000	80	199	648060
>=5000	16	31	320427
>=10000	9	11	179301

Source: NMFS weighout data.

Table 29. Landings by species for all otter trawl trips harvesting 100 pounds or more of black sea bass, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
SQUID (*LOLIGO*)	13,225,429	34.099%	7,362,802	29.238%
HAKE, SILVER	5,191,162	13.384%	2,382,006	9.459%
SCUP	4,803,237	12.384%	2,980,079	11.834%
FLOUNDER, SUMMER	4,467,072	11.517%	6,536,286	25.956%
MACKEREL, ATLANTIC	1,694,588	4.369%	155,991	0.619%
ANGLER	1,227,456	3.165%	864,277	3.432%
DOGFISH SPINY	1,102,054	2.841%	102,464	0.407%
BUTTERFISH	991,346	2.556%	583,126	2.316%
SEA BASS, BLACK	955,795	2.464%	911,281	3.619%
FLOUNDER, WINTER	891,065	2.297%	882,725	3.505%
BLUEFISH	862,789	2.225%	257,425	1.022%
HAKE, RED	693,049	1.787%	209,526	0.832%
SKATES UNC	654,466	1.687%	65,288	0.259%
FLOUNDER, YELLOWTAIL	383,695	0.989%	405,644	1.611%
HERRING, ATLANTIC	237,891	0.613%	11,383	0.045%
COD	205,272	0.529%	202,287	0.803%
WEAKFISH, SQUETEAGUE	195,664	0.504%	141,236	0.561%
DOGFISH (NK)	124,699	0.322%	21,272	0.084%
SCALLOP, SEA	98,084	0.253%	452,404	1.797%
SQUID *(ILLEX)*	96,332	0.248%	26,532	0.105%
TAUTOG	94,488	0.244%	62,167	0.247%
LOBSTER	85,303	0.220%	319,489	1.269%
FLOUNDER, WITCH	69,900	0.180%	76,943	0.306%
EEL, CONGER	64,638	0.167%	16,972	0.067%
TILEFISH	64,426	0.166%	40,826	0.162%
POUT, OCEAN	56,134	0.145%	9,486	0.038%
SEA ROBINS	42,401	0.109%	9,949	0.040%
HAKE, WHITE	22,141	0.057%	8,037	0.032%
OTHER FISH	20,590	0.053%	824	0.003%
CONCHS	17,015	0.044%	16,271	0.065%
CROAKER, ATLANTIC	13,342	0.034%	2,796	0.011%
FLOUNDER, SAND-DAB	13,287	0.034%	3,985	0.016%
CRAB, HORSESHOE	12,000	0.031%	1,200	0.005%
PUFFER, NORTHERN	10,604	0.027%	3,676	0.015%
CRAB, JONAH	9,670	0.025%	4,553	0.018%
POLLOCK	8,153	0.021%	4,056	0.016%
OTHER FISH	8,141	0.021%	4,121	0.016%
STURGEONS	7,478	0.019%	9,107	0.036%
SQUIDS (NS)	6,722	0.017%	3,243	0.013%
SHAD, AMERICAN	5,226	0.013%	2,313	0.009%
SHARK, SANDBAR	5,146	0.013%	1,851	0.007%
MENHADEN	5,070	0.013%	314	0.001%
SHARK, NK	4,848	0.012%	2,654	0.011%
FLOUNDER, AM. PLAICE	4,384	0.011%	5,819	0.023%
MACKEREL, SPAN	4,316	0.011%	2,811	0.011%
WOLFFISHES	3,480	0.009%	2,100	0.008%
WHITING, KING	3,314	0.009%	858	0.003%
DOGFISH SMOOTH	3,157	0.008%	1,062	0.004%
SHARK, PORBEAGLE	2,712	0.007%	1,481	0.006%

Table 29 (continued). Landings by species for all otter trawl trips harvesting 100 pounds or more of black sea bass, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
JOHN DORY	2,479	0.006%	1,503	0.006%
WHELK, CHANNELED	2,126	0.005%	2,072	0.008%
WHELK, KNOBBED	2,027	0.005%	907	0.004%
HERRING (NK)	1,409	0.004%	196	0.001%
SPOT	1,227	0.003%	168	0.001%
BONITO	1,097	0.003%	365	0.001%
CUNNER	732	0.002%	66	0.000%
SHEEPSHEAD	655	0.002%	167	0.001%
SPADEFISH	640	0.002%	606	0.002%
BASS, STRIPED	611	0.002%	1,075	0.004%
FLOUNDERS (NK)	510	0.001%	335	0.001%
SHARK, THRESHER	412	0.001%	131	0.001%
COBIA	302	0.001%	316	0.001%
MULLETS	275	0.001%	73	0.000%
CRAB, BLUE	242	0.001%	99	0.000%
CRAB, ROCK	227	0.001%	225	0.001%
OCTOPUS	224	0.001%	189	0.001%
HADDOCK	177	0.000%	173	0.001%
TRIGGERFISH	157	0.000%	80	0.000%
DRUM, BLACK	121	0.000%	61	0.000%
HALIBUT, ATLANTIC	113	0.000%	196	0.001%
REDFISH	76	0.000%	30	0.000%
SHARK, BLACK TIP	65	0.000%	21	0.000%
MACKEREL, KING	60	0.000%	46	0.000%
DRUM, RED	58	0.000%	17	0.000%
AMBER JACK	38	0.000%	24	0.000%
SHARK, DUSKY	38	0.000%	11	0.000%
ALEWIFE	31	0.000%	2	0.000%
WEAKFISH, SPOTTED	21	0.000%	14	0.000%
Total	38,785,381	100.000%	25,182,166	100.000%

Note: Records with unknown vessel identity were excluded.
Number of Trips = 1,132.

Source: 1992 NMFS weighout data.

Table 30. Estimated cost data for otter trawlers that operated in the US mackerel fishery from 1989-1991 by gross tonnage.

Item	Vessel Size 5-50 $	GRT %	51-150 $	GRT %	>150 $	GRT %
Fixed Costs						
Gear	8,902	22.43	14,095	15.12	33,407	19.46
Electronics	3,509	8.84	3,385	3.62	8,352	4.87
Engine	3,123	7.87	9,216	9.88	26,951	15.70
Other hull costs	4,038	10.17	5,090	5.46	6,170	3.59
Insurance	7,800	19.65	21,095	22.63	34,256	19.95
Subtotal	27,372	68.95	52,881	56.72	109,146	63.57
Variable costs						
Fuel	6,371	16.05	26,624	28.56	42,656	24.84
Ice	3,534	8.90	7,584	8.13	11,160	6.50
Food	2,418	6.09	6,144	6.59	8,730	5.08
Subtotal	12,323	31.04	40,352	43.28	62,546	36.43
Total	39,695	100	93,233	100	171,692	100

[1] All values are in 1987 dollars.
[2] GRT=gross registered tonnage.

Source: Adapted from Walden 1993.

Table 31. Estimated number of party and charter boats operating along the Atlantic Coast and associated revenues by state, 1985.

State	Charter	Party	Revenues ('000 1985 $)
Maine	35	10	2,696
New Hampshire	19	21	3,226
Massachusetts	136	41	10,717
Rhode Island	78	6	4,164
Connecticut	46	15	3,753
New York	300	100	24,723
New Jersey	375	100	28,074
Delaware	80	12	2,511
Maryland	221	109	11,307
Virginia	200	30	5,196
North Carolina	136	10	4,376
Total	1,626	454	100,723

Source: Sport Fishing Institute 1988.

Table 32. Average total cost[a] for a day trip, by mode for selected states (1980-1989).

State	Mode					
	Pier	Beach	Party	Charter	Rental	Private
New York	$16.09	$13.77	$43.35	$59.88	$78.19	$44.38
New Jersey	21.10	16.32	45.36	146.66	92.41	40.93
Delaware	34.15	44.44	69.69	73.66	[b]	40.33
Maryland	21.71	23.31	57.27	181.08	52.25	41.19
Virginia	20.14	15.20	36.00	74.00	122.47	44.50
North Carolina	24.85	18.69	137.00	222.81	237.03	53.03

[a] Travel and services (services might be composed of a combination of the following: costs for bait, tackle, cleaning, fuel, pier fees, and boat fees).
[b] Not enough observations for precise estimates.

Source: Adapted from Strand *et al.* 1991.

Table 33. Charter and party boat survey distribution and returns, 1990.

State	Number sent	Usable returns	Non-usable returns
ME	24	5	1
NH	21	5	-
MA	80	17	9
RI	15	7	2
CT	17	4	2
NY	92	24	3
NJ	159	51	6
PA	16	7	1
DE	14	3	-
MD	4	2	-
VA	143	44	5
NC	1	1	-
FL	6	2	1
Total	592	172	30

Table 34. Relative Customer Interest and Success in Catching Selected Species in 1989. (1 = Low, 2 = Somewhat Low, 3 = Moderate, 4 = Somewhat High, and 5 = High).

	Charter boats		Party boats	
Species	Interest (mean)	Success (mean)	Interest (mean)	Success (mean)
Large pelagics (marlin, tunas)	3.9	2.4	3.1	2.8
Sharks (other than dogfish)	3.2	2.4	2.1	1.9
Bluefish	3.9	3.9	4.6	4.0
Atlantic mackerel	2.4	3.0	3.5	3.5
Summer flounder	3.2	1.9	3.6	1.5
Scup	1.4	1.7	2.2	2.0
Black sea bass	2.1	2.6	3.2	2.9
Hakes	1.4	1.6	2.3	2.5
Groundfish (cod, haddock, yellowtail)	3.0	2.6	3.0	2.4
Weakfish	3.1	1.7	3.3	1.7
Striped bass	3.7	2.5	3.5	1.7
Other: spot	4.6	3.9	4.7	3.4

Table 35. Party and Charter Boat Operating Experience in 1985 and 1989.

	Charter		Party	
	1985 (mean)	1989 (mean)	1985 (mean)	1989 (mean)
Ave. number of trips per year	57.0	50.0	142.0	130.0
Ave. number of trips per day OR	1.0	1.0	1.3	1.4
Ave. number of days per trip	1.1	1.1	1.2	1.3
Ave. number days fishing per week	3.2	3.1	5.0	4.6
Ave. number of anglers per trip	5.2	5.1	20.9	19.5
Ave. trip price per customer ($)	121.8	149.5	26.2	29.2
Ave. number of fish Taken per customer	10.9	8.3	15.2	9.9
Ave. number of crew members	1.4	1.4	2.1	2.0
Ave. cost of fuel & supplies ($)	96.1	131.1	113.3	146.6

Table 36. The percent of measured black sea bass (TL) less than a given size based on 1983-1991 NEFSC weighout data.

Year	< 7.0	< 8.0	< 9.0	< 10.0	<11.0	<12.0	N
1983	0.2	5.5	19.3	50.5	66.2	81.1	3,219
1984	0.3	3.1	9.9	28.5	42.0	64.0	3,841
1985	0.0	2.1	13.3	38.5	51.5	62.3	2,509
1986	0.2	7.3	20.1	40.6	50.0	60.1	2,922
1987	0.0	4.6	13.3	35.4	46.0	56.8	1,545
1988	0.1	2.7	9.5	25.5	38.3	61.8	1,376
1989	0.0	6.9	17.0	30.7	44.4	64.2	883
1990	0.0	1.1	7.0	28.5	42.9	69.4	1,142
1991	0.0	2.9	19.0	42.4	50.6	62.2	735

Table 37. The percent of measured black sea bass (TL) less than a given size based on 1983-1991 NEFSC weighout data for each state.

State	< 7.0	< 8.0	< 9.0	< 10.0	<11.0	<12.0	N
MA	0.0	0.0	0.0	0.0	0.0	5.1	313
RI	0.0	0.0	2.6	14.5	20.4	31.7	2,136
CT							0
NY	0.0	0.0	0.0	5.6	16.2	37.1	197
NJ	0.2	5.2	18.8	46.4	60.7	77.6	9,950
DE							0
MD	0.1	2.5	13.6	33.5	45.9	65.8	966
VA	0.2	4.7	12.5	30.7	44.1	61.1	4,610

Table 38. The percent of measured black sea bass (TL) less than a given size based on 1983-1991 NEFSC weighout data for each major gear type.

Gear	< 7.0	< 8.0	< 9.0	< 10.0	<11.0	≤12.0	N
Otter Trawl	0.2	3.3	10.8	29.6	42.0	59.5	13,374
Floating Traps		0.0	0.0	0.0	1.0	8.7	31.6
206 Pots/Traps	0.1	7.1	25.8	59.3	73.0	85.1	4,592

Table 39. The percent of measured black sea bass (TL) less than a given size based on 1982-1992 North Carolina winter trawl data.

Year	< 7.0	< 8.0	< 9.0	< 10.0	<11.0	≤12.0	N
1982-1983	0.3	4.5	26.3	53.3	70.5	82.6	38,239
1983-1984	0.3	2.5	17.1	41.2	63.8	77.4	94,048
1984-1985	2.4	9.8	22.7	43.2	59.4	71.0	175,099
1985-1986	0.2	13.7	38.4	54.9	69.1	77.2	105,684
1986-1987	1.5	5.1	26.9	56.2	75.2	82.4	108,696
1987-1988	1.8	11.6	38.9	61.3	73.6	82.6	120,197
1988-1989	0.4	5.8	23.1	49.0	68.7	79.9	29,927
1989-1990	0.2	6.6	27.1	55.8	74.5	85.7	153,044
1990-1991	0.8	11.7	34.3	56.0	71.4	84.9	5,832
1991-1992	0.0	3.8	25.6	56.9	83.7	94.0	83,885

Table 40. The length at which 25% of the black sea bass would be retained by a particular mesh size. Estimates represent L_{25}'s and are based on retention lengths as calculated from the body depth/total length relationship for black sea bass derived by Weber and Briggs (1983).

Mesh size	Total Length
2.0	4.0
2.5	5.3
3.0	6.6
3.5	7.9
4.0	9.3
4.5	10.6
5.0	11.9

Table 41. Catch Composition (%) for Black Sea Bass Otter Trawl Trips, 1983-1987 Average.

Species	>0 Lbs/Trip	>100 Lbs/Trip	>250 Lbs/Trip	>500 Lbs/Trip	>1,000 Lbs/Trip
Black Sea Bass	*	2	4	5	12
Scup	16	29	37	34	41
Bluefish	1	2	2	4	5
Butterfish	7	4	5	9	4
Croaker	*	*	*	*	*
Winter flounder	4	1	*	*	*
Summer flounder	29	24	18	13	6
Mackerel	4	13	7	3	3
Weakfish	1	*	*	*	*
Tautog	*	*	*	*	*
Whiting	9	3	3	3	5
Lobster	*	*	*	*	*
Sea scallop	*	*	*	*	*
Loligo	15	17	19	26	22
Other	11	4	3	3	2
Trips	11,357	1,154	478	216	72

*=less than 0.5%.
Source: NMFS NEFSC weighout data.

Table 42. The percent of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of black sea bass landings, 1992.

Threshold Pounds	Vessels	Trips	Pounds
>=1	100	100	100
>=100	62	34	95
>=200	54	24	90
>=300	47	18	85
>=400	42	14	81
>=500	36	12	78
>=600	32	10	75
>=800	26	7	68
>=1000	24	6	64
>=5000	5	1	32
>=10000	3	0	18

Source: Unpublished NMFS General Canvass data.

Table 43. The number of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of *Loligo* landings, 1992.

Threshold	Vessel	Trips	Pounds
>=1	383	5608	39548368
>=200	313	3794	39426206
>=400	283	3187	39252701
>=600	260	2806	39066885
>=800	245	2529	38875824
>=1000	229	2352	38716974
>=2500	172	1644	37605209
>=5000	139	1159	35857109
>=10000	110	719	32697193

Source: NMFS weighout data.

Table 44. The percent of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of *Loligo* landings, 1992.

Threshold	Vessel	Trips	Pounds
>=1	100	100	100
>=200	82	68	100
>=400	74	57	99
>=600	68	50	99
>=800	64	45	98
>=1000	60	42	98
>=2500	45	29	95
>=5000	36	21	91
>=10000	29	13	83

Source: NMFS weighout data.

Table 45. Landings by species for all otter trawl trips harvesting 2,500 pounds or more of *Loligo*, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
SQUID *(LOLIGO)*	37,605,209	48.861%	21,946,834	51.956%
HAKE, SILVER	9,431,248	12.254%	4,082,811	9.665%
MACKEREL, ATLANTIC	7,063,093	9.177%	1,214,848	2.876%
SCUP	4,685,335	6.088%	3,186,156	7.543%
BUTTERFISH	3,983,006	5.175%	2,510,065	5.942%
SQUID *(ILLEX)*	3,963,974	5.150%	1,137,752	2.693%
FLOUNDER, SUMMER	2,195,269	2.852%	3,595,796	8.513%
ANGLER	1,379,661	1.793%	922,119	2.183%
BLUEFISH	1,150,885	1.495%	287,213	0.680%
HAKE, RED	1,114,031	1.447%	303,351	0.718%
FLOUNDER, WINTER	1,008,942	1.311%	969,747	2.296%
SKATES UNC	641,492	0.834%	64,277	0.152%
SEA BASS, BLACK	502,602	0.653%	456,282	1.080%
HERRING, ATLANTIC	428,410	0.557%	38,235	0.091%
FLOUNDER, YELLOWTAIL	393,679	0.512%	405,059	0.959%
COD	218,049	0.283%	204,273	0.484%
DOGFISH (NK)	190,695	0.248%	25,416	0.060%
TILEFISH	175,398	0.228%	97,953	0.232%
WEAKFISH, SQUETEAGUE	96,904	0.126%	92,866	0.220%
EEL, CONGER	93,578	0.122%	19,914	0.047%
TAUTOG	93,516	0.122%	59,635	0.141%
FLOUNDER, WITCH	89,113	0.116%	109,019	0.258%
LOBSTER	72,531	0.094%	277,736	0.657%
HAKE, WHITE	65,306	0.085%	23,264	0.055%
POUT, OCEAN	51,657	0.067%	8,548	0.020%
WHITING, BLACK	40,206	0.052%	10,258	0.024%
SEA ROBINS	39,423	0.051%	10,135	0.024%
FLOUNDER, SAND-DAB	21,551	0.028%	6,172	0.015%
OTHER FISH	20,590	0.027%	824	0.002%
SCALLOP, SEA	19,941	0.026%	101,002	0.239%
DOGFISH SPINY	16,350	0.021%	1,512	0.004%
OTHER FISH	10,387	0.013%	4,746	0.011%
POLLOCK	10,066	0.013%	5,266	0.012%
CONCHS	9,005	0.012%	11,410	0.027%
CROAKER, ATLANTIC	6,844	0.009%	1,383	0.003%
STURGEONS	6,338	0.008%	7,469	0.018%
FLOUNDER, AM. PLAICE	5,954	0.008%	7,768	0.018%
SHAD, AMERICAN	5,762	0.007%	2,398	0.006%
DOGFISH SMOOTH	5,349	0.007%	1,782	0.004%
SHARK, SANDBAR	5,225	0.007%	1,859	0.004%
SQUIDS (NS)	5,209	0.007%	2,738	0.006%
MENHADEN	4,900	0.006%	294	0.001%
JOHN DORY	4,490	0.006%	2,502	0.006%

Table 45. (continued). Landings by species for all otter trawl trips harvesting 2,500 pounds or more of *Loligo*, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
MACKEREL, SPAN	4,141	0.005%	2,730	0.006%
WHITING, KING	4,102	0.005%	811	0.002%
WOLFFISHES	3,802	0.005%	2,304	0.005%
HADDOCK	3,335	0.004%	747	0.002%
SWORDFISH	2,829	0.004%	8,022	0.019%
PUFFER, NORTHERN	2,313	0.003%	1,237	0.003%
BONITO	1,946	0.003%	623	0.001%
HERRING (NK)	1,506	0.002%	240	0.001%
SHARK, NK	1,460	0.002%	1,664	0.004%
SHARK, THRESHER	1,400	0.002%	1,076	0.003%
REDFISH	869	0.001%	523	0.001%
BASS, STRIPED	698	0.001%	1,214	0.003%
SHARK, BLACK TIP	666	0.001%	120	0.000%
CUNNER	598	0.001%	51	0.000%
SHARK, DUSKY	582	0.001%	91	0.000%
CRAB, JONAH	425	0.001%	309	0.001%
COBIA	207	0.000%	267	0.001%
CRAB, ROCK	172	0.000%	170	0.000%
SPOT	170	0.000%	42	0.000%
TRIGGERFISH	145	0.000%	68	0.000%
FLOUNDER, FOURSPOT	102	0.000%	19	0.000%
SHARK, PORBEAGLE	97	0.000%	52	0.000%
FLOUNDERS (NK)	59	0.000%	60	0.000%
CRAB, HORSESHOE	40	0.000%	4	0.000%
ALEWIFE	31	0.000%	2	0.000%
HALIBUT, ATLANTIC	29	0.000%	40	0.000%
SHARK, MAKO SHORTFIN	15	0.000%	46	0.000%
MACKEREL, KING	10	0.000%	9	0.000%
TUNA, ALBACORE	9	0.000%	4	0.000%
CUSK	6	0.000%	2	0.000%
WHELK, CHANNELED	6	0.000%	5	0.000%
WHELK, KNOBBED	6	0.000%	4	0.000%
Total	76,962,949	100.000%	42,241,243	100.000%

Note: Records with unknown vessel identity were excluded.
Number of Trips = 1,644.

Source: NMFS Weighout data.

Table 46. The number of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of scup landings, 1992.

Threshold	Vessel	Trips	Pounds
>= 1	394	4135	9220675
>= 200	287	1961	9120186
>= 400	255	1607	9018579
>= 600	230	1408	8922550
>= 800	217	1262	8822145
>= 1000	203	1155	8726706
>= 5000	99	401	6976707
>= 10000	60	213	5648598

Source: NMFS weighout data.

Table 47. The percent of otter trawl vessels, trips, and associated pounds for a given threshold (pounds) of scup landings, 1992.

Threshold	Vessel	Trips	Pounds
>=1	100	100	100
>=200	73	47	99
>=400	65	39	98
>=600	58	34	97
>=800	55	31	96
>=1000	52	28	95
>=5000	25	10	76
>=10000	15	5	61

Source: NMFS weighout data.

Table 48. Landings by species for all scup - otter trawl trips harvesting 1,000 pounds or more of scup, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
SQUID (*LOLIGO*)	13,018,782	29.350%	7,284,066	30.199%
SCUP	8,726,706	19.674%	5,359,489	22.220%
MACKEREL, ATLANTIC	6,154,322	13.874%	937,815	3.888%
HAKE, SILVER	6,005,925	13.540%	2,621,675	10.869%
FLOUNDER, SUMMER	1,756,288	3.959%	2,893,398	11.996%
BUTTERFISH	1,327,231	2.992%	735,860	3.051%
ANGLER	1,072,460	2.418%	786,734	3.262%
BLUEFISH	1,057,301	2.384%	265,791	1.102%
FLOUNDER, WINTER	1,028,547	2.319%	989,719	4.103%
HAKE, RED	818,438	1.845%	215,078	0.892%
SKATES UNC	707,300	1.595%	70,080	0.291%
SEA BASS, BLACK	527,857	1.190%	485,966	2.015%
HERRING, ATLANTIC	394,617	0.890%	27,616	0.114%
FLOUNDER, YELLOWTAIL	283,940	0.640%	282,531	1.171%
COD	214,515	0.484%	190,671	0.791%
SQUID (*ILLEX*)	165,623	0.373%	42,347	0.176%
WEAKFISH, SQUETEAGUE	159,393	0.359%	122,011	0.506%
TAUTOG	153,497	0.346%	87,188	0.361%
DOGFISH (NK)	101,820	0.230%	17,607	0.073%
DOGFISH SPINY	99,379	0.224%	10,701	0.044%
LOBSTER	86,447	0.195%	313,335	1.299%
TILEFISH	63,173	0.142%	43,101	0.179%
EEL, CONGER	58,399	0.132%	15,301	0.063%
FLOUNDER, WITCH	54,691	0.123%	63,336	0.263%
FLOUNDER, SAND-DAB	47,298	0.107%	13,090	0.054%
SEA ROBINS	40,407	0.091%	9,945	0.041%
POUT, OCEAN	34,588	0.078%	5,396	0.022%
SCALLOP, SEA	32,234	0.073%	152,331	0.632%
HAKE, WHITE	30,625	0.069%	11,346	0.047%
OTHER FISH	20,590	0.046%	824	0.003%
CRAB, HORSESHOE	16,420	0.037%	1,675	0.007%
OTHER FISH	12,539	0.028%	8,407	0.035%
STURGEONS	9,249	0.021%	10,213	0.042%
CONCHS	8,872	0.020%	14,242	0.059%
SQUIDS (NS)	8,833	0.020%	4,459	0.018%
MENHADEN	8,545	0.019%	541	0.002%
CRAB, JONAH	8,151	0.018%	3,575	0.015%
FLOUNDERS (NK)	6,510	0.015%	4,235	0.018%
SHAD, AMERICAN	6,473	0.015%	2,304	0.010%
POLLOCK	4,540	0.010%	2,709	0.011%
MACKEREL, SPAN	4,211	0.009%	2,764	0.011%
BONITO	3,570	0.008%	1,219	0.005%
WHELK, KNOBBED	2,511	0.006%	1,365	0.006%
PUFFER, NORTHERN	2,313	0.005%	1,222	0.005%
SHARK, NK	1,785	0.004%	1,092	0.005%
WHELK, CHANNELED	1,193	0.003%	777	0.003%

Table 48 (continued). Landings by species for all scup - otter trawl trips harvesting 1,000 pounds or more of scup, 1992.

Common Name	Pounds*	Species % of Total Pounds	Value	Species % of Total Value
JOHN DORY	1,026	0.002%	472	0.002%
BASS, STRIPED	940	0.002%	1,603	0.007%
FLOUNDER, AM. PLAICE	850	0.002%	554	0.002%
CUNNER	757	0.002%	66	0.000%
HERRING (NK)	706	0.002%	101	0.000%
WHITING, KING	699	0.002%	180	0.001%
SHARK, PORBEAGLE	687	0.002%	195	0.001%
SHARK, SANDBAR	556	0.001%	200	0.001%
WHITING, BLACK	515	0.001%	155	0.001%
SHARK, THRESHER	365	0.001%	102	0.000%
WOLFFISHES	340	0.001%	217	0.001%
SHARK, TIGER	321	0.001%	69	0.000%
CRAB, ROCK	227	0.001%	225	0.001%
CROAKER, ATLANTIC	171	0.000%	40	0.000%
REDFISH	165	0.000%	84	0.000%
PERCH, WHITE	160	0.000%	42	0.000%
TRIGGERFISH	145	0.000%	68	0.000%
HADDOCK	137	0.000%	122	0.001%
SWORDFISH	72	0.000%	243	0.001%
AMBER JACK	38	0.000%	24	0.000%
ALEWIFE	31	0.000%	2	0.000%
SPOT	20	0.000%	5	0.000%
DOGFISH SMOOTH	18	0.000%	8	0.000%
COBIA	15	0.000%	15	0.000%
SHARK, DUSKY	14	0.000%	4	0.000%
HAKE MIX RED & WHITE	5	0.000%	2	0.000%
CRAB, BLUE	5	0.000%	2	0.000%
Total	44,357,093	100.000%	24,119,947	100.000%

Note: Records with Vessel identity unknown were excluded.
Number of Trips = 1,155.

Table 49. The total length (inches) at which 50% of the black sea bass would be retained (L_{50}) by a fish trap fitted with escape vents (inches). The vent size in the table is the width of a rectangular vent that was also 6" in length. The derived fish lengths are based on the results of a Mid-Atlantic Council study conducted in 1994.

Vent	L_{50}
1.125	8.7
1.250	10.1
1.375	11.5
1.500	12.0

Table 50. The minimum theoretical size of black sea bass (TL inches) that would be retained by a fish trap fitted with escape vents (inches). The derived lengths are based on the body depth/total length relationship for black sea bass derived by Weber and Briggs (1983).

Vent Diameter	Size (TL)
1.9	7
2.2	8
2.5	9
2.76	10
3.0	11
3.31	12

Table 51. State shares of a coastwide quota of 2.6 million pounds for black sea bass. Shares are based on five years of landings data, 1988 - 1992.

State	Percent	Pounds
ME	0.046%	1,184
MA	9.472%	246,272
RI	5.124%	133,215
CT	0.600%	15,609
NY	2.892%	75,190
NJ	32.296%	839,707
DE	5.102%	132,653
MD	12.103%	314,675
VA	20.799%	540,786
NC	11.566%	300,709
Total	100.00%	2,600,000

Table 52. Bimonthly allocations based on a coastwide quota of 2.6 million pounds for Black Sea Bass. Shares are based on five years of landings data, 1988 - 1992.

Bimonthly Period	Percent	Pounds
Jan - Feb	26.44%	687,440
Mar - Apr	20.19%	524,940
May - Jun	20.79%	540,540
Jul - Aug	8.46%	219,960
Sep - Oct	10.83%	281,580
Nov - Dec	13.29%	345,540
Total	100.00%	2,600,000

Table 53. Average bimonthly landings by State, Maine to Cape Hatteras, NC. Percentage of bimonthly landings which occur in each State, 1988 - 1992.

State	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec
ME	0.11%	0.01%	0.03%	0.00%	0.02%	0.09%
MA	0.02%	0.04%	17.87%	2.65%	4.41%	0.29%
RI	5.85%	4.51%	5.32%	2.47%	2.35%	9.86%
NY	1.91%	2.29%	1.76%	5.43%	3.44%	3.01%
NJ	33.07%	27.11%	30.80%	30.00%	45.67%	46.66%
DE	0.00%	0.61%	8.01%	6.66%	9.58%	16.00%
MD	2.46%	4.10%	26.94%	32.05%	19.09%	9.07%
VA	35.76%	38.33%	7.64%	8.25%	10.74%	11.24%
NC	20.82%	22.99%	1.65%	12.48%	4.69%	3.77%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 54. Average bimonthly landings of black sea bass, Maine - Cape Hatteras, NC. Percentage of State landings which occur in each bimonthly period, 1988 - 1992.

State	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec	Total
ME	57.05%	2.20%	12.56%	0.00%	5.41%	22.78%	100.00%
MA	0.14%	0.20%	83.10%	5.02%	10.69%	0.85%	100.00%
RI	29.00%	17.06%	20.70%	3.91%	4.77%	24.55%	100.00%
NY	19.66%	18.03%	14.27%	17.93%	14.52%	15.58%	100.00%
NJ	25.49%	15.96%	18.66%	7.40%	14.42%	18.07%	100.00%
DE	0.00%	2.25%	30.17%	10.22%	18.82%	38.55%	100.00%
MD	4.98%	6.34%	42.86%	20.76%	15.83%	9.23%	100.00%
VA	42.70%	34.97%	7.17%	3.16%	5.25%	6.75%	100.00%
NC	43.84%	36.98%	2.73%	8.42%	4.05%	3.99%	100.00%

Table 55. The percent of measured black sea bass (TL) less than a given size based on 1990-1994 MRFSS intercept data.

ST	7	8	9	10	11	12	N
ME	-	-	-	-	-	-	-
NH	-	-	-	-	-	-	-
MA	2.4	2.4	2.4	4.8	7.2	18.1	83
RI	0.0	0.8	3.3	11.5	25.4	39.3	122
CT	16.7	25.0	37.5	54.2	70.8	79.2	24
NY	2.2	9.2	22.3	39.5	53.1	73.8	866
NJ	4.2	17.6	34.1	50.8	67.9	79.4	2518
DE	3.4	12.9	31.1	54.1	74.0	85.8	1896
MD	2.3	7.2	17.7	37.6	60.5	79.3	875
VA	4.9	10.5	24.5	40.8	55.7	71.4	3057
NC	2.8	11.0	24.8	41.4	58.5	71.9	1675
TOTAL	3.7	12.1	26.8	44.5	61.5	75.7	11116

Table 56. The percent reduction in exploitation associated with various size limits for black sea bass, 1990-1994. The reductions are based on measured fish from the MRFSS survey and assume a post-release mortality of 25%.

Size (TL)	PR
7	2.8
8	9.1
9	20.1
10	33.4
11	46.1
12	56.8

Table 57. The percent of successful anglers landing 1 to 150 black sea bass (MRFSS A fish) per day, coastwide, 1990-94.

C_PER_T	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	2939	48.8	2939	48.8
2	805	13.4	3744	62.2
3	449	7.5	4193	69.6
4	330	5.5	4523	75.1
5	270	4.5	4793	79.6
6	163	2.7	4956	82.3
7	104	1.7	5060	84.0
8	156	2.6	5216	86.6
9	74	1.2	5290	87.8
10	150	2.5	5440	90.3
11	13	0.2	5453	90.5
12	36	0.6	5489	91.1
13	41	0.7	5530	91.8
14	36	0.6	5566	92.4
15	84	1.4	5650	93.8
16	11	0.2	5661	94.0
17	47	0.8	5708	94.8
18	9	0.1	5717	94.9
19	5	0.1	5722	95.0
20	18	0.3	5740	95.3
21	25	0.4	5765	95.7
22	22	0.4	5787	96.1
23	10	0.2	5797	96.2
24	16	0.3	5813	96.5
25	16	0.3	5829	96.8
26	6	0.1	5835	96.9
27	8	0.1	5843	97.0
28	13	0.2	5856	97.2
29	2	0.0	5858	97.3
30	42	0.7	5900	98.0
31	5	0.1	5905	98.0
32	4	0.1	5909	98.1
33	2	0.0	5911	98.1
35	11	0.2	5922	98.3
36	2	0.0	5924	98.4
38	8	0.1	5932	98.5
40	3	0.0	5935	98.5
41	3	0.0	5938	98.6
42	3	0.0	5941	98.6
45	12	0.2	5953	98.8
46	2	0.0	5955	98.9
48	7	0.1	5962	99.0
49	1	0.0	5963	99.0
50	9	0.1	5972	99.2
52	2	0.0	5974	99.2
54	3	0.0	5977	99.2
55	1	0.0	5978	99.3
56	1	0.0	5979	99.3

Table 57 (Cont.)

57	2	0.0	5981	99.3
60	13	0.2	5994	99.5
61	1	0.0	5995	99.5
63	4	0.1	5999	99.6
64	1	0.0	6000	99.6
68	2	0.0	6002	99.7
70	1	0.0	6003	99.7
74	1	0.0	6004	99.7
75	2	0.0	6006	99.7
76	5	0.1	6011	99.8
80	1	0.0	6012	99.8
90	1	0.0	6013	99.8
100	5	0.1	6018	99.9
105	1	0.0	6019	99.9
120	1	0.0	6020	100.0
135	2	0.0	6022	100.0
150	1	0.0	6023	100.0

Table 58. The percent reduction in exploitation associated with various possession limits for black sea bass, 1990-1994. The reductions assume a post-release mortality of 25%.

BAG	PR	BAG	PR
1	59.3	26	9.6
2	51.4	27	9.1
3	45.4	28	8.7
4	40.7	29	8.2
5	36.8	30	7.8
6	33.6	31	7.5
7	30.9	32	7.2
8	28.4	33	6.9
9	26.3	34	6.6
10	24.4	35	6.3
11	22.9	36	6.0
12	21.4	37	5.8
13	20.0	38	5.5
14	18.7	39	5.3
15	17.6	40	5.1
16	16.6	41	4.8
17	15.6	42	4.6
18	14.8	43	4.4
19	14.0	44	4.2
20	13.3	45	4.0
21	12.5	46	3.8
22	11.9	47	3.6
23	11.2	48	3.4
24	10.7	49	3.3
25	10.1	50	3.1

Table 59. Black Sea Bass recreational landings by wave, 1990-1994 combined.

Wave	% of total
J-F	0.0
M-A	4.0
M-J	30.9
J-A	11.8
S-O	36.6
N-D	16.7

Table 60. Overview of state laws for black sea bass, Maine to North Carolina. (Note that this table is only a summary of state regulations. Fishermen should contact state agencies to obtain a complete copy of regulations applicable to black sea bass in their state.)

Maine

Size limits	none.
Gear restrictions	5.5" minimum mesh size for trawls, scottish seines, bottom-tending gillnets and bottom-tending seines. Regulations exist regarding the placement of stop seines and fish weirs. Additional gear/season restrictions for specific locations are detailed in Department regulations.
Area closures	Groundfish spawning closure in Booth Bay and Sheepscot Bay from May 1 to June 30.
Seasons	See above.
Licenses	A commercial license is required for the harvest, transport, and sale of fish that are not for personal use: $33 for individual, resident operators; $89 for resident operator with crew; $334 for nonresident operator and crew. No license is required for fish taken with hook and line for personal use. There is no recreational license, except for Atlantic Salmon.
Other	Nonresidents are required by law to report all groundfish catches.

New Hampshire

Size limits	none.
Gear restrictions	Mobile fishing gear may not be used in state waters between April 16 and Dec 14. Use of trawls and drag seines are prohibited in Piscataqua River or its tributaries north of the Portsmouth Memorial Bridge.
Area closures	See above
Seasons	none.
Licenses	Resident commercial saltwater fishing license: $26; no sport fishing license. Residents are not required to have a license to sell fish caught by hook and line, but a $200 minimum license fee is required for nonresidents.

Massachusetts

Size limits — As of January 1, 1995: 12" recreational and commercial; (All are possession restrictions; total length measurements.)

Gear restrictions — Minimum mesh sizes for mobile trawl gear:
* North of Cape Cod:
- 6" required year-round. Permitted small mesh exemptions are allowed for underutilized species (e.g. dogfish, ocean pout) with no bycatch of regulated species.
* South of Cape Cod:
- 5.5" required Nov. 1 - April 23.
- 4.5" required June 1 - Oct. 31.
- No minimum required April 23 - June 1 (squid season).
* East of Cape Cod:
- 6" required year round.

There is a special black sea bass moratorium permit for pots (no new permits are being issued), and a pot limit of 200 or 350 if two permit holders fish from the same vessel. Gillnets may not exceed 2,400 feet; mesh size of gillnets must be greater than 6" stretched measure.

Area closures — Buzzards Bay is closed to trawling year-round. State waters from Nauset Light around Monomoy west to Succonessett Point, Mashpee are closed to trawling from May 1 - Oct. 31. All waters south of Cape Cod banned to gillnetting April 1 - Nov. 15. (See Mass. regulations for additional closures.)

Seasons — See above

Licenses — Commercial fishing licenses: Vessel license ranges from $130 to $260, depending on length; license for individuals = $65 each. There is no sport license for fish caught for personal use. A license to sell fish caught with hook and line is $35, and applies to any individual selling fish.

Other — Night trawling prohibited 1/2 hour after sunset to 1/2 hour before sunrise from March 1- Oct. 31 and from 6 am- 6 pm from Nov. 1- Feb. 28. Also, the bycatch of finfish in the lobster fishery may not exceed the catch of lobster (by weight).

Rhode Island

Size limits — 10" total length measurement which applies to both commercial and recreational fishermen.

Gear restrictions — Trawling is prohibited in the upper portion of Narragansett Bay from Nov 1 - July 1; 5" cod end minimum mesh size in a portion of central Narragansett Bay from Nov 1 - Feb 28. Numerous specific gillnet regulations by geographic location and season; trap and fyke net regulations regarding leaders, distance from shore, distance between traps, etc. Each person utilizing traps or pots in the fishery for finfish are limited to no more

than 50 pots, and each vessel is limited to 50 pots regardless of the number of license holders on board. In addition, finfish traps (pots) must be constructed with escape openings which may be circular (minimum 2 3/8" diameter), rectangular (1 7/8" X 5 3/4" minimum) or of square mesh wire at least 2 1/4" X 2 1/4".

Area closures Numerous restrictions on the location of traps off the Island of Rhode Island, the Sakonnet River, and in Narragansett Bay. Cannot set, haul, and/or maintain a seine within 0.5 mile of the seaward entrance of several ponds/rivers; significant portion of the state is closed to various forms of netting.

Seasons Fish traps must be out of the water Jan 1 - end of Feb.

Licenses Multipurpose commercial licenses allow for harvest and sale of fish: $150, with additional fees for specific gear types. There is no sport license to fish for personal use.

Connecticut

Size limits 8" commercial and recreational.

Gear restrictions Cod end minimum mesh size of 5.5" (6" square) in trawls from Nov 15 - June 30 and 4"(4.5" square) from July 1 - Nov 14. May 15- July 31 vessels fishing for squid may use mesh of any size. Gillnet minimum mesh size 3"; Pound, trap, fyke, and weir minimum mesh: 2".

Area closures Fish traps and pound nets may not be set in an area off the mouth of the Connecticut River; pound nets must be set at least one mile apart; trawling is prohibited in rivers, coves and harbors as well as in portions of Long Island Sound (LIS). Night trawling prohibited in the western two-thirds of LIS. Vessels greater than 44 ft prohibited in western one-third of LIS unless owner fished there in 1982.

Seasons None except as noted above

Licenses A variety of commercial resident and non-resident licenses are available allowing for the harvest and sale of fish. Fees range from $50- $225. No marine recreational fishing license required but commercial sale of fish taken by hook and line requires a commercial license ($50) and the fee is doubled for species regulated by recreational creel limit. Personal use fishing with trawls and other specific gear requires a commercial license.

New York

Size limits 8" commercial only.

Gear restrictions No minimum mesh size for trawls at the present time.

Area closures There are numerous specific locations where trawl and/or other net gear are restricted.

Seasons none.

Licenses A commercial license is required for the harvest and sale of fish: Resident: $100, Non-resident: $1,000. (The non-resident harvest license may only be purchased in January.) A non-resident license which allows landing only: $250. There is no sport license for fish caught for personal use.

New Jersey

Size limits 8" commercial only.

Gear restrictions None pertaining to black sea bass. Gillnets may not exceed 2,400 ft in length from Feb 1 - May 15, and may not exceed 1,200 ft from May 15 - Dec 15.

Area closures Trawling and purse seining (for food fish) are prohibited within two miles of the coast; gillnetting is limited to the Atlantic Ocean and Delaware Bay.

Seasons Gillnets cannot be fished from Dec 16 - Feb 1.

Licenses Commercial gears are licensed, with fees dependent on the gear type. There is no sport fishing license for hook and line gear, and no license is required to sell hook and line caught fish. Limited entry for gill net licenses in Delaware Bay only.

Delaware

Size limits none.

Gear restrictions Trawls, purse seines, power-operated seines, and run-around gillnets are prohibited. A single gillnet cannot exceed 200 yards in length; a series of connected gillnets cannot exceed 500 yards; a fyke net cannot exceed 72" in diameter; fish traps may not exceed 125 cubic ft and must have an escape panel. There is a moratorium on issuance of new commercial (> 200 ft) gillnet permits until the number of fishermen falls below 30.

Area closures Areas within a 0.5 mile sector at the mouths of all major tributaries to the Delaware River and Bay are closed to all fixed gears; numerous specific areas closed to commercial fishing.

Seasons From April 1 - May 10, commercial fishermen cannot set over 1,000 yards of **fixed** gillnet from one vessel; from May 10 to Sept 30, commercial fishermen cannot set over 1,000 yards of drifting gillnet from one vessel; drift gillnets cannot be set from 2,400

hrs Friday - 1,600 hrs Sunday during this period; specific seasonal closures for gillnets in certain areas.

Licenses — Commercial food fishing license is required for the harvest and sale of fish: Residents: $150; Non-residents: $1,500. Additional fees are levied for the use of specific gear types. There is no sport license for fish caught for personal use.

Maryland

Size limits — none.

Gear restrictions — Trawls prohibited within one mile of the coastline, and in Chesapeake Bay. Use of monofilament gillnets prohibited, except in coastal bays and the Atlantic Ocean; several specific gillnet restrictions exist for Chesapeake Bay; minimum mesh sizes for pound nets, haul seines, and fyke nets are 1.5"; purse seines prohibited.

Area closures — There are numerous specific locations where trawl, gill, seine and/or other net gear are restricted.

Seasons — none.

Licenses — An appropriate commercial fishing or license or a fish dealers license is required to catch, buy, sell, process, export, transport, or otherwise deal in fish that were caught in the tidal waters of Maryland. License fees vary from $37.50 to $300.00 depending on license type. Chesapeake sportfishing license: resident - $7.00, non-resident $12.00.

Virginia

Size limits — None.

Gear restrictions — Trawls and encircling gillnets are prohibited in Virginia waters. Minimum mesh sizes: pound nets = 2"; haul seines over 200 yards = 3"; Various gill net mesh restrictions in various areas at different times of the year.

Area closures net closures — Fish trot lines cannot be set on the sea side of the eastern shore. Various area gill at different times of the year.

Seasons — None.

Licenses — Commercial licenses are required for specific fishing gears, with the fee dependent on the gear type. There is sport fishing license (Atlantic Ocean exempt) with variable fees and a $25 license is required to sell hook and line caught fish. All fishermen must register ($150 fee) before they can purchase individual gear licenses. There also is a two-year waiting period for commercial registration.

Other	Virginia required mandatory reporting for all species caught in commercial gear in Virginia waters beginning in 1993.

North Carolina

Size limits	8" south of Cape Hatteras (nothing to the north).
Gear restrictions	No net may be towed by more than one vessel except in long-haul (seine) fishing operations. Flynet codends must be at least 15 ft. in length and have a minimum mesh of 3" square or 3.5 "diamond. In addition, flynets must have an extension a minimum of 20 ft. in length constructed of 3" square mesh. All trawls fished in the Atlantic Ocean (except flynets) required to have a minimum codend mesh of 5.5". Additional exceptions include vessels possessing State Atlantic mackerel and/or squid permits and crab trawls.
Area closures	Numerous specific gear restrictions by geographic area. Trawls are prohibited within one-half mile of the beach between the Virginia line and Oregon Inlet. No flynet fishing in Atlantic Ocean south of Cape Hatteras.
Seasons	Several specific seasonal restrictions pertaining to gillnets.
Licenses	A commercial license is required for vessels, with fees dependent on vessel length (non-residents have an additional $200 surcharge). An endorsement on the vessel license or a non-vessel endorsement to sell fish is required to sell fish products.
Other	There is a two-year moratorium on any new vessel, shellfish or crab license.

Table 64. Cetaceans and Turtles found in Survey Area.

Scientific name	Common name	Est. Minimum Number in Study Area	Endan-gered	Threat-ened
LARGE WHALES				
Balaenoptera physalus	fin whale	1,102	X	
Megaptera novaeangliae	humpback whale	684	X	
Balaenoptera acutorostrata	minke whale	162		
Physeter catodon	sperm whale	300	X	
Eubalaena glacialis	right whale	29	X	
Balaenoptera borealis	sei whale	109	X	
Orcinus orca	killer whale	unk		
SMALL WHALES				
Tursiops truncatus	bottlenose dolphin	6,254		
Globicephala spp.	pilot whales	11,448		
Lagenorhynchus acutus	Atl. white-sided dolphin	24,287		
Phocoena	harbor porpoise	2,946		
Grampus griseus	grampus (Risso's) dolphin	10,220		
Delphinus delphis	saddleback dolphin	17,606		
Stenella spp.	spotted dolphin	22,376		
Stenella coeruleoalba	striped dolphin	unk		
Lagenorhynchus albirostris	white-beaked dolphin	unk		
Ziphius cavirostris	Cuvier's beaked dolphin	unk		
Stenella longirostris	spinner dolphin	unk		
Steno bredanensis	rough-toothed dolphin	unk		
Delphinapteras leucas	beluga	unk		
Mesoplodon spp.	beaked whales	unk		
TURTLES				
Caretta caretta	loggerhead turtle	4,017		X
Dermochelys coriacea	leatherback turtle	636	X	
Lepidochelys kempi	Kemp's ridley turtle	unk	X	
Chelonia mydas	green turtle	unk		X

Source: University of Rhode Island 1982.

Table 65. Closed seasons necessary to achieve reductions in exploitation for black sea bass.

Subregion	Gear	Closed Season	% Reduction 0% Rec	% Reduction 15% Rec
Coast	Otter Trawl	Nov 15-Jan 31	34	22
		Oct 15-Feb 7	41	31
North (ME-NY)	Pots/Traps	Apr 1-May 15	24	-
	Hand Lines	May 1-Jul 15	29	17
		May 1-Jul 31	40	33
South (NJ-NC)	Pots/Traps	Apr 1-May 31	27	-
	Hand Lines	Jul 1-Sep 30	30	18
		Jul 1-Oct 31	41	30