AMENDMENT 12

TO THE

SUMMER FLOUNDER, SCUP, AND BLACK SEA BASS

FISHERY MANAGEMENT PLAN

(Includes Environmental Assessment and Regulatory Impact Review)

October 1998

Mid-Atlantic Fishery Management Council

and the

the Atlantic States Marine Fisheries Commission,

in cooperation with

the National Marine Fisheries Service,

the New England Fishery Management Council,

and

the South Atlantic Fishery Management Council

Draft adopted by MAFMC: 18 August 1998
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A Publication of the Mid-Atlantic Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA57FC0002

11 October 1998

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

APR 28 1999

James Gilford, Chairman
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-2331

Dear Jim;

This letter is to inform you that the National Marine Fisheries Service (NMFS) has partially approved portions of Amendment 12 to the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (FMP), Amendment 8 to the Atlantic Mackerel, Squids and Butterfish FMP, and Amendment 12 to the Atlantic Surfclam and Ocean Quahog FMP (collectively referred to as the SFA amendments). The portions disapproved based on the national standards and other applicable law, and the reasons for disapproval, are as follows:

- **Scup Rebuilding Schedule**

NMFS disapproves the *finding* presented by the Council that the management measures in place to rebuild the scup fishery are adequate under Sustainable Fisheries Act (SFA) guidelines. Given the general decline of this fishery and the risk prone fishing mortality rate target selected as a F_{MSY} proxy, the rebuilding plan is unacceptably risk-prone. The 27th Stock Assessment Workshop (SAW-27) had suggested a more conservative $F_{0.1} = 0.15$ as a proxy, versus the specified F_{MAX}, currently 0.26. Although the fishing mortality rate portion of the overfishing definition (OFD) is - by itself - conceptually sound, the combination of the less conservative choice of F by the Council and the risk prone rebuilding program warrants disapproval.

The Northeast Fisheries Science Center (Center) certified conditionally this OFD, reaffirming the SAW-27 recommendation that $F_{0.1}$ should be used as a F_{MSY} proxy. The Center noted that greater caution was necessary in setting a fishing mortality threshold for scup. This caution is necessary to accommodate the greater uncertainty in the assessment of scup compared to other species where F_{MAX} has been acceptable. The uncertainty arises especially in the limited discard estimates (pattern of catch-at-age). An alternative way to build in caution is through the rebuilding program. Thus, to address this deficiency, the Council must adopt a precautionary approach when setting specifications to account for lack of information on discards. Given that F_{MAX} is risk prone for this fishery, the rebuilding must be correspondingly risk averse. The biomass threshold proxy of the maximum value of the Northeast Fisheries Science Center (Center) Spring survey spawning stock biomass (SSB) index, the 1977-79 three year moving average of 2.77 kilograms (kg) per tow, is in accordance with advice from SAW-27 for SFA reference points, and complies with the 50 CFR Part 600 guidelines.

- **Scup Bycatch Provision**

NMFS disapproves the bycatch provision for scup as inconsistent with national standard 9. Measures in the current FMP do not reduce adequately bycatch or minimize bycatch mortality. SAW-27 advised reducing F "substantially and immediately" and noted that reducing discards (especially in small mesh fisheries) would have the most impact in that regard. NMFS acknowledges that data with respect to identifying primary discard sources sufficient to implement management measures are limited. Still, it is envisioned that the Council would take the precautionary approach to develop measures to reduce discards as a result of this disapproval.

I support action begun on addressing this issue in the April 27, 1999, workshop held by the Council's Comprehensive Management Committee. This Committee is charged with investigating alternatives to address scup discard, such as gear modification and season/area closures. I encourage this Committee's rapid development of management measures to reduce bycatch in the small mesh fishery.

- **Surfclam Overfishing Definition**

NMFS disapproves the surfclam OFD as inconsistent with national standard 2 (best available science). The amendment specified a B_{MSY} proxy equal to the 1997 biomass for the Northern New Jersey (NNJ) portion of the stock. The Center did not certify that the surfclam OFD complies with the 50 CFR Part 600 guidelines.

With respect to fishing mortality targets, no attempt is made to calculate a global fishing mortality rate that just removes the annual surplus production, F_{PO}. With respect to a biomass threshold, the proposed parameter is based on NNJ biomass and production, and does not take into account the biomass or surplus production in *other* geographical regions. The NNJ area accounts for only 27 percent of current total annual production. Some level of productivity could be sustained in other resource areas, should economic conditions warrant. The proposed proxies, therefore, represent neither *global* values nor the potential long term biological productivity of the resource over its entire range. The OFD is a "local" definition, and creates management implications when applied globally. This disapproval leaves the fishery without an OFD that meets the requirements of the Act. The provision should be revised as soon as practicable.

- **Essential Fish Habitat**

The essential fish habitat (EFH) portions of the SFA amendments are deficient in addressing the requirements of the SFA and EFH regulations regarding gear impacts on EFH. The SFA requires that the Councils "minimize to the extent practicable adverse effects on [EFH] caused by fishing." The EFH regulations at 50 CFR 600.815(a)(iii) require Councils to "act to prevent, mitigate or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH..." The SFA amendments contain very little discussion of compliance with these requirements.

The SFA amendments suggest that several types of fishing gear have the potential to cause identifiable adverse impacts to EFH; however, the amendments lack a complete assessment of the potential adverse effects of EFH of the gears used in each fishery, as required by 50 CFR 600.015(a)(3)(iii). Moreover, there is insufficient discussion to justify the Council's conclusion that it is not practicable to take measures to minimize these effects. As a result of these deficiencies, the following sections of the SFA amendments were not approved:

- Section 2.2.3.7 Fishing Impacts on EFH and Section 2.2.4 Options for Managing Adverse Effects from Fishing in Amendment 12 to the Summer Flounder, Scup and Black Sea Bass FMP.
- Section 2.2.3.7 Fishing Impacts on EFH and Section 2.2.4 Options for Managing Adverse Effects from Fishing in Amendment 8 to the Atlantic Mackerel, Squids and Butterfish FMP.
- Section 2.2.3.8 Fishing Impacts on EFH,, and Section 2.2.4 Options for Managing Adverse Effects from Fishing in Amendment 12 to the Atlantic Surfclam and Ocean Quahog FMP

In letters to the Council dated September 4, 1998, and October 2, 1998, NMFS identified the need for improvements in these sections of the Amendments and provided specific recommendations. Although the Council attempted to address many of the comments provided by NMFS, the SFA amendments fell short of the requirements set forth in both the SFA and the EFH regulations. I have attached detailed guidance for bringing the EFH portions of the SFA amendments into compliance.

- **Approved Measures**

NMFS approves the remaining measures contained in the SFA amendments. Those measures include:

- The implementation of new or revised overfishing definitions and specifications of optimum yield for the respective species not disapproved. The status determinations for several species may change with the new assessments, based on a review by the SAW at the end of June.
- The designation of essential fish habitat (EFH).
- The addition to each of the FMPs of a framework adjustment process that is separate from the annual specification setting process.
- The requirement that operator in the surfclam and ocean quahog fisheries obtain a permit.
- The vessel size restriction for that Atlantic mackerel fishery.

I appreciate the difficulty of the task the Council undertook in responding to the new requirements of the law. I look forward to working with the Council in the future to address the outstanding issues noted above.

Sincerely,

Jon C. Rittgers
Acting Regional Administrator

CC: J. Dunnigan

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EXECUTIVE SUMMARY

Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to manage the summer flounder, scup, and black sea bass fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The purpose of this amendment is to bring the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan into compliance with the new and revised National Standards and other required provisions of the Sustainable Fisheries Act. Specifically, this amendment revises the overfishing definitions for summer flounder, scup, and black sea bass and addresses the new and revised National Standards relative to the existing management measures. In addition this amendment would add a framework adjustment procedure that would allow the Council to add or modify management measures through a streamlined public review process.

The management unit is summer flounder (*Paralichthys dentatus*) in US waters in the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border, and scup (*Stenotomous chrysops*) and black sea bass (*Centropristis striata*) 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:

1. Reduce fishing mortality in the summer flounder, scup, and black sea bass fisheries to assure that overfishing does not occur.

2. Reduce fishing mortality on immature summer flounder, scup, and black sea bass to increase spawning stock biomass.

3. Improve the yield from these fisheries.

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

5. Promote uniform and effective enforcement of regulations.

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

National Standard 1: Overfishing Definitions

In order to address revised National Standard 1 (which established new standards for overfishing definitions), the Council proposes the following revised definitions of overfishing:

Summer Flounder

Overfishing for summer flounder is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Because F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. F_{max} is 0.24 under current stock conditions. The target fishing mortality rate is also equal to 0.24. The summer flounder stock is overfished when the biomass falls below the minimum biomass threshold of ½ B_{MSY}. The biomass target is specified to equal B_{MSY}. Because B_{MSY} cannot be reliably estimated, the maximum biomass based on yield per recruit analysis and average recruitment is used a proxy. As such, the threshold and target biomass would be 169 million lbs (76,650 mt) and 338 million lbs (153,300 mt), respectively.

Scup

Overfishing for scup is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Because F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. F_{max} is 0.26 under current stock conditions. The maximum value of the spring survey index based on a three year moving average (2.77 kg/tow), would serve as a biomass threshold. B_{MSY} cannot be reliably estimated for scup.

Black Sea Bass

Overfishing for black sea bass is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Because F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. F_{max} is 0.32 under current stock conditions. The maximum value of the spring survey index based on a three year moving average (0.9 kg/tow), would serve as a biomass threshold. B_{MSY} cannot be reliably estimated for black sea bass.

Essential Fish Habitat Definition

The SFA significantly altered the requirement of FMPs to address habitat issues. The SFA contains provisions for the identification and protection of habitat essential to the production of federally managed species. The act requires FMPs to include identification and description of essential fish habitat (EFH), description of non-fishing and fishing threats, and suggest conservation and enhancement measures. These new habitat requirements are addressed in this amendment in section 2.2.

Management Measures

The specific management measure adopted by the Council for this Amendment is:

Framework Adjustment Process

In addition to the annual review and modifications to management measures detailed in section 3.1.1.6, the Council could add or modify management measures through a framework adjustment procedure. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process. As such, management measures that have been identified in the plan could be implemented or adjusted at any time during the year. The following management measures could be implemented or modified through framework adjustment procedures:

1. Minimum fish size.
2. Maximum fish size.
3. Gear restrictions.
4. Gear requirements or prohibitions.
5. Permitting restrictions.
6. Recreational possession limit.
7. Recreational seasons.
8. Closed areas.
9. Commercial seasons.
10 Commercial trip limits.
11. Commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch.
12. Recreational harvest limit.
13. Annual specification quota setting process.
14. FMP Monitoring Committee composition and process.
15. Description and identification of essential fish habitat (EFH) and fishing gear management measures that impact EFH.
16. Description and identification of habitat areas of particular concern.
17. Overfishing definition and related thresholds and targets.
18. Regional gear restrictions.
19. Regional season restrictions (including option to split seasons).
20. Restrictions on vessel size (LOA and GRT) or shaft horsepower.
21. Operator permits.

22. Any other commercial or recreational management measures.
23. Any other management measures currently included in the FMP.
24. Set aside quotas for scientific research.

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APPENDICES

1.0 INTRODUCTION

Amendment 12 Summer Flounder, Scup, and Black Sea Bass Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to manage the summer flounder, scup, and black sea bass fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act (Magnuson-Stevens Act) of 1976, as amended by the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposes new requirements concerning definitions of overfishing in fishery management plans. The SFA also added three new National Standards, including requirements that FMPs take into consideration the effects on fishing communities (National Standard 8), reduce bycatch (National Standard 9), and promote safety of life at sea (National Standard 10). In addition, the Councils are required to identify essential habitat for species managed under the Magnuson-Stevens Act.

1.1 PURPOSE AND NEED FOR ACTION

The purpose of this amendment is to bring the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan into compliance with the new and revised National Standards and other required provisions of the Sustainable Fisheries Act. Specifically, this amendment revises the overfishing definitions for summer flounder, scup, and black sea bass and addresses the new and revised National Standards relative to the existing management measures. In addition, this amendment would add a framework adjustment procedure that would allow the Council to add or modify management measures through a streamlined public review process. It should be noted that any management measure implemented by an earlier amendment not specifically referenced in this amendment is intended to continue in force.

1.1.1 History of FMP Development

The Council first considered the development of a fishery management plan for summer flounder in late 1977. During the early discussions, the fact that a significant portion of the catch was taken from state waters was considered. As a result, on 17 March 1978 a questionnaire was sent by the Council to east coast state fishery administrators seeking comment on whether the plan should be prepared by the Council or by the states acting through the Atlantic States Marine Fisheries Commission (Commission).

It was decided that the initial plan would be prepared by the Commission. The Council arranged for NMFS to make some of the Council's programmatic grant funds available to finance preparation of the Commission's plan. New Jersey was designated as the state with lead responsibility for the plan. The state/federal draft was adopted by the Atlantic States Marine Fisheries Commission (ASMFC) at its annual meeting in October 1982. The original Council FMP (MAFMC 1988) was based on the Commission's management plan. NMFS approved the original FMP on 19 September 1988.

Amendment 1 to the FMP was developed in the summer of 1990 solely to protect the 1989 and 1990 year classes by imposing a minimum net mesh size comparable to the 13" minimum fish size included in the original FMP. On 15 February 1991 the Council was notified that NMFS had approved the overfishing definition for summer flounder contained in Amendment 1, but had disapproved the minimum net mesh provision.

The Council adopted the hearing draft of Amendment 2 on 29 May 1991. The amendment was also adopted for hearings at the May meeting of the ASMFC Interstate Fishery Management Program Policy Board. Amendment 2 was approved by NMFS on 6 August 1992.

Amendment 3 to the Summer Flounder FMP was developed in response to fishermen's concerns that the demarcation line for the small mesh exempted fishery bisected Hudson Canyon and was difficult to enforce. Amendment 3 revised the Northeast exempted fishery line to 72°30.0'W. In addition, Amendment 3 increased the large mesh net threshold to 200 lbs during the winter fishery, 1 November to 30 April. Furthermore, Amendment 3 stipulated that otter trawl vessels fishing from 1 May through 31 October could only retain up to 100 lbs of summer flounder before using the large mesh net. Amendment 3 was approved by the Council on 21 January 1993 and submitted to NMFS on 16 February 1993.

Amendment 4 adjusted Connecticut's commercial landings of summer flounder and revised the state-specific shares of the coastwide commercial summer flounder quota as requested by ASMFC. Amendment 5 allowed states to transfer or combine the commercial quota. Amendment 6 allowed multiple nets on board as long as they were properly stowed and changed the deadline for publishing the overall catch limits and commercial management measures to 15 October and the recreational management measures to 15 February. Amendment 7 revised the fishing mortality rate reduction schedule for summer flounder.

Amendment 8 established management measures for scup (*Stenotomus chrysops*) and Amendment 9 established a management program for black sea bass (*Centropristis striata*). Both of these were major amendments that implemented a number of management measures for scup and black sea bass including commercial quotas, commercial gear requirements, minimum size limits, recreational harvest limits, and permit and reporting requirements.

Amendment 10 made a number of changes to the summer flounder regulations implemented by Amendment 2 and later amendments to the Summer Flounder, Scup and Black Sea Bass FMP. Specifically this amendment modified the commercial minimum mesh regulations, continued the moratorium on entry of additional commercial vessels, removed provisions that pertain to the expiration of the moratorium permit, prohibited the transfer of summer flounder at sea, and established a special permit for party/charter vessels to allow the possession of summer flounder parts smaller than the minimum size.

Amendment 11 was drafted to achieve consistency among Mid-Atlantic and New England FMPs regarding vessel replacement and upgrade provisions, permit history transfer, splitting, and renewal regulations for fishing vessels issued Northeast Limited Access federal fishery permits. This amendment has not yet been approved by NMFS.

1.1.2 Problems for Resolution

1.1.2.1 Revised definitions of overfishing required under the SFA

The Magnuson-Stevens or Sustainable Fisheries Act (SFA) imposed new requirements concerning definitions of overfishing in US fishery management plans. To comply with National Standard 1 section 3 (29) of the SFA requires that each Council FMP define both overfishing and overfished as a rate or level of fishing mortality that jeopardizes a fisheries capacity to produce maximum sustainable yield (MSY) on a continuing basis. The proposed guidelines for implementation of the new National Standards suggest that sustainability or the phrase "on a continuing basis" are generally accepted to mean an average stock level and/or average potential yield from a stock over a long period of time. Each FMP must specify an MSY a harvest strategy that, if implemented, is expected to result in long-term average yield close to MSY.

1.1.2.2 The SFA added three new National Standards

The SFA added three new National Standards, including requirements that FMPs take into consideration the effects on fishing communities (National Standard 8), reduce bycatch (National Standard 9), and promote safety of life at sea (National Standard 10). These new National Standards are addressed in this amendment.

1.1.2.3 Essential fish habitat

The SFA also significantly altered the requirement of FMPs to address habitat issues. The SFA contains provisions for the identification and protection of habitat essential to the production of federally managed species. The act requires FMPs to include identification and description of essential fish habitat (EFH), description of non-fishing and fishing threats, minimize to the extent practicable adverse impacts from fishing, and suggest conservation and enhancement measures. These new habitat requirements are also addressed in this amendment.

1.1.2.4 Framework adjustment procedure

The current plan only allows management measures to be adjusted annually. In addition to the annual review and modifications to management measures associated with the quota setting process, the Council would like to be able to add or modify management measures through a framework adjustment procedure. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process. As such, management measures that have been identified in the plan could be implemented or adjusted at any time during the year.

1.1.3 Management Objectives

The objectives of the FMP are:

1. Reduce fishing mortality in the summer flounder, scup, and black sea bass fisheries to assure that overfishing does not occur.

2. Reduce fishing mortality on immature summer flounder, scup, and black sea bass to increase spawning stock biomass.

3. Improve the yield from these fisheries.

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

5. Promote uniform and effective enforcement of regulations.

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

1.1.4 Management Unit

The management unit is summer flounder (*Paralichthys dentatus*) in US waters in the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border, and scup (*Stenotomous chrysops*) and black sea bass (*Centropristis striata*) in US waters in the western Atlantic ocean from Cape Hatteras, North Carolina northward to the US-Canadian border.

1.1.5 Management Strategy

The management strategy for this Amendment is to provide the information and analyses necessary to meet the Congressional mandates associated with the SFA. The Council intends to continue the management programs in the FMP and reduce overfishing and rebuild the summer flounder, scup, and black sea bass stocks.

1.2 PREFERRED AND ALTERNATIVE MANAGEMENT MEASURES

1.2.1 Preferred Management Measures

In addition to meeting the requirements of the SFA, the Council is proposing one management measure in this Amendment:

1. Implement a framework adjustment process.

1.2.2 Alternative to Preferred Management Measures

1. Take no action.

2.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 DESCRIPTION OF THE STOCK

2.1.1 Species Distribution

The distribution of summer flounder, scup, and black sea bass is described in section 5.1 of Amendments 2, 8, 9, and 10, and in section 2.2 of this amendment.

2.1.2 Abundance and Present Condition

The abundance and present condition of summer flounder, scup, and black sea bass are described in section 5.2 of Amendments 2, 8, 9, and 10, and in section 2.2 of this amendment.

2.1.3 Ecological Relationships and Stock Characteristics

The ecological relationships and stock characteristics of summer flounder, scup, and black sea bass are described in section 5.3 of Amendments 2, 8, 9, and 10, and in section 2.2 of this amendment.

2.2 DESCRIPTION OF HABITAT

2.2.1 Inventory of Environmental and Fisheries Data

According to section 600.815 (a)(2)(i)(A) an initial inventory of available environmental and fisheries data sources relevant to the managed species should be used in describing and identifying essential fish habitat (EFH).

In section 600.815 (a)(2)(i)(B) in order to identify EFH, basic information is needed on current and historic stock size, the geographic range of the managed species, the habitat requirements by life history stage, and the distribution and characteristics of those habitats.

The geographical range of the summer flounder or fluke (*Paralichthys dentatus*) encompasses the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida (Ginsburg 1952; Bigelow & Schroeder 1953; Anderson & Gehringer 1965; Leim & Scott 1966; Gutherz 1967; Gilbert 1986; Grimes *et al.* 1989), although Briggs (1958) gives their southern range as extending into the northern Gulf of Mexico. The center of its abundance lies within the Middle Atlantic Bight from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (Figure 1) (Hildebrand & Schroeder 1928).

Scup is a warm temperate species that occurs from Canada to the Georgia Bight. It is considered as two populations for management purposes, separated by Cape Hatteras, with the southern population requiring some taxonomic attention and the northern population discussed in this review. The northern population differs from the southern population by making extensive seasonal migrations from inshore summering areas to offshore wintering area, and it appears to grow larger then the southern population.

Black sea bass is basically a warm-temperate species in distribution, and usually strongly associated with structured, sheltering habitats, such as reefs and wrecks. The population north of Cape Hatteras migrates south and offshore (to off New Jersey to North Carolina) in the winter but returns to coastal structured habitats for the summer.

Climate, physiographic, and hydrographic differences separate the Atlantic ocean from the Gulf of Maine to Florida into two distinct areas, the New England-Middle Atlantic Area and the South Atlantic Area, with the natural division occurring at Cape Hatteras. These differences result in major zoogeographic faunal changes at Cape Hatteras. The New England region from Nantucket Shoals to the Gulf of Maine includes Georges Bank, one of the worlds most productive fishing grounds. The Gulf of Maine is a deep cold water basin, partially sealed off from the open Atlantic by Georges and Browns Banks, which fall off sharply into the continental shelf.

The New England-Middle Atlantic area is fairly uniform physically and is influenced by many large coastal rivers and estuarine areas including Chesapeake Bay, the largest estuary in the United States, Narragansett Bay, Long Island Sound, the Hudson River, Delaware Bay, and the nearly continuous band of estuaries behind the barrier beaches from southern Long Island to Virginia. The southern edge of the region includes the estuarine complex of Currituck, Albemarle, and Pamlico Sounds, a 2,500 square mile system of large interconnecting sounds behind the Outer Banks of North Carolina.

The South Atlantic region is characterized by three long crescent shaped embayments, demarcated by four prominent points of land, Cape Hatteras, Cape Lookout, and Cape Fear in North Carolina, and Cape Romain in South Carolina. Low barrier islands occur along the coast south of Cape Hatteras with concomitant sounds that are only a mile or two wide. These barriers become a series of large irregularly shaped islands along the coast of Georgia and South Carolina separated from the mainland by one of the largest coastal salt-water marsh areas in the world. Similarly, a series of islands border the Atlantic coast of Florida. These barriers are separated in the north by broad estuaries which are usually deep and continuous with large coastal rivers, and in the south by narrow, shallow lagoons.

The continental shelf (characterized by water less than 650 feet in depth) extends seaward approximately 120 miles off Cape Cod, narrows gradually to 70 miles off New Jersey, and is 20 miles wide at Cape Hatteras. South of Cape Hatteras, the shelf widens to 80 miles near the Georgia-Florida border, narrows to 35 miles off Cape Canaveral, Florida and is 10 miles or less off the southeast coast of Florida and the Florida Keys. The shelf is at its narrowest, reaching seaward only 1.5 miles, off West Palm Beach, Florida.

Surface circulation is generally southwesterly on the continental shelf during all seasons of the year, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. There may be a shoreward component to this drift during the warm half of the year and an offshore component during the cold half. The direction of this drift, fundamentally the result of temperature-salinity distribution, is largely determined by the wind. A persistent bottom drift at speeds of tenths of nautical miles per day extends from beyond mid-shelf toward the coast and eventually into the estuaries.

Water temperatures range from less than 33 °F in the New York Bight in February to over 80 °F off Cape Hatteras in August. The vertical thermal gradient is minimized during winter. In late April to early May, a thermocline develops in shelf waters except over Nantucket Shoals where storm surges retard thermocline development. The thermocline persists through the summer until surface waters begin to cool in early autumn. By mid-November surface to bottom temperature along the shelf is nearly homogeneous.

Coastwide, an annual salinity cycle occurs as the result of freshwater stream flow and the intrusion of slope water from offshore. Water salinities nearshore average 32 ppt, increase to 34-35 ppt along the shelf edge, and exceed 36.5 ppt along the main lines of the Gulf stream..

2.2.1.1 Summer flounder

2.2.1.1.1 Range

The following information on summer flounder range is taken directly from "Life History and Habitat Requirements of Summer Flounder, *Paralichthys dentatus*" (Packer and Griesbach 1998). This document is referred to hereafter as the summer flounder EFH background document. Most of the Tables and Figures from summer flounder EFH background document are included in this FMP. This Packer and Griesbach (1998) summer flounder EFH background document is currently being modified for publication by NMFS and can be obtained in its entirety from NMFS, James J. Howard Marine Sciences Laboratory, 74 McGruder Road, Highlands, New Jersey 07732.

The geographical range of the summer flounder or fluke (*Paralichthys dentatus*) encompasses the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida (Ginsburg 1952, Bigelow & Schroeder 1953, Anderson & Gehringer 1965, Leim & Scott 1966, Gutherz 1967, Gilbert 1986, Grimes *et al.* 1989), although Briggs (1958) gives their southern range as extending into the northern Gulf of Mexico. The center of its abundance lies within the Middle Atlantic Bight from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (Figure 1) (Hildebrand & Schroeder 1928). The management unit is summer flounder in US waters in the western Atlantic Ocean from the US-Canadian border southward to the southern border of North Carolina, it is not managed south of there. North of Cape Cod and south of Cape Fear, North Carolina, summer flounder numbers begin to diminish rapidly (Grosslein & Azarovitz 1982). South of Virginia, two closely related species, the southern flounder (*Paralichthys lethostigma*) and the gulf flounder (*Paralichthys albigutta*) occur and sometimes are not distinguished from summer flounder (Hildebrand & Cable 1930, Byrne & Azarovitz 1982). For more detailed discussions of the summer flounder's distribution on the shelf and in the various estuaries, see the Life History section.

Summer flounder exhibit strong seasonal inshore-offshore movements, although their movements are often not as extensive as compared to other highly migratory species. Adult and juvenile summer flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the fall and winter (Figures 2 and 3). Complete descriptions of the inshore-offshore migratory patterns of the summer flounder are in the Life History and Habitat Requirements sections of this paper.

It is important to note that throughout the U.S. EEZ, summer flounder is managed and assessed as a single stock by the Mid-Atlantic Fishery Management Council (NMFS 1997). However, several stocks of summer flounder may exist throughout its range, and numerous attempts have been made to identify them. Since a genetically distinct stock can have unique rates of recruitment, growth, and mortality (Cushing 1981), identification of the various stocks or subpopulations of summer flounder and their stock-specific biological traits, as well as their habitat distribution and overlap, is necessary for proper management. Stock identification studies suggest that significant differences exist between summer flounder north and south of Cape Hatteras; i.e., between those in the Mid-Atlantic Bight and South Atlantic Bight (Wilk *et al.*1980, Fogarty *et al.* 1983, Able *et al.* 1990, Wenner *et al.* 1990a).

2.2.1.1.2 Status of the stock

The following information on summer flounder stock status is taken directly from the summer flounder EFH background document (Packer and Griesbach 1998).

The stock is at a medium level of historical (1968-1996) abundance and is over-exploited. The age structure of the spawning stock has begun to expand, with 34% of the biomass at ages 2 and older in 1996, although under equilibrium conditions about 85% of the spawning stock biomass would be expected to be ages 2 and older. The 1995 year class is about average (1982-1996), but the 1996 year class is estimated to be the smallest since the poor year class of 1988.

Commercial landings of summer flounder averaged 29.1 million lbs (13,200 mt) during 1980-1988, reaching a high of 37.7 million lbs (17,100 mt) in 1984 (Figure 4). The recreational fishery for summer flounder harvests a significant proportion of the total catch, and in some years recreational landings have exceeded the commercial landings. Recreational landings have historically constituted about 40% of the total landings. Recreational landings averaged 21.6 million lbs (9,800 mt) during 1980-1988, and peaked in 1983 at 28.0 million lbs (12,700 mt). During the late 1980s and into 1990, landings declined dramatically, reaching 9.26 million lbs (4,200 mt) in the commercial fishery in 1990 and 3.09 million lbs (1,400 mt) in the recreational fishery in 1989. Reported 1996 landings in the commercial fishery used in the assessment were 12.7 million lbs (5,770 mt) and estimated 1996 landings in the recreational fishery were 10.4 million lbs (4,704 mt).

Spawning stock biomass declined 72% from 1983 to 1989 (41.7 to 11.5 million lbs; 18,900 mt to 5,200 mt), but has since increased with improved recruitment to 38.4 million lbs (17,400 mt) in 1996 (Figure 4). The age structure of the stock is improving, with 34% of the spawning biomass in 1996 composed of fish of ages 2 and older, compared to only 17% in 1992.

Figure 5a-d shows the contrast between the distribution of summer flounder from periods of high abundances in the past (1974-1978) to recent periods of low abundances (1989-1993), for both adults and juveniles in the fall and spring.

2.2.1.1.3 Habitat requirements by life history stage

The following information eggs, larvae, juveniles, and adult summer flounder habitat requirements is taken directly from the document the summer flounder EFH background document (Packer and Griesbach 1998).

The habitat requirements by life history stage were summarized for inshore areas and are presented in Table 1.

2.2.1.1.3.1 Eggs

Eggs of summer flounder are pelagic and buoyant. They are spherical with a transparent, rigid shell; yolk occupies about 95% of the egg volume. Mean diameter of mature unfertilized eggs is 0.04 inches (0.98 mm).

Habitat requirements

Temperature

Smith (1973) found that eggs were most abundant in the water column where bottom temperatures were between 54 and 66 °F (12 and 19 °C); however, eggs were found in temperatures as cold as 9 °C and as warm as 23 °C. NMFS MARMAP ichthyoplankton data from 1978-1987 also shows that the eggs occur at water column temperatures around 52-73 °F (11-23 °C) with peak abundances in the fall at temperatures of around 57-63 °F (14-17°C; Figure 6). The rate of development is dependent on temperature, with development rate increasing as temperature increases.

Salinity

Watanabe *et al.* (1998) studied the effects of salinity on eggs from captive summer flounder broodstock in the laboratory. Salinities of approximately 25-35 ppt did not influence development time or hatching rate.

Dissolved Oxygen

No information is available.

Light

Watanabe *et al.* (1998) studied the effects of light on eggs from captive summer flounder broodstock in the laboratory. Although the rate of embryonic development appeared to be faster at higher light intensities, hatching rate was not influenced by light intensity within the range of 0-2,000 lx.

Water Currents

No information is available.

Predation

No information is available.

Distribution and abundance

Eggs are most abundant between Cape Cod/Long Island and Cape Hatteras (Figures 7 and 8); the heaviest concentrations have been reported within 28 miles (45 km) of shore off New Jersey and New York during 1965-1966 (Smith 1973), and from New York to Massachusetts during 1980-1986 (Able *et al.* 1990). Able *et al.* (1990) discovered that the highest frequency of occurrence and greatest abundances of eggs in the northwest Atlantic occurs in October and November (Figure 8), although, due to limited sampling in December south of New England, December could be under represented. Festa (1974) also notes an October-November spawning period off of New Jersey. In southern areas, eggs have been collected as late as January-May (Smith 1973, Able *et al.* 1990).

The eggs have been collected mostly at depths of 100-230 ft (30-70 m) in the fall, as far down as 363 ft (110 m) in the winter, and from 10-30 m in the spring (Figure 9).

2.2.1.1.3.2 Larvae

Habitat requirements

The following habitat requirements are summarized for juvenile summer flounder, as well as larval, because these two life stages are so closely related.

Temperature

Larvae have been found in temperatures ranging from 0-73 °F (0-23 °C), but are most abundant between 48 and 64 °F (9 and 18 °C). NMFS Marine Resources Monitoring and Assessment Program (MARMAP) ichthyoplankton data from 1977-1987 shows a seasonal shift in offshore larval occurrence with water column temperatures (Figure 10): most larvae are caught at temperatures greater than or equal to 54 °F (12 °C) in the fall, from 39-50 °F (4-10 °C) in the winter and from 48-57 °F (9-14 °C) in the spring. Sissenwine *et al.* (1979) found pre-recruit summer flounder in the Mid-Atlantic Bight are often most abundant at temperatures in excess of 59 °F (15 °C) during the spring, summer and fall, and usually at depths of 130-200 ft (40-60 m). Larval flounder have been collected inshore earlier in years with mild winters than in years with severe winters (Cain & Dean 1976, Bozeman & Dean 1980). In the estuaries, transforming larvae (0.44-0.68 in.; 11-17 mm TL) have been collected over a temperature range from 28-57 °F (-2.0-14 °C) in Great Bay/Little Egg Harbor in New Jersey (Szedlmayer *et al.* 1992, Able & Kaiser 1994); from 36-64 °F (2.1-17.6 °C) in the lower Chesapeake and Eastern Shore, Virginia (Wyanski 1990); from 36-72 °F (2-22 °C) in North Carolina (Williams & Deubler 1968b); and from 47-74 °F (8.4-23.4 °C) in South Carolina (McGovern & Wenner 1990). Hettler *et al.* (1997) also reported an increase in summer larval abundance with increasing temperatures (45-64 °F; 7-18 °C) in Beaufort Inlet, North Carolina; however, they suggest that unknown factors are probably91, Szedlmayer et al. 1992). For a complete discussion of these experiments see the summer flounder EFH document (Packer and Griesbach 1998).

Laboratory experiments also indicate that temperature is related to mortality and growth rate of juveniles (Malloy and Targett 1991, 1994a,b, Peters and Angelovic 1971, Able et al. 1990 in Packer and Griesbach 1998). Mortality resulting from acute exposure to low temperatures in Mid-Atlantic Bight estuaries probably occurs during a 2 to 4 week period each winter. Szedlmayer *et al.* (1992) hypothesized that year class strength may be affected by winter temperature in New Jersey estuaries, as has been suggested for juveniles by Malloy & Targett (1991) for the Mid-Atlantic Bight as a whole. Recruitment success may be lower in years with late winter cold periods (i.e. March vs. December) due to increased numbers of fish inshore at that time of the year being exposed to lethal low temperatures (Malloy & Targett 1991). Thus, the timing of ingress is critical. However, because Malloy & Targett (1991) found that there was 100% survival at temperatures above 37.4 °F (3 °C), juveniles are probably able to survive most winter water temperatures encountered throughout Mid-Atlantic Bight estuaries. However, Malloy & Targett (1994a) state that the magnitude of the variability in low temperatures may also be more important to pre-recruit mortality than the magnitude of the temperature itself. The low feeding rates observed at low temperatures in the laboratory and the apparent lack of a starvation effect on low-temperature tolerance suggest that food limitation during winter is less important than the magnitude and variability of temperature minima. They conclude that although low temperatures may contribute to pre-recruit mortality south of Cape Hatteras, they are probably more important in more northern nurseries because they persist longer there. In New Jersey, the most probable factors affecting survival of metamorphic summer flounder are the prevailing environmental conditions, especially the timing of ingress relative to estuarine water temperatures and predation (Szedlmayer *et al.* 1992, Keefe & Able 1993, Witting & Able 1993).

Tracking studies by Szedlmayer & Able (1993) in Schooner Creek, near Great Bay and Little Egg Inlet, NJ suggest that tidal movements of juveniles (8.4-10.2 in.; 210-254 mm TL) may be in response to a preferred range of environmental parameters. Although they were collected in a wide range of habitats during their first year (Szedlmayer *et al.* 1992), during the August to September study period, they were found within a narrow range of water temperature (mean 74 °F; 23.5 °C) and also dissolved oxygen. Small changes in these parameters may force the fish to move.

Several studies indicate that juvenile summer flounder in Chesapeake Bay may succumb to infections of the hemoflagellate *Trypanoplasma bullocki* at low temperatures (Burreson & Zwerner 1982, 1984, Sypek & Burreson 1983). Effective immune response to the parasite was not noted in natural infections below 50 °F (10 °C; Sypek & Burreson 1983). Therefore, because *T.bullocki* causes mortality of juvenile summer flounder during winter, suggesting that this mortality is temperature dependent, and since no fish with symptoms of the disease have been observed south of Cape Hatteras, Burreson & Zwerner (1984) hypothesize that the presence of the symptoms of this disease in juvenile summer flounder can be used as a measure of mortality north of Cape Hatteras. In addition, increased antibody production in early spring eliminates the infection in the flounder and the recovered fish are immune for at least one year, even if challenged at temperatures as low as 48.2 °F (9 °C; Burreson & Frizzell 1986).

NMFS NEFSC groundfish data shows a seasonal shift in offshore juvenile summer flounder occurrence with bottom temperatures (Figure 11a): most juveniles are caught over a range of temperatures from 50-81 °F (10-27 °C) in the fall, from 37-55 °F (3-13 °C) in the winter, from 37-63 °F (3-17 °C) in the spring, and from 50-81 °F (10-27 °C) in the summer. Massachusetts inshore trawl survey data also shows a seasonal shift in juvenile occurrence with bottom temperature. In the spring, most juveniles occur at a range of temperatures from 48-57 °F (9-14 °C), while in the fall they occur at temperatures from 59-70 °F (15-21 °C).

Salinity

Watanabe *et al.* (1998) studied the effects of salinity and light intensity on yolk-sac larvae hatched from captive summer flounder broodstock in the laboratory. Significant effects of both salinity and light intensity on larval size were evident at hatching: larvae hatched under 500 lx and salinities of approximately 35 ppt. showed maximum values, a trend observed at the first feeding stage. These conditions are consistent with those of oceanic waters where the eggs and early larvae are naturally found. Watanabe *et al.* (1998) suggest that high survival as seen in the laboratory under all light intensities and salinities reflects an adaptability in the wild for inshore movement during the pelagic larval stage.

Transforming larvae and juveniles are most often captured in the higher salinity portions of estuaries. In New Jersey, Festa (1974) captured larval summer flounder in salinities of 26.6-35.6 ppt, while in two marsh creeks, larvae occurred at salinities ranging from 20-33 ppt (Able & Kaiser 1994). In the lower Chesapeake Bay, VA, young-of-the-year were common in creeks with salinities >15 ppt and were most abundant at the highest salinities, but were absent in a small tributary of the Poropotank River with salinities 3-11 ppt (Able & Kaiser 1994). In North Carolina, Williams & Deubler (1968a) found postlarval summer flounder in waters ranging from 0.02-35 ppt, with optimal conditions at 18 ppt. In addition, postlarval summer flounder (10-18 mm SL) were captured most frequently at salinities exceeding 7.4 ppt in the Cape Fear River Estuary, North Carolina (Weinstein *et al.* 1980a). However, Turner & Johnson (1973) reported that summer flounder of all ages occurred in the Newport River, North Carolina, at salinities of 3-33 ppt. Data from 1987-1991 trawl surveys from Pamlico Sound show that almost all individuals were collected in the sound while few were found in the adjacent sub-estuaries with lower salinities such as the Pamlico and Neuse Rivers (Able & Kaiser 1994). Street (pers. comm.) mentioned that summer flounder distribution in Pamlico Sound varied in response to salinity changes. In dry years the area of higher salinity greatly expands in Pamlico Sound, and nursery areas similarly expand.

In South Carolina, larvae have been collected at salinities from 0-24.7 ppt (McGovern & Wenner 1990). Recently settled individuals (<50 cm TL) in the Charleston Harbor estuary occur at both very low and very high salinities from February to March. However by May, individuals 20-100 mm TL are found at higher salinities of >10 ppt. This suggests that as the flounder disperse in this estuary, they may move up into nearly fresh water, but as they grow they concentrate in the higher salinities of the lower estuary (Wenner *et al.* 1990a, Hoffman 1991, Able & Kaiser 1994).

In an estuarine complex in Georgia, Dahlberg (1972) noted that adult and juvenile summer flounder were most abundant in the higher salinity zones.

Malloy & Targett (1991) found that salinities of 10-30 ppt had no significant effect on feeding, growth, or survival of juvenile summer flounder (1.64-3.2 in.; 41-80 mm TL) in Delaware. However, there was a slight interaction of temperature and salinity on growth rate, suggesting that fish have higher growth rates at high salinities and at high temperatures. This agrees with other laboratory studies which show that larval and juvenile growth rate and growth efficiency are greatest at salinities >10 ppt (Deubler & White 1962, Peters & Angelovic 1971, Watanabe *et al.* 1998), although Malloy & Targett (1991) suggest that there appears to be no significant physiological advantage or greater capacity for growth in waters of higher salinities, except at high temperatures. In other laboratory experiments, however, summer flounder grew best at higher salinities and more moderate temperatures, typical of habitats close to the mouths of estuaries (Peters 1971). This could explain why Powell & Schwartz (1977) captured juveniles in the central portions and around inlets of North Carolina estuaries at intermediate to high salinities of 12-35 ppt. Burke (1991) and Burke *et al.* (1991) also found newly settled summer flounder concentrated on tidal flats in the middle reaches of a North Carolina estuary. In the spring, older juveniles moved to high salinity salt marsh habitats. Young-of-the-year in spring were also significantly correlated with salinity (around 22-23 ppt) in eelgrass beds in the shallow water (4ft; 1.2 m), high salinity area near Hog Island in Pamlico Sound (Ross & Epperly 1985, it is unclear if this applies to the larger juveniles and adults caught in the study with sizes up to 12.5 in.; 320 mm). But Burke (1991) and Burke *et al.* (1991) make it clear that the summer flounder's distribution is due to substrate preference and is not affected by salinity. Malloy & Targett (1991) also suggest that reported distributions of juvenile summer flounder at salinities >12 ppt are probably the result of substrate and prey availability.

Dissolved Oxygen

Klein-MacPhee (1979) measured oxygen consumption rhythms in juvenile summer flounder over a 24 hour period in a flow-through metabolic chamber. The flounder showed a standard metabolic rate cycle, as manifested by oxygen consumption, with maximum consumption occurring between the hours of 2300 and 0100, and a minimum between 1130 and 1300. Oxygen consumption varied inversely with the size of the fish. Mean oxygen consumption was 33.5 ppm body weight per hour for 4.2 oz (120 g) fish; 31.1 ppm body weight per hour for 5.8 oz (165 g) fish; and 22.9 ppm per hour for 8.8 oz. (250 g) fish. Comparisons of metabolic rate cycles with activity cycles showed that the pattern was the same (high activity, high oxygen consumption in the dark) but the peaks of the two cycles did not always coincide, and there was less day to day variation in the oxygen consumption cycle.

As reported previously under the temperature section, tracking studies by Szedlmayer & Able (1993) in Schooner Creek, near Great Bay and Little Egg Inlet, New Jersey suggest that tidal movements of juveniles (8.4-10.2 in.; 210-254 mm TL) may be in response to a preferred range of environmental parameters. They were found within a narrow range of water temperature and dissolved oxygen (mean 6.4 ppm), and small changes in these parameters may force the fish to move.

Postlarvae of the closely related southern flounder (*Paralichthys lethostigma*) responded negatively to water with dissolved oxygen concentrations 5.3 ppm (<3.7 ml/l; Deubler & Posner 1963). The southern flounders also showed no difference in sensitivity to oxygen depletion when subjected to temperatures of 43, 57, and 77 °F (6.1, 14.4, and 25.3 °C). Growth rates of young-of-the-year winter flounder (*Pseudopleuronectes americanus*) were significantly reduced for fish exposed to low (2.3 ppm) and diurnally fluctuating (2.5-6.5 ppm; avg. 5.1 ppm) levels of dissolved oxygen (Bejda *et al.* 1992).

Light

As stated previously, Watanabe *et al.* (1998) studied the effects of light intensity and salinity on yolk-sac larvae hatched from captive summer flounder broodstock in the laboratory. Significant effects of both salinity and light intensity on larval size were evident at hatching: larvae hatched under 500 lx and salinities of approximately 35 ppt. showed maximum values, a trend observed at the first feeding stage. Shorter notochord lengths of larvae grown under a light intensity of 2,000 lx compared with 0-1,000 lx is presumably related to higher light-induced activity and energy metabolism. 500 lx appears to be the optimal intensity for culture of eggs and yolk-sac larvae. As stated previously, Watanabe *et al.* (1998) suggest that high survival as seen in the laboratory under all light intensities and salinities reflects an adaptability in the wild for inshore movement during the pelagic larval stage.

Hettler *et al.* (1997) found that larvae inside Beaufort Inlet, North Carolina were more abundant in catches made later in the night, suggesting that they disperse into the water column from the edges and bottom. Night-time sampling by Rountree & Able (1997) at the mouths of marsh creeks in Little Egg Harbor estuary, New Jersey, suggests that young-of-the-year (range 5.5-15.6 in.;138-390 mm SL) summer flounder make extensive use of these shallow habitats during night-time hours.

White & Stickney (1973) found that late larval and early postlarval summer flounder reared in the laboratory feed well with a surface light intensity of 300-500 foot candles (1 foot candle = 10.76 meter candles). Other laboratory studies by Keefe & Able (1994) in New Jersey suggest that metamorphic flounder exhibit a diel pattern in burying behavior with a higher incidence of burying occurring during the day, with swimming in the water column at night. Klein-MacPhee (1979) showed that, under 12 h light/12 h dark photoperiods, maximum activity by juveniles occurred in the dark and had a bimodal distribution. Peaks occurred at 1900 and 0400 h. Under constant dark regimes, peak activity occurred at 2000 and 0100 with a minor peak at 1200. The free running period was 26 hours. In natural light, major activity occurred at 0300 with minor peaks at 1200 and 1800 h. In constant light, activity was reduced and found to be acyclic. Activity patterns of laboratory juveniles were different from wild adults, the latter being light active. Laboratory studies by Lascara (1981) on juveniles and adults from lower Chesapeake Bay showed that peak feeding activity (search-pursuits/unit time) generally occurred during daylight hours between 0800 and 1200.

Grover (1998) studied the incidence of feeding of oceanic larval summer flounder collected north and east of Hudson Canyon. The incidence of feeding was defined as the percentage of frequency of larvae with prey in their guts, in relation to the total number of specimens examined in a time block. Pelagic larvae began feeding near sunrise; the presence of prey in the guts reached its lowest point at 0400-0599, then dramatically increased at 0600-0759. At 0800-0959, the incidence of feeding was 100%, and throughout daylight remained high until 2000. Full guts were not observed until 1200-1359. Maximum gut fullness was at 1200-1559 and 2000-2159. The only time block in which all larvae contained prey in their guts was at 0800-0959. These observations confirm the visual nature of oceanic larval feeding. The incidence of feeding in estuarine larvae was significantly lower than oceanic larvae at 1800-1959 and 2000-2159.

Surveys in the lower Chesapeake Bay, Virginia (Orth & Heck 1980, see also Lascara 1981) and near Beaufort Inlet, North Carolina (Adams 1976a) show that during daylight hours, juveniles tend to occupy areas in the estuaries that have submerged aquatic vegetation.

Water Currents

Smith (1973) found that larvae did not drift far from spawning areas, and were taken near the eggs. Williams & Deubler (1968a) stated that larvae shorter than 0.28 in. (7 mm) SL depend on currents for dispersal; however, there are no data that describe relationships between recruitment to nursery areas and wind-driven (Ekman) transport or prevailing directions of water flow. Greater densities of young fish were found in or near inlets, and greater numbers were captured during periods of the full moon (Williams & Deubler 1968a). Young-of-the-year summer flounder have been found in high concentrations around the mouths of tidal creeks (Szedlmayer *et al.* 1992, Szedlmayer & Able 1993, Rountree & Able 1997). This could serve to maximize energy efficiency, as the creek mouths are often areas of reduced current speed.

Laboratory experiments by Keefe & Able (1994) in New Jersey indicated an increase in burying behavior by early metamorphic summer flounder on a flood tide. This may represent a mechanism that allows the flounder to remain in favorable habitats.

Dispersal in areas having strong tidal currents may be accomplished by diel vertical migrations that result in tidal transport (Weinstein *et al.* 1980b, Burke 1991, Burke *et al.* 1991). Tidal transport of young-of-year summer flounder has been shown to occur in a New Jersey marsh creek (Szedlmayer & Able 1993). Movement behavior within the creek system appeared to maximize energy efficiency by selective tidal transport (i.e., fish moved up the creek on flood tides and down the creek with ebb tides). Rountree & Able (1992b) and Szedlmayer & Able (1993) hypothesize that tidal movements of summer flounder in marsh creeks are also the result of both foraging behavior and behavioral homeostasis (e.g. behavioral thermoregulation). Stomach fullness of fish captured leaving the creeks on ebb tides was significantly greater than that of fish captured entering the creeks on flood tides, suggesting that summer flounder undergo tidal movements to take advantage of high concentrations of prey available in the creeks. Although the summer flounder were found in a wide range of temperatures, salinities and dissolved oxygen concentrations, they generally stayed within narrow limits of these parameters. Thus, movements may also be related to the avoidance of environmental extremes.

Substrate/shelter

Powell & Schwartz (1977) state that benthic substrate appears to influence juvenile summer flounder and southern flounder distributions in Pamlico Sound and adjacent estuaries, North Carolina. Summer flounder were dominant in sandy substrates or where there was a transition from fine sand to silt and clay, while southern flounder were dominant in muddy substrates. Turner & Johnson (1973) also note juvenile summer flounder occur more frequently over sandy substrates than mud or silt bottoms in Pamlico Sound. Burke (1991) and Burke *et al.* (1991), however, in their North Carolina study demonstrated that it is salinity which affects the distribution of southern flounder while the most important factor affecting the distribution of summer flounder is substrate type. Their data indicated that the highest probability of encountering juvenile summer flounder occurred on mixed to sandy substrates. As stated above, surveys by Hoffman (1991) in marsh creeks in Charleston Harbor, South Carolina also showed that recently settled summer flounder were abundant over a wide variety of substrates including mud, sand, shell hash, and oyster bars. In Virginia, Wyanski (1990) and Norcross & Wyanski (1988) found newly recruited juvenile summer flounder in shallow, mud bottom marsh creek habitat until they were 2.4-3.2 in. (60-80 mm) TL in late spring, at which time they were on shallow sand substrates (including seagrass beds), deep sand substrate, and deep fine-sand substrates. In addition, Burke (1991) demonstrated that metamorphosing larvae raised in the lab exhibit substrate preferences that correspond to the habitat of older flounders in the wild. Summer flounder preferred sand whether benthic prey species were present or excluded from test substrates. However, Keefe & Able (1994) suggest other cues may affect substrate preference as well as burying behavior in metamorphic and juvenile summer flounder. These would include the presence and types of predators as well as prey. In addition, although Keefe & Able (1994) found that metamorphic and juvenile summer flounder collected from Great Bay-Little Egg Harbor estuary in southern New Jersey showed a preference for sandy substrates in the laboratory, studies by Szedlmayer *et al.* (1992) and Rountree & Able (1992a, 1997) show that in southern New Jersey they also occur abundantly in marsh creeks with soft mud bottoms and shell hash. Timmons (1995) also reports a preference for sand by juvenile (3.0-9.8 in; 7.6-24.9 cm TL) summer flounder from the south shores of Rehobeth Bay and Indian River Bay, Delaware. In her study, the flounder were captured near large aggregations of the macroalgae *Agardhiella tenera* only when large numbers of their principal prey, the grass shrimp *Paleomonetes vulgaris*, were present. Timmons (1995) suggests that the summer flounder are attracted to the algae because of the presence of the shrimp, but remain near the sand to avoid predation ("edge effect"). Indeed, in her laboratory experiments, the juvenile summer flounder did not show a preference for the macroalgae, and in caging experiments, blue crabs were least able to prey on the flounder in cages with sand bottoms only, but had an advantage in capturing the flounder in cages containing macroalgae. Similar results have been reported in laboratory experiments by Lascara (1981) on larger juveniles and adults from lower Chesapeake Bay. Flounder appeared to utilize submerged aquatic vegetation (eelgrass) as a "blind", they lie-in-wait along the vegetative perimeter, effectively capturing prey (in this case, juvenile spot, *Leiostomus xanthurus*) which moved from within the grass. In the absence of the eelgrass, the spot visually detected and avoided the flounder; the flounder therefore consumed fewer spot on average in the non-vegetated treatment than in the vegetated treatments. Therefore, Lascara (1981) concludes that the ambush tactics of summer flounder are especially effective when the flounder are in patchy habitats where they remain in the bare substrate (sand) between eelgrass patches. Lascara (1981) also notes that if flounder remained within densely vegetated areas, they would probably be conspicuous to prey. As the flounder moved through the vegetation in his laboratory experiments, the grass blades were matted down and essentially 'traced out' their body shape. The flounder might also be conspicuous to potential predators as well, again suggesting the "edge effect" hypothesis of Timmons (1995). Thus, flounder remain near the sand to both avoid predation and conceal themselves from prey.

Although juvenile summer flounder make extensive use of marsh creeks (Wyanski 1990, Burke *et al.* 1991, Malloy & Targett 1991, Rountree & Able 1992b, 1997, Szedlmayer *et al.* 1992, Szedlmayer & Able 1993), other portions of the estuary are used as well. For example, in North Carolina estuaries, Burke (1991) suggests that the preferred habitat of summer flounder appears to be mid-estuary stations, which also appears to correspond to high densities of their principal prey. Adams (1976a) reported the occurrence of juvenile summer flounder in eelgrass (*Zostera marina)* meadows near Beaufort, North Carolina during the summer; YOY juveniles in spring also appeared to favor the eelgrass beds in the shallow water (4ft; 1.2 m), high salinity (means 22-28 ppt) area near Hog Island in Pamlico Sound (Ross & Epperly 1985). *Paralichthys* spp. in the eelgrass communities near Beaufort, North Carolina, collectively accounted for about 1% of the annual production and respiration of the fish assemblage (Thayer & Adams 1975, Adams 1976b). Juveniles have also been reported in North Carolina saltmarsh cordgrass habitat by Hettler (1989) during flood tides. Orth & Heck (1980) and Heck & Thoman (1984) indicated that summer flounder also used similar shallow vegetated areas during daylight in Chesapeake Bay, Lascara (1981) also reports that juvenile and adult flounder entered and fed in these same areas. In a Virginia tidal marsh creek prior to late summer, juveniles were randomly distributed, but in late summer and early fall, they were more abundant in the adjacent seagrass beds (Weinstein & Brooks 1983). These data indicate that grass bed habitats are important to the summer flounder, and any loss of these areas along the Atlantic seaboard may affect flounder stocks (Rogers & Van Den Avyle 1983). In the inland bays of Delaware, Timmons (1995) suggests that macroalgal systems appear to act as ecological surrogates to seagrass beds and seagrass/macroalgal systems as described by various authors. As with seagrass systems that attract juveniles when the submerged aquatic vegetation (SAV) increases from June to September, so does the macroalgae attract summer flounder, because, as stated previously, the macroalgae attracts their prey. This may also be true for Great Bay and Little Egg Harbor in southern New Jersey. Szedlmayer & Able (1996) report that juvenile and adult summer flounder (5.6-16.6 in.; 140-416 mm SL) were associated with the station considered to be a sea lettuce (*Ulva lactuca*) macroalgae habitat.

Conversely, also in Great Bay-Little Egg Harbor, Keefe & Able (1992) determined habitat quality as measured by relative growth of juvenile summer flounder (0.68-1.6 in.; 17-41 mm SL). Growth did not appear to be related to the habitats tested, including eelgrass and adjacent unvegetated substrate, macroalgae (*Ulva*) and adjacent unvegetated substrate, and marsh creek. The fastest growth occurred in shallow bays and marsh creeks. However, Malloy & Targett (1994b) suggest that juvenile growth is related to substrate or habitat in the Newport River estuary, North Carolina because of the presence of specific prey items. The growth limitation of juveniles (18-80 mm TL) in one sandy-marsh habitat could be explained by the low abundance of mysids from May into summer, while the increasing abundance of other prey (polychaetes and amphipods) during that same month at a muddier site may account for favorable growth seen there. Other diet studies in this estuary (Burke 1991, 1995, Burke *et al.* 1991) suggest that polychaetes are actually the preferred prey for juveniles of this size (see the Food Habits section below).

Distribution and abundance (larvae only)

Planktonic larvae (0.08-0.52 in.; 2-13 mm) are often most abundant 12-52 miles (19-83 km) from shore at depths of around 30-230 ft (10-70 m), and are found in the northern part of the Middle Atlantic Bight from September to February, and in the southern part from November to May, with peak abundances occurring in November (Smith 1973; Able *et al.* 1990; Figures 12, 13, 14). The smallest larvae (less than 0.24 in.; 6 mm) were most abundant in the Mid-Atlantic Bight October-December, while the largest larvae (less than or equal to 0.44 in.; 11 mm) were abundant November-May with peaks in November-December and March-May (Able *et al.* 1990). Off eastern Long Island and Georges Bank, the earliest spawning and subsequent larval development occurs as early as September (Able & Kaiser 1994). By October, the larvae are primarily found on the inner continental shelf between Chesapeake Bay and Georges Bank. During November and December they are evenly distributed over both the inner and outer portions of the shelf. By January and February the remaining larvae are primarily found on the middle and outer portions of the shelf. By April, the remaining larvae are concentrated off North Carolina (Able & Kaiser 1994).

From October to May larvae and postlarvae migrate inshore, entering coastal and estuarine nursery areas to complete transformation (Table 2; Merriman & Sclar 1952, Olney 1983, Olney & Boehlert 1988, Able *et al.* 1990, Szedlmayer *et al.* 1992). Larval to juvenile metamorphosis, which involves the migration of the right eye across the top of head, occurs over the approximate range of 0.32-0.72 in. (8-18 mm) SL (Burke *et al.* 1991, Keefe & Able 1993, Able & Kaiser 1994). They then leave the water column and settle to the bottom where they begin to bury in the sediment and complete development to the juvenile stage, although they may not exhibit complete burial behavior until mid-late metamorphosis when eye migration is complete, often at sizes as large as 1.08 in. (27 mm) SL (Keefe & Able 1993 1994). However, burying behavior of metamorphic summer flounder is also significantly affected by substrate type, water temperature, time of day, tide, salinity, and presence and types of predators and prey (Keefe & Able 1994).

2.2.1.1.3.3 Juveniles

Habitat requirements

The life history of juvenile and larval summer flounder are closely related, therefore the habitat requirements of juveniles are included in the section on habitat requirements of larvae (Section 2.2.1.1.3.2).

Distribution and abundance

Juveniles are distributed inshore and in many estuaries throughout the range of the species during spring, summer, and fall (Table 2; Deubler 1958, Pearcy & Richards 1962, Poole 1966, Miller & Jorgenson 1969, Powell & Schwartz 1977, Fogarty 1981, Rountree & Able 1992a-b, 1997, Able & Kaiser 1994). During the colder months in the north there is some movement to deeper waters offshore with the adults (Figures 2a-d, 11b), although many juvenile summer flounder will remain inshore through the winter months while some juveniles in southern waters may generally overwinter in bays and sounds (Smith & Daiber 1977, Wilk *et al.* 1977, Able & Kaiser 1994). In estuaries north of Chesapeake Bay, some juveniles remain in their estuarine habitat for about 10 to 12 months before migrating offshore their second fall and winter; in North Carolina sounds, they often remain for 18 to 20 months (Powell & Schwartz 1977). The offshore juveniles return to the coast and bays in the spring and generally stay the entire summer. The average catch of juvenile and adult summer flounder from 1986 through 1996, by region, in the Southeast Monitoring and Assessment Program (SEAMAP) survey is presented in Figure 15 (Boylan pers. comm.).

Fogarty (1981) examined the distribution patterns of pre-recruit (less than or equal to 12 in.; 30.5 cm) summer flounder caught during the 1968-1979 spring surveys and found a striking absence of small fish in northern areas. Both spring and autumn bottom trawl survey data indicated that the concentration of young-of-year summer flounder was south of 39° latitude. The importance of the Chesapeake Bight to this species is demonstrated by the fact that almost all of the young-of-year caught during those spring surveys were from this area.

2.2.1.1.3.4 Adults

Reproduction

Summer flounder have a protracted spawning season of variable duration with early maturation (age 1 or 2), high fecundity, serial spawning (multiplicity of egg batches which are continuously matured and shed), and extensive migrations across the shelf (Morse 1981, Grimes *et al.* 1989).

Spawning occurs over the open ocean areas of the shelf. Summer flounder spawn during the fall and winter while the fish are moving offshore or onto their wintering grounds; the offshore migration is presumably keyed to declining water temperature and decreases in photoperiod during the autumn. The spawning migration begins near the peak of the summer flounder's gonadal development cycle, with the oldest and largest fish migrating first each year (Smith 1973).

The seasonal migratory/spawning pattern varies with latitude (Smith 1973); i.e., gonadal development, spawning and offshore movements occur earlier in the northern part of their range (Rogers & Van Den Avyle 1983). For example, in Delaware Bay, gonads of summer flounder appear to ripen from mid-August through November (Smith & Daiber 1977), while peak gonadal development occurs during December and January for fish around Cape Hatteras (Powell 1974). Spawning begins in September in the inshore waters of southern New England and the Mid-Atlantic. As the season progresses, spawning moves onto Georges Bank as well as southward and eastward into deeper waters across the entire breadth of the shelf (Berrien & Sibunka, in press). Spawning continues through December in the northern sections of the Middle Atlantic Bight, and through February/March in the southern sections (Smith 1973; Morse 1981; Almeida *et al.* 1992). Spawning peaks in October north of Chesapeake Bay and November south of the Bay (Smith 1973; Able *et al.* 1990; note that the latter statement on spawning south of the Bay in November appears to contradict the published information above concerning peak gonadal development occurring December-January near Cape Hatteras). The half year spawning season reduces larval crowding and decreases the impact of predators and adverse environmental conditions on egg and larval survival (Morse 1981). In the South Atlantic Bight, maturity observations by Wenner *et al.* (1990a) suggest that spawning begins as early as October, and may continue through February and possibly early March.

Habitat requirements

Temperature

NMFS NEFSC groundfish data shows a seasonal shift in offshore adult summer flounder occurrence with bottom temperatures (Figure 16a): most adults are caught over a range of temperatures from 48-79 °F (9-26 °C) in the fall, from 39-55 °F (4-13 °C) in the winter, from 36-68 °F (2-20 °C) in the spring, and from 48-81 °F (9-27 °C) in the summer. Massachusetts inshore trawl survey data also shows a seasonal shift in adult occurrence with bottom temperature. In the spring, most adults occur at a range of temperatures from 43-63 °F (6-17 °C), while in the fall they occur at temperatures from 57-70 °F (14-21 °C). Prior to 1979, Sissenwine *et al.* (1979) reported that NMFS trawl surveys on the continental shelf showed that the distribution of summer flounder by depth was related to their temperature distribution. During spring they were distributed widely over the continental shelf, from 0-360 m depth (Figure 16b), and primarily in waters between 46-64 °F (8-16 °C). During summer the flounder were primarily captured in depths of less than 330 ft (100 m), and in waters between 59-82 °F (5-28 °C). The autumn distribution was also at depths of less than 330 ft (100 m) and temperatures between 54-82 °F (12-28 °C). During winter, they generally were found at depths greater than 230 ft (70 m), and at temperatures between 41-52 °F (5-11 °C; Sissenwine *et al.* 1979).

In the Mid-Atlantic Bight north of Chesapeake Bay, spawning and the offshore limits of migration coincide with the inshore edge of the mass of cold bottom water which disappears along with the thermocline in November (Smith 1973).

A study by Stolen *et al.* (1984a) compared the effect of temperature on the humoral antibody formation in the summer and winter flounder at 46, 54, and 63 °F (8, 12 and 17 °C) during the same time of the year. Summer flounder showed only a delay in the appearance of circulating antibody at lower temperatures while winter flounder showed both a delay and a marked suppression at lower temperatures. Summer flounder produced a high titered antibody that persisted over a long period of time and over a wide temperature range, while in winter flounder antibody levels began decreasing after one month.

A similar study on the kinetics of the primary immune response in summer flounder was also studied by Stolen *et al.* (1984b). The flounder produced antibody over a wide range of environmental temperatures ranging from 45.5-81 °F (7.5-27 °C). At the lower environmental temperatures, a corresponding delay in the appearance of circulation antibody occurred, although the magnitude and duration of the response was not appreciably affected. After immunizing at 54 °F (12 °C), lowering the environmental temperature gradually to 46 °F (8 °C) did not appear to inhibit an ongoing primary response. Typical secondary responses were seen in fishes kept at warmer temperatures, but when the temperature was lowered to 46 °F (8 °C), no anamnestic response was seen. Individual variation was most noticeable at middle temperature ranges.

Salinity

Adult summer flounder return inshore to coastal waters in April through June, and are often found in the high salinity portions of estuaries (e.g. Abbe [1976] in Delaware, Tagatz & Dudley [1961] and Powell & Schwartz [1977] in North Carolina, Dahlberg [1972] in Georgia). However, the adult summer flounder's distribution may be due more to substrate preference than salinity preference.

Dissolved Oxygen

Effects of dissolved oxygen concentration on summer flounder adults has not been investigated (Rogers & Van Den Avyle 1983). Festa (1977) reported that the high variability in catch rates of summer flounder off of New Jersey in the summer of 1976 appeared to be directly related to the movement of an anoxic water mass present that year. Large numbers of summer flounder were forced into inlets and bays where they were more concentrated and vulnerable to the sport fishery (Freeman & Turner 1977).

Light

Laboratory studies (Olla *et al.* 1972, Lascara 1981) and field collections (Orth & Heck 1980) indicate that adult summer flounder are active primarily during daylight hours. To repeat what was stated above for juveniles: laboratory studies by Lascara (1981) on juveniles and adults from lower Chesapeake Bay showed that peak feeding activity (search-pursuits/unit time) generally occurred during daylight hours between 0800 and 1200.

Water Currents

No information is available.

Substrate/shelter

Adults have often been reported as preferring sandy habitats (Bigelow & Schroeder 1953, Schwartz 1964, Smith 1969). For example, in Pamlico Sound, North Carolina, Powell & Schwartz (1977) found that summer flounder were most abundant at stations where quartz sand or coarse sand and shell predominated. In Barnegat Bay, New Jersey, Vouglitois (1983) suggests that both juvenile and adult summer flounder are found in greater numbers in the eastern portion of the Bay, where sandy sediments predominate. However, adults can camouflage themselves via pigment changes to reflect the substrate (Mast 1916). Thus, they can be found in a variety of habitats with both mud and sand substrates, including marsh creeks, seagrass beds, and sand flats (Bigelow & Schroeder 1953, Dahlberg 1972, Orth & Heck 1980, Lascara 1981, Rountree & Able 1992a).

As previously explained above in the Section on juveniles, laboratory experiments by Lascara (1981) on larger juveniles and adults from lower Chesapeake Bay found that flounders appear to utilize eelgrass beds as "blinds"; i.e., they lie-in-wait along the vegetative perimeter, effectively capturing prey which move from within the grass. Lascara (1981) concludes that the ambush tactics of summer flounder are especially effective when the flounder are in patchy habitats where they remain in the bare substrate (sand) between eelgrass patches. Lascara (1981) also notes that if flounder remained within densely vegetated areas, they would probably be conspicuous to prey because, in his laboratory experiments, as the flounder moved through the vegetation, the grass blades were matted down and essentially 'traced out' their body shape. The flounder might also be conspicuous to potential predators as well, suggesting the "edge effect" hypothesis of Timmons (1995). Thus, the flounder remain near the sand to both avoid predation and conceal themselves from prey.

Distribution and abundance

As stated above, summer flounder exhibit strong seasonal inshore-offshore movements (Figure 3a-d). Adult flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the colder months on the outer continental shelf at depths down to150 m (Figure 16b; Bigelow and Schroeder 1953; Grosslein & Azarovitz 1982). Some evidence suggests that older adults may remain offshore all year (Festa 1977). However, due to overfishing, most of the adults are $\leq$3 years of age and they return to the inner continental shelf and estuaries during the summer (Able & Kaiser 1994; Terceiro 1995; Northeast Fisheries Science Center 1997; in addition, Desfosse's [1995] study in Virginia waters notes that the majority of fish sampled from 1987-1989 were from 0-3 years of age, and over 90% of the summer flounder survey catch in Delaware Bay for 1996 was also less than age 3 [Michels 1997]). The southern population may undertake less extensive offshore migrations (Fogarty *et al.* 1983). Tagging studies indicate that fish which spend their summer in a particular bay tend largely to return to the same bay in the subsequent year or to move to the north and east (Westman & Neville 1946; Hamer & Lux 1962; Poole 1962; Murawski 1970; Lux & Nichy 1981; Monaghan 1992; Desfosse 1995). For example, tagging studies indicate that the majority of summer flounder from inshore New Jersey return to inshore New Jersey the following year. This homing is also evident in summer flounder which return to New York waters, with some movement to waters off Connecticut, Rhode Island and Massachusetts (Poole 1962). Once inshore during the summer months, there appears to be very little movement of inshore fish to offshore waters (Westman & Neville 1946; Poole 1962; Desfosse 1995).

Tagging studies conducted by Poole (1962) and Lux & Nichy (1981) on flounder released off Long Island and southern New England revealed that fish usually began seaward migrations in September or October. Their wintering grounds are located primarily between Norfolk and Veatch Canyons east of Virginia and Rhode Island, respectively, although they are known to migrate as far northeastward as Georges Bank. Fish that move as far north as the wintering grounds north of Hudson Canyon may become rather permanent residents of the northern segment of the Mid-Atlantic Bight (Lux and Nichy 1981). New York and New Jersey fish may move farther south in the winter months and generally may not move as far north in the summer as New England flounder (Poole 1962).

2.2.1.2 Scup

2.2.1.2.1 Range

The following information on scup range is taken directly from the document "FMP-EFH Source Document, Scup, *Stenotomus chrysops*, Life History and Habitat Requirements" (Steimle et al. 1998a). This Steimle et al. (1998a) document is referred to hereafter as the scup EFH background document. Most of the Tables and Figures from scup background document are included in this FMP. This Steimle et al. (1998a) scup EFH background document is currently being modified for publication by NMFS and can be obtained in its entirety from NMFS, James J. Howard Marine Sciences Laboratory, 74 McGruder Road, Highlands, New Jersey 07732.

Scup occur as far north as Bay of Fundy and Sable Island Bank, Canada, although rarely above Massachusetts (Bigelow and Schroeder 1953, Fritz 1965, Scott and Scott 1988) and as far south as South Carolina and occasionally Florida in the South Atlantic Bight (Morse 1978, Manooch, 1984). The management unit is scup in US waters in the western Atlantic Ocean from the US-Canadian border southward to Cape Hatteras, North Carolina, south of there scup are managed by the South Atlantic Fishery Management Council. The "southern porgy", *S. aculeatus*, referred to in a number of South Atlantic Bight studies or reviews (e.g., Morse 1978, Powles and Barans 1980, Sedberry and Van Dolah 1984), is currently not considered a separate species by the American Fisheries Society nomenclature committee (Robins et al. 1991) leading to some taxonomic confusion (Munroe pers. comm.). Miller and Richards (1980) list both *S. chrysops* and *S. aculeatus*, separately, as reef dwellers in the South Atlantic Bight. Although there can be some mixing of the Middle and South Atlantic scup populations in North Carolina waters, the Middle Atlantic population is treated separately here, because only the Middle Atlantic Bight population appears to make extensive seasonal migrations and few fish tagged in New England or New York waters have been caught south of Cape Hatteras (Nesbit and Neville 1935, Finklestein 1971). Within this range they are commonly found during warmer seasons from within larger estuaries and in coastal waters, and along the outer continental shelf to about 656 ft (200 m) and occasionally deeper. Beebe and Tee-Van (1933) also reported that scup had been introduced to Bermuda in about the 1920s, but the status of this introduction is unknown. Archeological evidence suggests scup have been common in southern New England waters for several thousand years and was used as food by native Americans (Waters 1967).

Its life history, in brief, is that the Middle Atlantic Bight population spawns along the inner continental shelf waters off southern New England from May through August, with peaks in June-July. Larvae are found in coastal waters during the warmer seasons, feed upon small zooplankters, and are preyed upon by any variety of planktivores that might be present, including medusae, crustaceans and fish. Larval settlement to the seabed appears to occur in coastal-estuarine waters when the larvae are about 1 in. (25 mm) in length, but this event is poorly known. Juveniles and adults are common in most larger estuaries and coastal areas in both open and structured (sheltering) habitats during the summer and early fall where they feed upon a variety of small benthic invertebrates. Scup begin to mature at age 2 (Finklestein 1969b) and at about 6.2 in. (15.5 cm) FL (O'Brien et al. 1993) and most fish are mature at 3 years and at a length of 8.3 in. (21 cm) FL (Gabriel 1995). In the last century, scup were reported up to 18 in. (45 cm) FL or slightly greater in length (Baird 1873), live up to 20 years and weigh up to about 4.4 lbs (2 kg) (Bigelow and Schroeder, 1953). Presently the population in the Middle Atlantic Bight is composed primarily of younger fish, with few fish being older than 7 years and longer than 13.2 in. (33 cm) FL (NEFSC 1997).

In the winter, scup leave the cold (less than 46-48 °F; 8-9 °C) inshore waters and to the warmer outer continental shelf south of the Hudson Canyon and along the coast from North Carolina to south of Long Island at depths from 250-610 ft (75-185 m; Morse 1978, Bowman et al. 1987). With falling inshore water temperature, juveniles follow adults to wintering areas on the mid to outer continental shelf south of Long Island, although during warmer winters some may remain in larger and deeper estuaries. During this migration they move south along the coast (within the 60 ft [18 m] isobath) and offshore(Hamer 1970) as bottom water temperature decline below 50 °F (10 °C). Adults use slightly deeper coastal waters during the summer but also move offshore with falling coastal temperatures to winter offshore south of Hudson Canyon. Phoel (1985) reported scup migrates south of Cape Hatteras to about Cape Fear, NC in the winter and spring (he assumed one species and no population mixing).

With rising temperatures in the spring, scup return inshore, with the larger fish arriving first. During seasonal migrations and perhaps at other times, scup appear to move in schools of similarly sized fish, and in the spring, schools of subadults have been report to appear in southern New England waters at a slightly later time then adults (Sisson 1974). They reach Chesapeake Bay by April (Hildebrand and Schroeder, 1928) and southern New England by early May (Baird 1873, Perlmutter 1939, Neville and Talbot 1964, Finklestein 1971). Larger fish are usually in the lead during these migrations and it has been suggested that the population moves in schools of similarly sized individuals (Baird 1873, Hildebrand and Schroeder 1928, Neville and Talbot 1964, Sisson 1974, Morse 1978). Fish that arrive early inshore can be caught in pockets of residual cold waters and there is an anecdotal report that, if so, they become inactive or dormant (Kessler and Wicklund 1966).

Scup can be considered as being part of an offshore-wintering guild of fish species, whose movements, residencies and feeding generally coincide with those of several other fishes (Musick and Mercer 1977, Colvocoresses and Musick 1984, Austen et al. 1994, Brown et al. 1996), especially summer flounder *Paralichtys dentatus*, black sea bass *Centropristis striata*, northern sea robin *Prionotus carolinus*, and smooth dogfish *Mustelus canis*, suggesting some biological interactions (Gabriel 1992, Shepherd and Terceiro 1994), although there may slight differences in environmental tolerances and habitat preferences or uses among these species (Neville and Talbot 1964).

2.2.1.2.2 Status of the stock

The following information on scup range is taken directly from the scup EFH background document (Steimle et al. 1998a).

Although the Middle Atlantic Bight population was once considered to be composed of two stocks in the past: southern New England and New Jersey stocks (Edwards et al. 1962, Neville and Talbot

1964, Hamer 1970, Morse 1978), more recent analysis finds the evidence for this segregation weak and does not support two populations and scup is considered one stock in the Middle Atlantic Bight (Pierce 1981, Mayo 1982). Pierce (1981) suggested that the apparent segregation of two stocks in the Middle Atlantic Bight noted in earlier studies may be a artifact of the temporary location of separate winter water masses containing temperatures acceptable to scup; in most years this water mass segregation may be lacking or less influential.

Commercial scup landings in the Middle Atlantic have declined substantially since recent peak landings in the 1950s through early 1960s, with a minor improvement about 1981; recreational landings have also declined (MAFMC 1996, NEFSC 1997; Figure 17). NMFS bottom trawl surveys, although indicating a series of short-term cyclic variations, also show a overall decline since the 1950-1960s and a temporary peak in the mid-1970s (Figure 17) and the stock consist primarily of smaller, < 3 yr old fish with an overall truncation of the age classes present (MAFMC 1996). Recent egg abundance in southern New England has been low, and thought to be cause for concern (Gray 1990). The Middle Atlantic Bight stock is currently considered overexploited and near record low abundance levels (Gabriel 1995, NEFSC 1997).

The recent abundance of this species seems to vary in cycles of about 3-4 years, and to be generally declining based on NEFSC groundfish survey results (Gabriel 1995; Figure 17). Jeffries and Terceiro (1985) reported that slightly warmer average summer temperatures (+1.8 °F; 1 °C) in southern New England coastal waters can increase scup abundance there (and they seem to have an inverse abundance pattern with winter flounder, *Pleuronectes americanus*), based on analysis of a sixteen year temperature and fish abundance data set.

2.2.1.2.3 Habitat requirements by life history stage

The following information eggs, larvae, juveniles, and adult scup habitat requirements is taken directly from the scup EFH background document (Steimle et al. 1998a).

2.2.1.2.3.1 Eggs

Scup eggs are small (0.8-1.0 mm in diameter) and are buoyant (Kuntz and Radcliffe 1918, Wheatland 1956). They require about two to three days (40 - 75 hrs) to hatch, and this incubation period is temperature dependent (Griswold and McKenney 1984). Little else is known of this ephemeral stage.

Habitat requirements

The habitats where scup eggs are common are mostly in larger bodies of coastal waters, such as bays and sounds in and near southern New England during spring-summer. Lebida (1969) reported the eggs are relatively abundant in Buzzards Bay MA from May through June at water temperatures of 47-75 °F (8.5 to 23.7 °C), which was similar to what was found for other Connecticut and Rhode Island estuaries (Herman 1963). Eggs hatch in about 70-75 hrs at 64 °F (18 °C) and 40-54 hrs at 70-72 °F (21-22 °C; Griswold and McKenney 1984), and may not develop normally at temperatures below 50 °F (10 °C; Bigelow and Schroeder 1953). Examination of the NEFSC, 1978-1987, MARMAP ichthyoplankton-survey data indicates that scup eggs were most commonly collected during May-August when integrated water column temperatures were between about 52-73 °F (11 to 23 °C), with a prominent high abundance mode at about 54 °F (12 °C) and a secondary mode at 57 °F (14 °C; Figure 18). The isolated, minor peak at 73 °F (23 °C) probably represents some eggs collected off Maryland-Virginia during the summer (Figure 18, 19). The MARMAP data also indicates that most eggs were collected in relatively shallow water, generally less than 165 ft (50 m; Figures 18).

Distribution and abundance

The eggs of scup are primarily collected in coastal southern New England and abundances can be highly variable. Berrien and Sibunka (in press) reported densities up to 1000 eggs /108 $ft^2$10 m^2 off southern New England, but samples containing > 100 eggs/10 m^2 were rare during the survey period 1978 to 1987, when stocks were relatively low (MAFMC 1996). Berrien and Sibunka (in press) report very few (generally < 10/10 m^2) eggs collected on the continental shelf from May to August (1978-1987), and those that were collected, were mainly from inshore southern New England (and mainly during June and July), with patchy mid-shelf occurrence in Chesapeake Bight in May through August (Figure 19). The MARMAP surveys, which were the basis for Berrien and Sibunka's data, did not survey waters generally shallower than 33 ft (10 m) and excluded most coastal bays; it is probable that eggs were more abundant and widely distributed in nearshore southern New England waters. For example, Wheatland (1956) reported eggs in eastern Long Island Sound and bays, also in May to August, with peak abundance in June-July but he reported three-fold variability in annual abundance in this Sound. Stone et al. (1994) does record eggs common to abundant in saline parts of coastal bays from southern Cape Cod to Long Island Sound and eastern Long Island (and in the Hudson-Raritan estuary). Merriman and Sclar (1952) did not report collecting them in Block Island Sound, however, nor are they reported along the south shore of Long Island or in coastal waters and bay to the south, except for the Hudson-Raritan (Stone et al.1994) or in the Chesapeake Bight, as found in the MARMAP surveys, mentioned above. Despite these summary reports of occurrence, Able and Fahay (1998) note that there has not been a verified collection of scup eggs within southern New England estuaries, since Sisson (1974).

North of Cape Cod, Scherer (1984) also reported the presence of scup eggs in southern Cape Cod Bay during June to August based on collections between 1974-1976 and thought it possible they were transported there from Buzzards Bay through the Cape Cod Canal but there are other reports of the occurrence of eggs in Massachusetts Bay that suggest spawning could occur there (MAFMC 1996).

2.2.1.2.3.2 Larvae

The newly hatched larvae are about 0.08 in. (2 mm) in total length (TL), pelagic and use their yolk for about three days, until they are about 0.11 in. (2.8 mm) TL in length (Bigelow and Schroeder, 1953) and then must begin active feeding. When they grow to about 0.6-1.2 in. (15-30 mm) TL in length (early July), the larvae were reported to become demersal in shoal waters (Lux and Nichy 1971, Johnson 1978, MAFMC 1996, Able and Fahay 1998). Griswold and McKenney (1984) consider the larvae as juveniles when they grow to about 0.72-0.74 in. (18-19 mm) TL. Nothing is reported on habitat use or requirements during this transition period.

Habitat requirements

The larval stage of scup is basically pelagic in coastal-oceanic areas and found during the warmer months. Larvae have been reported in the more saline parts of Long Island Sound and eastern Long Island bays, Narragansett Bay, Buzzards Bay, Vineyard Sound and into Cape Cod Bay from May through September at water ranging from about 57-72 °F (14-22 °C), with greatest densities between about 59-68 °F (15-20 °C; Fish 1925; Wheatland 1956; Pearcy and Richards 1962; Herman 1963; Scherer 1984; MAFMC 1996). The MARMAP larval data indicates a strong abundance peak at 17 °C (Figure 20). Herman (1958) found larvae when water temperatures were between 68-74 °F (20.0-23.5 °C), and Lawrence (1979) found 64 °F (18 °C) was the optimum for rearing larvae in the laboratory.

Distribution and abundance

The areas where scup larvae are abundant is even more puzzling than the limited distribution of eggs. Although Kendall (1973) notes that larvae occur offshore from Virginia to Cape Cod and in estuaries from Delaware Bay to Buzzards Bay, the 1977-1987 NEFSC's MARMAP ichthyoplankton surveys collected few larvae (<5/tow) and these were collected mostly inshore (about 100 ft; 30 m) off Rhode Island in July (Figures 21). Stone et al. (1994) note the occurrence of scup larvae in all southern New England bays where scup eggs were found, i.e., from southern Cape Cod to Long Island Sound and in the Hudson-Raritan Estuary. Despite these summary reports of occurrence, Able and Fahay (1998) note that there has not been a verified collection of scup larvae within southern New England estuaries, since Sisson (1974).

Scup larvae were not listed as being collected in the New York Bight coastal and shelf waters from July to August,1988 (Cowen et al. 1993) nor in bays and estuaries to the south. Scup larvae have not been commonly reported near or in Chesapeake Bay (Pearson 1932, Massman et al. 1961, Dovel 1967, Olney 1983) or in some smaller Middle Atlantic Bight estuaries (Scotton 1970, Pacheco and Grant 1973, Dovel 1981, Himchak 1982, Berg and Levinton 1985, Monteleone 1992), being especially rare south of New Jersey (Morse 1982). For example, deSylva et al. (1962) reported only a few larvae collected in Delaware Bay, which is thought to be an important juvenile nursery area (see below).

North of Cape Cod, Clayton et al. (1978) reported larvae from Rocky Pt. (Plymouth MA) in northwestern Cape Cod Bay, possibly coming through the Cape Cod Canal from Buzzards Bay (Scherer 1984), and there is a possibility of spawning in Massachusetts Bay based on presence of eggs and larvae there (MAFMC 1996).

2.2.1.2.3.3 Juveniles

Able and Fahay (1998) noted that the smallest young-of-year appear in estuaries in June. In southern New England juvenile scup grow to 2 to 3.2 in. (5 to 8 cm) FL long by September and to about 2.4 to 4 in. (6-10 cm) FL by November in New England (Bigelow and Schroeder, 1953; Simpson et al., in press). Growth of young-of-year (YOY) scup is considered relatively slow (Able and Fahay, 1998). Michelman (1988) estimated daily juvenile weight growth by two methods: at 0.84% dry wt (length frequency method) and 0.93% dry wt (bioenergetic method). The growth production rates were between 0.15 and 0.40 g dry wt/10.8 ft^2 ($1 m^2$) with a growth efficiency of about 24%. They do not appear to grow much during the winter as the returning juveniles in the spring are also about 10-13 cm FL (Michelman 1988, Able and Fahay 1998). Growth rates and curves for juvenile and adult scup have been reported by several studies, see MAFMC (1996). Wilk et al. (1978) examined length-weight, i.e., growth pattern, relationships of male and female scup from the New York Bight and found no significant difference in this relationship between sexes within an 4.4-14.4 in. (11-36 cm) FL size range; the relationship for 2234 fish, 1.1-14.9 in. (27-380 mm) FL, was $\log W = \log(-5.022) + 3.169 \log FL$, where W is weight in grams and fork length (FL) is in mm; there are similar relationships reported in MAFMC (1996). Penttila et al. (1989) show growth in length is curvilinear between 4-25 in. (10-38 cm) FL, corresponding to ages about 1 to 13 yrs, being relatively rapid at smallest sizes (e.g., 4-6 in.; 10-15 cm FL) and declining with increase in length-in-age.

Habitat requirements

Juvenile scup are most common inshore during the warmer months. They have been collected at water temperatures between 45-81 °F (7-27 °C), with thermal modes of highest abundance shifting from about 50 °F (10 °C) in the winter-spring to apparent bimodal peaks at about 61 and 72 °F (16 and 22° C) in the summer-fall (Figures 20, 21, ans 22a-d). Subadults, that usually follow the migrations of adults south in the fall, have been reported to be killed by sudden cold spells in shallow New England bays (Baird, 1873; Sherwood and Edwards, 1901; Morse, 1978). Thomson et al. (1978), however, reported juveniles overwintered in Long Island Sound during 1971-1975. Bigelow and Schroeder (1953) reported that they grow very little during the winter. Everich and Gonzalez (1977) reported a hyperthermal maxima of between 86-96 °F (30.2 - 35.6 °C), depending on the acclimation process.

Juveniles appear to use a variety of coastal sedimentary habitats during their seasonal inshore residency, but the specific type of offshore habitat they use during the winter is poorly known. In Rhode Island, YOY scup have been observed or collected in intertidal to subtidal areas, over sand, silty-sand, shell, mud, mussel beds, and eel grass beds(Baird 1873) with the presence of structure being important (Gray 1990). Richards (1963a) collected more juvenile scup on a sandy subtidal (30 ft; 9 m deep) area than on a 56 ft (17 m) deep, muddy one in Long Island Sound. Gottschall et al. (in review) report yr 1 juveniles were found on varying sediment types at different times of the warm season. Greeley (1939), Warfel and Merriman (1944), Briggs and O'Connor (1971), Himchak (1982), Weinstein and Brooks (1983), Sogard (1989),and Sogard and Able (1991) do not report scup common in shoreline seine or in throw trap collections in Chesapeake Bay, Long Island or New Jersey estuaries on vegetated and unvegetated habitats; however, Derickson and Price (1973) do mention the occurrence of scup in Delaware's smaller coastal bays. The specific benthic habitat that juvenile and adult scup use while wintering offshore is poorly known, and the winter-spring distribution maps cover a variety of habitats, from relatively flat, open sandy-silty bottoms to submarine canyon heads and other areas with topographical relief and varying sediments. Auster et al. (1991, 1995) observed juvenile scup using biogenic depressions in the sediments off southern New England in the fall, and the size of the scup in the depressions seemed to be directly related to the size of the depressions. They may use small depressions, sand waves and possibly molluscan shell fields for winter shelter, too.

The summer inshore residency means most of the stock is in relatively shallow water. During the warmer months small scup (YOY and age 1+) are found in many tidal bays, sound and coastal areas within the about 125 ft (38 m) contour (Morse, 1978; Figure 23), but this occurrence appears to be mainly north of Maryland. Zawacki and Briggs (1976) commonly seined them on the north shore of Long Island during July to October (complimenting Gottschall et al. (in review) trawl results in deeper waters), but not Schaefer (1967) or Briggs (1975a) in south shore estuaries or the surf zone. In Raritan Bay juvenile scup are most commonly collected in depths between approximately 17 and 33 ft (5 and 10 m). Juvenile scup's occurrence in New Jersey's coastal bay and estuaries is spotty, being collected in the larger Delaware and Raritan Bays (deSylva et al. 1962, Werme et al. 1983), but seldom in smaller coastal lagoonal bays, such as Barnegat Bay or tributaries of the Hudson-Raritan estuary in recent years (Marcellus 1972, Howells and Brundage III 1977, Vouglitois 1983, Wilk et al. 1997a-b). Arve (1960) and Schwartz (1961, 1964) do not report them using any habitats in Maryland-Virginia seaside bays to any great degree, however, nor did Orth and Heck (1980) report them abundant in lower Chesapeake Bay vegetated sites. However, they were collected by Richards and Castagna (1970) in their survey of Virginia's seaside bays.

Distribution and abundance

Despite our weakness of understanding of where scup eggs and larvae are found or abundant, juveniles are still collected widely, inshore and offshore from New England to the Chesapeake Bay area, during various surveys. During warmer months, juvenile scup are common in the shallower, less than 135 ft (40 m; intertidal in bays and estuaries and along the inner continental shelf), and more saline (>15 ppt) portions of Middle Atlantic Bight from about May to about November (Smith 1898, Breder 1922, Kendall 1973, Werme et al. 1983, Bowman et al. 1987, Szedlmayer and Able 1996, Gottschall et al. in review). YOY scup can be locally abundant north of Cape Cod (Clayton et al. 1978) especially in the fall (Lux and Kelly 1982; Figure 22 c). They have not occurred in large numbers in Chesapeake Bay during the summer in recent years, but were formerly more common (MAFMC 1996) and are common at the mouth of the Bay (Figure 22b). However, saline areas of Delaware Bay, Raritan Bay, Long Island Sound and Narragansett Bay seem to be important nursery areas (Richards 1963a, Abbe 1967, Oviatt and Nixon 1973, Werme et al. 1983, Michelman 1988, Gray 1990, Wilk et al. 1997a-b, Gottschall *et al.* in review). Smith (1894) reported juvenile scup were very abundant from Barnegat NJ to Hyannis MA in 1891; and Moore (1894) reported them not common further south than New Jersey. More recently, scup have not been reported common in multi-year studies of Barnegat Bay (Marcellus 1972, Vouglitois 1983) and were variably collected in New Jersey estuaries further south, e.g., within Hereford Inlet, NJ (Allen et al. 1978). Gottschall et al. (in review) report YOY scup, of about 1.6 in. (4 cm) FL, are first collected in Long Island Sound in August and become numerical dominants in the catch by September; they also report yr 1 juveniles appear in April.

Since the basic NEFSC groundfish surveys post-date the last period of peak scup abundance, ~1950-1965 (NEFSC 1997), Figure 22b shows overall warm season (fall) distributions on the continental shelf for relatively low stock abundance since about 1965. The only apparent change in this general coastal distribution pattern was in the late 1960s, when the juveniles were basically clustered only in two areas: off southern New England and off Virginia-North Carolina. This apparent clustered distribution has not persisted and there are little difference in juvenile distributions at recent relatively high and low population abundance levels.

2.2.1.2.3.4 Adults

Adult scup are common summer residents along the Middle Atlantic Bight, and are found generally in schools on a variety of habitats, from open sandy bottom to structured habitats such as mussel beds, reefs or rough bottom. Smaller sized scup are common in larger bays and estuaries and larger sizes tend to be in deeper waters. Schools are reported to be size structured (Morse 1978). Scup mature at about two years of age and 50 % of both sexes are reported to be mature when they achieve a length of 6.2 in (15.5 cm) FL (O'Brien et al. 1993).

Reproduction

Scup spawn once a year. The mean fecundity of 7 -9 in. (17.5-23.0 cm) FL scup has been reported to be about 7000 (" 4860 SD) eggs/female (Gray 1990). Spawning begins in the spring during inshore migration (Kendall 1973) where water temperatures are above 50 °F (10° C), e.g., May to June in eastern Long Island (NY) bays and Raritan Bay (NY-NJ) (Breder 1922, Finklestein 1969a). It continues to July along coastal Rhode Island (Werme et al. 1983) and extends to August when temperature were about 75 °F (24° C; Herman 1958), with a peak in June (O'Brien et al. 1993). In southern Massachusetts, spawning fish are found in less than 33 ft (10 m) shoal areas until late June, then they move to deeper waters (MAFMC 1996). Although scup were common in the spring, Eklund and Targett (1990) did not observe spring spawning over a hard bottom, reef habitat off Maryland-Virginia; the scup they observed appeared to be migrants as few remained summer residents in the study area. Spawning has been reported monthly in southern New England (including eastern Long Island Sound and Peconic and Garner's Bays) from Massachusetts Bay south and into the New York Bight (Goode 1884, Kuntz and Radcliffe 1918, Nichols and Breder 1926, Perlmutter 1939, Bigelow and Schroeder 1953, Wheatland 1956, Richards 1959, Finklestein 1969a, Sisson 1974, Morse 1978, Clayton *et al.* 1978), including Raritan Bay (Breder 1922). Spawning was not reported south of New Jersey (Morse 1982) and near or in Chesapeake Bay (Hildebrand and Schroeder 1928, Pearson 1932), however, Berrien and Sibunka (in press) show that eggs are present in this area between 1978 and 1987, although not abundant or widespread. Able and Fahay (1998) note that there has been no reported evidence of spawning in a number of specific areas within the overall areas were eggs have been found, e.g., Block Island Sound, Great South Bay (NY), the Hudson River estuary, and Great Bay (NJ). Although Breder (1922) reported ripe scup in the Hudson-Raritan estuary (presumed to be spawning), more recent studies in the estuary usually do not list the collection of scup eggs or larvae, e.g., Croker (1965), Berg and Levinton (1985); Esser's (1982) note on scup spawning in the estuary is unreferenced and most likely is based on Breder (1922).

Ferraro (1980) suggests that scup spawn in the morning in Peconic Bay Long Island, which is atypical of most fish, which generally spawn in the evening or at night. Morse (1978) reported that spawning is usually over weedy or sandy areas. Fertilization is external with no parental care (Morse 1978). Scup may abstain from feeding during spawning (Baird 1873, Bigelow and Schroeder 1953, Morse 1978). Some years spawning is considered a failure, e.g., 1958 (Edwards et al. 1962), even though spawning stocks were still near peak abundance, based on landings (MAFMC 1996); the relationship of this apparent failure to environmental or habitat variables are unknown. Spawning coincides with that of several other fish, such as weakfish *Cynoscion regalis*, tautog *Tautoga onitis* and northern sea robin (Morse 1978).

Habitat requirements

The characteristics of habitats commonly used by adult scup are similar to that used by juveniles. Adult scup also use coastal habitats until bottom water temperatures decline to below 46-50 °F (7.5-10° C) in the fall, then they begin to migrate offshore following their preferred minimum temperature range as suggested in Figures 24a-d. In New Jersey, they are reported to aggregate within the 20 m depth coastal zone as they begin their southerly and offshore movements (MAFMC 1996).

Adult scup are also often observed or caught over soft, sandy bottoms and on or near structured euryhaline habitats, such as submerged structures, rocky ledges, wrecks, artificial reefs, and mussel beds (Briggs 1975b, Eklund, 1988, MAFMC 1996). Because they use schooling as a defense strategy and have an eclectic benthic diet, they are probably not dependent on structure as habitat, although they can benefit from it. In Long Island Sound, they exhibit a strong preference for transitional sediments (mixed sand and mud) which are probably rich in small benthic prey. As for juveniles, the specific benthic habitat used by scup during the winter is not precisely known and the distribution of collections can include a variety of benthic habitat types that differ in sediment composition, potential availability of food, and structure or relief (Wigley and Theroux 1981, Steimle 1990). The use and value of these differing habitats within these winter distributions, and during seasonal migrations, to scup is not specifically known.

Although basically a demersal species, scup are reported to be occasionally observed at the water surface (Bigelow and Schroeder 1953). Magnuson *et al.* (1981) reported that scup may aggregate north of transient Gulf Stream frontal boundaries off Cape Hatteras in at least the fall where there was about a 15 °F (78 vs 63°F) temperature differential, although they had taxonomic uncertainties about the *Stenotomus* species involved.

Table 3 summarizes available information on the habitat usage, parameters and preferences for each major life stage of the population of scup north of Cape Hatteras NC.

Distribution and abundance

Adult scup are reported more widely distributed than other life stages of this species. Scup have been reported as summer visitors far north as Bay of Fundy, southern Nova Scotia and Sable Island Bank (Scott and Scott 1988) and possibly scattered occurrences up to the southern Grand Banks as part of a seasonal migrant guild of Middle Atlantic Bight fish (Brown et al. 1996); however the southern limits of the northern population (if indeed it is separate from the southern population and the same species) is operationally defined as Cape Hatteras, but it might extend further south, as suggested by Phoel (1985). They are mostly found in the Middle Atlantic Bight, however, being warm-seasonal migrants into coastal New England waters (Bigelow and Schroeder 1953, Richards 1963, Scott and Scott 1988, Morse 1978, Chang 1990).

During the summer, larger scup are found in or near the mouths of larger bays or in the coastal ocean, within the 122 ft (37 m) contour (Morse 1978); these larger fish also tend to stay in schools of similarly sized individuals. Their distribution and abundance off New England is temperature sensitive (Mayo 1982, Gabriel 1992) and also contingent on population levels. Smaller fish are found in more saline (> 15 ppt) shallow bays and parts of estuaries (Morse 1978) but they may not be abundant in all bays, e.g., not in Maryland (MAFMC 1996) or interpier or other areas of the New York Harbor (Stoecker et al. 1992, Will and Houston 1992), Barnegat Bay NJ (Marcellus 1972, Vouglitois 1983, Tatham et al. 1984), although they were reported in Hudson-Raritan Estuary (Werme et al. 1983, Wilk et al. 1997a-b) and Hereford Inlet NJ (Allen et al. 1978).

Winter migrating adult scup usually arrive offshore in December and winter in deep water from off Nantucket Shoals to Cape Hatteras to depths of about 610 ft (185 m; Pearson 1932, Neville and Talbot 1964, Morse 1978; Figures 25). Their density and geographic distribution during the winter depends on the location of the 45 °F (7.0 °C) bottom water temperature isotherm, their reported lower preferred limit (Neville and Talbot 1964). Nesbit and Neville (1935) indicated that this variable band of warmer outer continental shelf water is mostly influenced by the Gulf Stream, just off the shelf. During warm winters scup can be found across most of the continental shelf south of New Jersey (Nesbit and Neville 1935).

2.2.1.3 Black sea bass

2.2.1.3.1 Range

The following information on black sea bass range is taken directly from the document "FMP-EFH Source Document, Black Sea Bass, : Life History and Habitat Requirements" (Steimle et al.1998b). This document is referred to hereafter as the black sea bass EFH background document. Most of the Tables and Figures from the black sea bass EFH background document are included in this FMP. This black sea bass EFH background document is currently being modified for publication by NMFS and can be obtained in its entirety from NMFS, James J. Howard Marine Sciences Laboratory, 74 McGruder Road, Highlands, New Jersey 07732.

The species is basically warm-temperate in distribution, and usually strongly associated with structured, sheltering continental shelf and coastal habitats, such as reefs and wrecks. It has been collected or reported from southern Nova Scotia and Bay of Fundy (Scott and Scott 1988) to southern Florida (Bowen and Avise 1990) and into the Gulf of Mexico. The management unit is black sea bass in the western Atlantic Ocean from the US-Canadian border southward to Cape Hatteras, North Carolina, south of there black sea bass are managed by the South Atlantic Fishery Management Council. Beebe and Tee-Van (1933) also reported that they were once introduced to Bermuda; but the status of that introduction is unknown. Brown et al. (1996) reported that the summer migrant fish assemblage, that black sea bass is associated with, has also been reported from scattered sites on the Grand Banks of Canada; however, it is rarely found in the cool waters north of Cape Cod and into the Gulf of Maine (Scattergoode 1952, DeWitt et al. 198, Short, 1992). Over this wide distribution, the species is considered as three populations or stocks (northern, southern, Gulf of Mexico), with the northern stock, occurring north of Cape Hatteras, being the focus of this summary review. The life history and habitat uses of the southern and Gulf of Mexico populations, occurring south of Cape Hatteras, are covered in the Southeast Fishery Management Council's reeffish FMP.

Beginning with the eggs and larvae of this species, they are generally collected on midshelf to coastal waters in the late spring to late summer (see below for details). Larvae are believed to settle in coastal waters and then as early juveniles move into estuarine or sheltered coastal nursery areas, possibly in the two-step process: nearshore accumulation and estuarine passage, suggested by Boehlert and Mundy (1988). During the warmer months, juveniles are found in estuaries and coastal areas, and adults are found in slightly deeper coastal areas, between North Carolina and Massachusetts, often near some kind of shelter. Adults summer in coastal areas, usually containing some structured habitat, along the Middle Atlantic Bight and into the Gulf of Maine. As coastal waters cool in the fall, the population gradually migrates south and offshore to winter on the slightly warmer outer continental shelf off and south of New Jersey. Temperature appears to be the limiting factor in black sea bass distribution, not the availability of structured habitat, north of Cape Cod. In Middle Atlantic Bight waters they are usually the most common fish found on these structured habitats, especially south of New Jersey where the abundance of cunner, *Tautogolabrus adspersus,* declines. These structured habitats have been reported to include shellfish (oyster and mussel) beds, rocky areas, shipwrecks and artificial reefs (Verrill 1873, Bigelow and Schroeder 1953, Musick and Mercer 1977, Steimle and Figley 1996).

One major distinguishing characteristic of the Middle Atlantic Bight population is that it migrates south and offshore to winter in deeper waters between central New Jersey and North Carolina, generally, as bottom water temperatures decline below about 57 (14 °C) in the fall. This population then migrates inshore to reside in southern New England and Middle Atlantic Bight coastal areas and bays as bottom waters warm again above about 45 °F (7 °C) in the spring (see juvenile and adult distribution discussions below for details). The southern population is not known to make this extensive migration but may move away from shallow coastal areas during periods of cold winter conditions, especially in the Carolinas. Larger fish are commonly found in deeper waters and usually associated with rough bottom (Smith 1907, Hildebrand and Schroeder 1923, Bigelow and Schroeder 1953). Black sea bass have been reported to attain lengths of over 24 in. (60 cm) and weights of 7.7 lbs (3.5 kg) or greater in the Middle Atlantic Bight (Bigelow and Schroeder 1953) and live to up to 20 years; these largest and oldest fish being almost always males.

As previously mentioned, one of the characteristics of this population of black sea bass is its seasonal migrations. The summer coastal population migrates in scattered aggregates in the fall (Musick and Mercer 1977) by generally unknown routes across the continental shelf from the inshore areas to the outer continental shelf wintering areas south of New Jersey as bottom temperatures decline. The locations of a time series of tag returns from adult fish tagged in Nantucket Sound MA suggests that this local group of fish migrates directly south to the outer shelf near Block Canyon and moves southwest along this outer shelf zone to the vicinity of Norfolk Canyon, and returned by the same route (Kolek 1990). Offshore migrations are stimulated in the fall as coastal bottom water temperatures approach 45 °F (7 °C) and the return inshore migration begins in the spring (about April) as inshore bottom water temperatures rise above this 45 °F (7 °C) level (Nesbit and Neville 1935, June and Reintjes 1957, Colvocoresses and Musick 1984, Chang 1990, Shepherd and Terceiro 1994). Larger fish (again with a high proportion of males) begin migrating offshore sooner than smaller fish (Kendall 1977).

Black sea bass migrations appear to part of migration of a group of warm temperate species that are intolerant of colder inshore winter conditions, and these migrant associate species can include scup, summer flounder, northern sea robin, spotted hake, butterfish and smooth dogfish (Musick and Mercer 1977, Colvocoresses and Musick 1984); the composition of the seasonally migrating group that typically contains black sea bass is reported to vary inshore between spring-summer and fall (Phoel 1985). Any interactions among these species and their shared use of the habitat they transit are unknown, although juvenile-subadult black sea bass could be preyed upon by larger summer flounder and dogfish (see above). All other species, except butterfish, would be competitors for food and perhaps shelter, even if it were only a depression in the sediment or a exposed clam shell.

2.2.1.3.2 Status of the stock

The following information on black sea bass stock status is taken directly from the black sea bass EFH background document (Steimle *et al.* 1998b).

The species is presently considered "overexploited" in the Middle Atlantic Bight, and recent CPUE and survey indices have been moderate to low compared to levels in the mid-1970s (Figure 26), and before 1965, with recent both poor (1992-1993) and above-average (1994) juvenile recruitments reported (Shepherd, 1995; MAFMC 1996; NEFSC 1997). Spawning stock estimates suggest it has been relatively stable since 1984 (NEFSC 1997). Arve (1960) attributed declining black sea bass catches in the late 1950s (compared to the relatively high levels of the early 1950s) to a decline in oyster beds, an interesting speculation.

The black sea bass population south of Cape Hatteras, to about Cape Kennedy FL in the South Atlantic Bight, is considered distinct population (Mercer 1978, Shepherd 1991, Collette and Klein-MacPhee in prep.) and the Gulf of Mexico population is considered as a distinct subspecies, *C. s. melanus*, based on sharp genetic and other distinctions (Link 1980, Bowen and Avise 1990). Within the northern population stock, no subpopulations are currently identified, although the evidence of a putative local Nantucket Sound population suggested by Kolek's (1990) study, mentioned above, bears further consideration.

2.2.1.3.3 Habitat requirements by life history stage

The following information eggs, larvae, juveniles, and adult black sea bass habitat requirements is taken directly from the black sea bass EFH background document and is summarized in Table 4(Steimle *et al.* 1998).

2.2.1.3.3.1 Eggs

The northern population spawns on the Middle Atlantic Bight continental shelf during the spring trough fall, and their eggs are pelagic (Able and Fahay 1998). Spawning begin in the spring in the southern portion of the range of this population, i.e., off North Carolina and Virginia, and progresses north into southern New England waters in the summer-fall; eggs are naturally, closely associated with spawning. The incubation period of the eggs was reported to be five days (~120 hrs) for *C. striata striata* at 59 °F (15 °C) in the Middle Atlantic Bight (Kendall 1972); but Able and Fahay (1998) give an briefer incubation period range, between 35 to 75 hours, that is dependent on ambient surface water temperature. Little else is known or can be said of this passive stage.

Habitat requirements

In general, the habitat requirements of planktonic stages of temperate "reef fishes" are thought to be little different from many tropical species. These requirements involve highly complex biological, physical and chemical interactions such as predation, oceanographic processes, and food availability (Richards and Lindeman 1987), and a greater exposure to anthropogenic alterations. The effects and interactions among these recruitment processes and habitat parameters can be somewhat chaotic or random. The specific oceanographic characteristics and tolerances associated with black sea bass egg concentrations are poorly known, but MARMAP data shows that the eggs are most frequently collected at average water column temperatures between about 54-75 °F (12-24° C), with a mode evident at about 59-64 °F (15-18° C), except in January and during August-September when there seems to be a secondary mode at about 68-72 °F (20-22 °C; Figure 27a). The buoyant eggs were also collected mostly in less than 165 ft (50 m) water depths, but a substantial percentage (>5%) were collected in waters greater than 792 ft (240 m) in May and October (Figure 27b). These wide ranges of occurrences undoubtedly reflect the relatively long spawning period, that begins in the spring and extends into the fall, and the seasonal changes in water temperature and adult population location (from offshore to inshore).

Hoff (1970) found that lab-spawned *C. striata melanus* eggs and larvae were sensitive to high salinity, low pH, high nitrite-nitrate concentrations, and temperature extremes; no such data are known for *C. striata striata*, although similar sensitivities might be expected.

Distribution and abundance

Black sea bass eggs are buoyant and have been collected during NEFSC MARMAP surveys in the water column across most of the Chesapeake Bight (North Carolina to Delaware) continental shelf and in the inner continental shelf of the New York Bight (New Jersey and Long Island; Figure 28; Berrien and Sibunka in press), and have been reported in Buzzards Bay, Massachusetts (Stone *et al.* 1994). In this area, the highest egg concentrations were collected between May and October, although they were collected in January and April, as well (with the month of February not being surveyed). Eggs were reported inconsistently in Long Island Sound (Merriman and Sclar 1952, Wheatland 1956, Richards 1959), but were not reported in Delaware Bay (Wang and Kernehan 1979) or Narragansett Bay (Bourne and Govoni 1988). Eggs collected as early as January and April off Cape Hatteras were possible products of the spawning of the South Atlantic Bight population being transported by the inner edge of the Gulf Stream as it flows north closely by Cape Hatteras (Mercer 1978).

2.2.1.3.3.2 Larvae

Because of the relatively short incubation period, larvae are also found near black sea bass spawning areas during the spring and summer. Larval length at hatching is about 0.59-0.83 in. (1.5-2.1 mm) SL (Fahay 1983). The duration of the pelagic larval stage is unknown. Tucker (1989) reported larval black sea bass can grow for two days before their yolk is exhausted, but will die within three days thereafter if they can not acquire enough planktonic food. Cowen *et al.* (1993) classified black sea bass larvae as belonging to a New York Bight mid-summer, coastal assemblage, which usually included a cusk-eel (*Ophidion* sp.). Larvae settle and become demersal in coastal areas when they grow to about 0.4-0.64 in. (10-16 mm) TL (Able and Fahay 1998), although Kendall (1972) reported that settlement might be delayed until they are 1 in. (25 mm) TL. Allen *et al.* (1978) reported 0.6-0.68 in. (15-17 mm) black sea bass larvae (transitional to juveniles) in epibenthic sled collections off the oceanic side of the upper Cape May peninsula (NJ) in late July.

Habitat requirements

Because the duration of larval stage and habitat-related settlement cues are unknown, the distribution and habitat use of this pelagic stage may only partially overlap with that of the egg stage. MARMAP hydrographic data show that larvae are most frequently or abundantly collected in waters with an average water column temperature range of about 52-79 °F (11-26 °C), but mostly between about 55-70 °F (13-21 °C; Figure 29a); this is a slightly wider range than found for the eggs. They are also generally collected at depths of less than 330 ft (100 m), but with some significant collections during May-July and October over deeper (greater than 660 ft; 200 m) water (Figure 29b). These deep water occurrences could reflect off-shelf transport effects of Gulf Stream gyres (or other oceanographic processes) and possibly result in a reduction of any opportunity of these larvae to settle inshore and find their way into estuarine nurseries.

Distribution and abundance

MARMAP collections of larvae from the water column were reported from January to November from near Cape Hatteras to southern New England (Figure 30a), and collections seasonally progressed northward and shoreward from the Cape Hatteras area, mostly during June through October with some larvae still being collected in November in isolated areas (Kendall 1972, Able *et al.* 1995a; Figures 31a-j). Pearson (1941) reported black sea bass larvae were more commonly collected by plankton nets in subsurface waters than surface tows in June-July, 1929-1930, at the mouth of and in the lower Chesapeake Bay during July.

As discussed above in Section 2b, larvae were rarely reported from within estuaries, regardless of the size of the estuary. For example, Pacheco and Grant (1965) found black sea bass larvae in Delaware's Indian River estuary in only one of three survey years, and a later, two-year survey found none in this estuary (Scotton 1970, Derickson and Price 1973). Larvae were not reported in Delaware Bay (Wang and Kernehan 1979), Great Bay NJ (Able and Fahay 1998) or Hudson-Raritan Estuary (Croker 1965, Dovel 1981). Few larvae were collected in Cape Cod Bay (Scherer 1984), Narragansett Bay RI (Herman 1962, Bourne and Govoni 1988) and rarely in other southern New England estuaries (Stone *et al.* 1994). Neither eggs nor larvae were collected in Connecticut's Mystic River estuary (Pearcy and Richards 1962). Larvae have been reported, however, in high salinity coastal areas of southern New England in August and September (Stone *et al.* 1994, Collette and Klein-MacPhee in prep.). Able *et al.* (1995a), discussing Kendall's (1972) note about the absence of larvae in many estuarine surveys, believes that larval settlement occurs in nearshore marine waters, but not usually in estuaries.

2.2.1.3.3.3 Juveniles

It appears most juvenile settlement does not occur in nursery estuaries, but in coastal areas and then these recently settled juveniles somehow find their way to estuarine nurseries. For example, Adams (1993), during semi-monthly to monthly monitoring, reported a "major settlement" of less than 1.2 in. (3.0 cm) juvenile black sea bass in August 1992, approximately 9.3 miles (15 km) off the Virginia-North Carolina border near an artificial reef complex. He did not note such a settlement the previous year, however. These fish were observed by diving and were found singly or in small groups associated with shelter on the artificial reef or in depressions in the nearby sand containing shell fragments. The transport mechanism or behavior that move these early juveniles into estuaries are presently unknown (Able and Fahay 1998).

Although we do not know how they locate estuaries, young-of-year (YOY) juveniles are known to enter Middle Atlantic Bight estuarine habitats generally in July to September (Able *et al.* 1995b, Able and Hales 1997). This entry appears earliest to the south, e.g., Kimmel (1973), reported the occurrence of 1.2-5.8 (30-146 mm) juveniles in Magothy Bay, Virginia, as early as March and later elsewhere in Chesapeake Bay (Chesapeake Bay Program 1996). But Richards (1963a,b) did not find them in central Long Island Sound until September and October. Older juveniles return to estuaries in late spring, early summer and may follow the migration routes of adults, to some degree, into coastal waters.

The use of estuaries by juveniles black sea bass has been long known. For example, Bean (1902) reported that juveniles were "very common" in Great South Bay, New York, and Great Egg Harbor Bay, New Jersey, estuaries, as did Sherwood and Edwards (1902) in Vineyard Sound, Massachusetts, but here they noted they were decreasing in abundance at that time.

The seasonal recruitment of YOY black sea bass to estuaries seems to be annually and perhaps spatially variable. For example, Able *et al.* (1995b) reported juvenile black sea bass to be a dominant species in the late summer assemblage in New York Harbor within and near shoreline piling fields, based on the use of traps during 1993. Juvenile black sea bass were also collected in relatively high abundance (averaging 1.2-5.5 per tow) from trawls in adjacent Raritan Bay during late summer 1997 (D. McMillan unpubl. data), but they were rarely collected the previous five years of surveys in that estuary. Howells and Brundage (1977) reported them to be rare in the Arthur Kill tributary of the Hudson-Raritan Estuary, as did Breder (1922) and Wilk *et al.* (1996) for Raritan and Sandy Hook Bays, and none were collected in Newark Bay (Wilk *et al.* 1997) in the early 1990s.

The irregularity of occurrence noted in the Hudson-Raritan Estuary monitoring can explain why they have not been collected or found commonly in all Middle Atlantic Bight estuaries. For example, Marcellus (1972), Vouglitois (1983), and Tatham *et al.* (1984) reported there were no or only minor use of Barnegat Bay, New Jersey, as black sea bass nursery habitat; although Allen *et al.* (1978) reported Hereford Inlet Estuary, New Jersey, about 60 km south, was found to be an important black sea bass nursery area during several years of monitoring, but they also reported significant fluctuations in annual abundance.

The estuarine nursery habitat of black sea bass has been reported to be relatively shallow, hard bottom with structure (sheltered places for the fish to lie beside or retreat to), such as shellfish (oyster and mussel), sponge, amphipod (*Ampelisca abdita*) tube, and sea grass beds (especially *Ruppia*), wharves, pilings, wrecks, artificial reefs, crab and conch pots, cobble and shoal grounds (the latter in southern New England waters to Cape Cod) and salinities above 8 ppt (Bean 1888, Moore 1892, Sherwood and Edwards 1902, Arve 1960, Hildebrand and Schroeder 1972, Kendall 1972, Derickson and Price 1973, Musick and Mercer 1977, Clayton *et al.* 1978, Weinstein and Brooks 1983, Feigenbaum *et al.* 1989, Able et al. 1995a) and at the mouths of small salt marsh creeks (Werme 1981, Hales and Able 1994, Szedlmayer and Able 1996, Able and Hales 1997). However, Able *et al.* (1995a) reported little use of eelgrass in New Jersey. Juveniles were not common on open, unvegetated-unstructured sandy intertidal flats or beaches (Allen *et al.* 1978), or deeper, muddy bottoms (Richards 1963b). Bean (1888) and Allen *et al.* (1978) reported that larger juveniles used deeper estuarine channels. In some urbanized areas, such as in the Hudson-Raritan estuary, there were early reports of juvenile black sea bass using habitats formerly common but now rare, such oyster beds near Staten Island (Nichols and Breder 1927) and eelgrass beds in

Gravesend Bay, Brooklyn (Bean 1902); recent surveys have found red beard sponge (*Microciona prolifera*) beds continue to serve as sheltering habitat for YOY recruits in this estuary, as they were usually collected only when this sponge was common in trawl hauls (F. Steimle unpubl. observations) .

Within estuarine nurseries, YOY and older juveniles can use different parts of the available habitat. For example, older juveniles were reported to tend to stay in shallower waters, e.g., < 10 m (Musick and Mercer 1977), but not in the shallow shoals and marsh fringe favored by YOY, although they were reported to use nearby channels (Bean 1888, deSylva *et al.* 1962, Richards and Castagna 1970, Zawacki and Briggs 1976, Szedlmayer and Able 1996), jetties (Schwartz 1964) and bridge abutments (Allen *et al.* 1978). Dixon (pers. comm. 1998). Werme (1981) reported that seasonally invasive, juvenile (1.2-3.0 in.; 3.0-7.5 cm TL) black sea bass shared a southern Massachusetts sandy, saltmarsh creek bottom during the summer (August-September) with juvenile tautog, *Tautoga onitis*, and winter flounder, *Pleuronectes americanus*. While there, there were differences in diets among these species that would limit competition.

Juvenile black sea bass seem to grow relatively fast in estuaries during a summer season. For example, Schwartz (1961) reported 1.2-1.5 in. (30-37 mm) juveniles, which occurred in Virginia east shore bays as early as April, and grew to between 4 and 8 in. (98 and 182 mm) by November. This is consistent with Able and Fahay's (1998) note that YOY reach up to 100 mm by the fall. Able and Hales (1997) reported mean growth rates for 0+ and 1+ aged YOY black sea bass in coastal southern New Jersey of about 0.02in./day (0.45 mm/day) from spring to fall, with peak rates, 0.03 in./day (0.74 mm/day), in the summer. In a previous study, age 1+ fish were reported to grow at the higher average rate of 0.03 in./day (0.77 mm/day; Able *et al.*, 1995a). In contrast, Allen *et al.* (1978) reported that the postlarvae (early juveniles) that enter the Hereford Estuary in July at about 18 mm leave at greater than 1.6 in. (40 mm) in the fall; they also reported that 1 year old (age 0+) fish arrive in this estuary at about 2.4 in. (60 mm) and leave at about 4 in. (100 mm).

Kim (1987) reported that juvenile growth in laboratory experiments was affected by food type, consumption rates, and fish size. He also reported juvenile growth can be increased 4-5 times with an enriched artificial diet and thus the species has good aquaculture potential. Laboratory studies have indicated that in the summer, the occurrence of temporary hypoxic conditions in some estuaries can inhibit the growth rates of young-of-the year (Hales and Able 1995). Growth of juveniles were reported to be clearly evident in otoliths and showed an annulus formation in May or June (Dery and Mayo 1988).

Within these structured nursery habitats, YOY black sea bass were reported to have high habitat fidelity, move very little and perhaps be territorial (Werme 1981, Able and Hales 1997). There is a observation in Able and Fahay (1998) of young-of-year exhibiting territorial behavior to defend a small shell, used for shelter, from others of its cohort.

There seems to be a general inadequacy of information for year-round habitat relationships of overwintering YOY and yearlings. Able *et al.* (1995a) reported that yearlings winter on the continental shelf and return to the estuaries the following spring, as early as March in Chesapeake and other bays, but more specific winter habitat use information is not available. Some juveniles may spend the warmer months outside the estuary in coastal surfclam or ocean quahog shell accumulations or in irregularities or holes in exposed clay as suggested by Able *et al.* (1995a). They remain in these nursery habitats until temperatures go below 57 °F (14 °C), then they gradually migrate to deeper and warmer water (Able and Fahay 1998, Collette and Klein-MacPhee in prep.), and few are found when temperatures go below 6° C (see Section 3c). For sudden drops in temperature below 43° F (6° C), laboratory studies found juveniles will bury themselves in sand bottoms, and cease feeding at below 39° F (4° C) and mortality increases (Hales and Able 1995), thus juvenile black sea bass that overwinter in shallow New Jersey estuaries can experience thermal stress and mortalities (Able and Hales 1997). The continued late fall-early winter use of shallow waters of southeastern New England as nurseries did result in mortalities when there was a sudden cold spell, as mentioned by Baird (1873). In warmer winters, juveniles are reported to overwinter successfully in deeper waters of Chesapeake Bay (MAFMC 1996, Chesapeake Bay Program 1996). Able *et al.* (1995a) reported that linear windrows, patches or beds of empty hinged clam shells (surf and ocean quahog) may be important (and perhaps essential) coastal habitat for juvenile/sub-adult black sea bass, perhaps especially so in the winter.

Habitat requirements

As with most reeffish, the distributional displays and relative abundance data based on results associated with towed nets, discussed below for juvenile and adult black sea bass, probably do not fully represent all the benthic habitats that are used by and their relative value to black sea bass. For example, the NEFSC and state trawl surveys may avoid excessively rough bottom or reefs for safety reasons or tow over it with larger rollers that can not sample many fish that seek shelter in the holes commonly available within rough/reef bottoms. This probable undersampling can potentially under represent the species' seasonal close association with rough bottom habitats or areas with sharp depth gradients, and abundance associations with hydrographic data. The minimum depth limits of trawl surveys also under-surveys the species' use of shallow, coastal habitats. Thus the results summarized below may contain sampling biases of concern to habitat use analysis for black sea bass. These biases are minimal for species that are common on the open bottom for most or all seasons, and readily sampled by trawls.

The most readily available habitat data associated with relative abundance distributions of juveniles are hydrographic. Hydrographic data collected with the NEFSC groundfish surveys indicates that juvenile black sea bass prefer bottom water temperatures above 41° F (5° C) and that most abundant collections are made at about 52° F (11-12° C) in the winter-spring (Figure 32a) and at a wide range of depths, about 66 to 800 ft (20-240 m), with a prominent mode at about 300 to 330 ft (90-100 m; Figure 32b). There was a clear bimodal thermal preference pattern, with prominent modes apparent at both 63° F (17 °C) and 77° F (25° C) for the summer (Figure 32a), that might suggest two habitat uses, but depth preference results does not support this and shows a preference for shallow (33-66 ft; 10-20 m) depths (Figure 32b). In the fall, the temperature preference appears unimodal again, but with a wide thermal range, 48-81° F (9-27° C), but with a prominent preference mode apparent at about 57-59° F (14-15° C; Figure 32a); inshore waters, less than 165 ft (50 m), were also preferred at this season (Figure 32b). The Massachusetts DMF spring and fall hydrographic data is mostly consistent with the preference patterns noted above; however, it also probably reflects the conditions of the warmer, shallower coastal areas that dominate their survey used by black sea bass. The Hudson-Raritan Estuary data is also mostly consist with overall NEFSC groundfish hydrographic results, i.e., 43-73° F (6-23° C) preferred temperature range, 33 ft (10 m) depth preference, and this data adds a salinity preference of >20 ppt and a DO preference of less than 4 ppm (mg/l), although some fish were collected at the 2 ppm (mg/l) level.

Although the above discusses survey results from larger estuarine bays, hydrographic data associated with juvenile black sea bass use of specific estuarine nursery habitats within smaller estuaries are scarce, those that are available are mostly estimates of extremes in tolerance (not preference) or based on laboratory results, e.g., Hales and Able (1995); Able and Fahay (1998). Within smaller estuaries, natural coastal geological processes can alter the suitability of some areas as nursery habitat. For example, Schwartz (1961) noted how the natural opening and closing of inlets in barrier islands along the Virginia eastern shore can change salinity (and temperature) regimes in lagoonal estuaries that causes a change in distribution of acceptable nursery habitat and associated juvenile fish, such as black sea bass.

Although the species has the above oceanographic preferences, in many studies of reef fish, such as black sea bass, the availability of shelter is considered to greatly limit successful postlarval/ juvenile recruitment (Huntsman *et al.* 1982, Richards and Lindeman 1987). Shelter appears to be a prime habitat factor in the occurrence and survival of juveniles of this species, too.

Distribution and abundance

As mentioned above in Section 2c, recently settled juveniles are usually found in high saline parts of most estuaries during the warmer months, from North Carolina to southern Cape Cod and occasionally into areas of the southern Gulf of Maine. The NEFSC fall groundfish surveys results since the early 1960s show juvenile black sea bass abundance distributions varied seasonally (Figures 33a-d). Recent winter survey results show that they are mostly collected along the outer continental shelf south of Long Island, New York (Figure 33d). As the continental shelf water warms in the spring, they are also collected inshore in the Chesapeake Bight (Figure 33a). There were few summer surveys, but they collected juveniles in several coastal areas mostly south of New Jersey (Figure 33b). However, during this season many juveniles inhabit estuaries or submerged coastal reefs, wrecks, etc., which are habitats that are outside of the NEFSC survey area or are poorly sampled by trawl. Fall survey results show juvenile are very common in two areas, along the southern New England to Maryland coast, and shelf-wide, off Virginia-North Carolina (Figure 33c); this seasonal distribution probably reflects to some degree their migration out of shallow coastal areas as these waters cooled. At recent relatively low population abundance levels, e.g., since 1990 (see Section 5), the fall survey distributions (not shown) are similar to those at previous high abundance levels. The survey distribution results for 1 yr (to 3.8 in.; 9.5 cm TL) and 2 yr (4-8 in.; 10-19 cm) old juveniles (also not shown) were also similar.

The spring/fall Massachusetts Division of Marine Fisheries (DMF) groundfish surveys also collected few juveniles in the spring, i.e., May. In the fall (September), however, they were collected in abundance south and west of Cape Cod, with some also being collected in Cape Cod Bay. The near-monthly, 1992-1997, monitoring of the Hudson-Raritan Estuary collected juvenile black sea bass (mostly in 1997) in the spring through fall (April-December), but only one fish in the winter. In another survey, Mansueti (1955) reported juvenile black sea bass common in the lower Potomac River (Maryland-Virginia) at the time of his review.

2.2.1.3.3.4 Adults

Adult black sea0 bass are also very structure oriented, especially during their summer coastal residency. Unlike juveniles, they tend to enter only larger estuaries and are most abundant along the coast. Larger fish tend to be found in deeper water them smaller fish. A variety of coastal structure are known to be attractive, and these include shipwrecks, rocky and artificial reefs, mussel beds and any other object or source of shelter on the bottom. While on these shelters they are usually observed by divers hovering near or above these shelters, retreating into them, if threatened. They seem to stay near the structure during the day, but may move away at crepuscular times (dawn and dusk) to feed on the adjacent open bottom or to snap up a small fish or squid that comes into view.

One of the characteristics of the northern population of black sea bass is their seasonal migration to southern and offshore wintering grounds. Black sea bass adults in the Middle Atlantic Bight winter on the middle to outer continental shelf, 100-800 ft (30-240 m; some being collected as deep as 1350 ft [410 m], but mostly between 200-500 ft [60-150 m]) depth zone and generally south of the Hudson Canyon off central New Jersey (Musick and Mercer 1977). Some wintering can occur in more northern, deep water, greater than 260 ft (80 m), off southern New England, based on winter commercial catches (Chang 1990, Kolek 1990) and other sources (Bigelow and Schroeder 1953). The distribution of bottom temperatures above about 46° F (7.5° C) can suggest the potential winter distribution of the species, and its associates (Neville and Talbot 1964). Cold or warm water mass movements on the continental shelf can thus influence fish winter distribution. Larger fish (mostly males) tend to occur in deeper water (Nesbit and Neville 1935, Musick and Mercer 1977, Able *et al.* 1995a). Off Virginia, offshore artificial reef and wrecks are populated with active resident adult black sea bass during most winters and support commercial and recreational fisheries (Chee 1977, Adams 1993). Adams (1993) observed that when bottom water temperature were near 43° F (6° C) on inshore artificial reefs, adult fish became more inactive and were often found resting in reef holes and crevices. Schwartz (1964) reported adult black sea bass in aquaria at 15 ppt salinity stopped feeding at water temperatures below 46° F (8° C) and died at temperatures below about 36° F (2° C).

The species' use of specific offshore winter habitat is poorly known. There are speculative or anecdotal reports of the species' northern population association with rough bottom during the winter offshore residency (Pearson 1932, June and Reintjes 1957, Neville and Talbot 1964). The existence of significant amounts of this type of bottom in those wintering areas has not been confirmed. Wigley and Theroux (1981) characterized this wintering area as being basically flat, sandy-silt with occasional areas of relict and active sand waves of variable size, without hard bottom. There are reports, however, of hard bottom, such as consolidated clay or rock, near the heads of submarine canyons at the shelf edge and in a few other isolated places (Emory and Uchupi 1972, Stanley *et al.* 1972, Grimes *et al.* 1987). Scattered shipwrecks and man-made debris are also available as offshore wintering shelter habitat. Shellfish beds, current and relict, and observations of shallow pits in the mid to outer shelf, possibly created by larger crabs or lobsters or some other species of fish (Emory and Uchupi 1972, Folger *et al.* 1979, Shepard *et al.* 1986, Able *et al.* 1995a), suggest other usable sheltering habitat. Parker (1990) reports observations of black sea bass burrowing into sediments during cold spells off the Carolinas; perhaps this behavior explains how structure-associated black sea bass accommodate themselves during the winter on the relatively featureless continental shelf off the Middle Atlantic Bight. Burrowing in open soft sediments may not protect them from trawls, however, or the possible harm from suspended sediments (Churchill 1989). Several other valuable fish use the same general winter habitat as black sea bass; these include scup, *Stenotomus chrysops*; summer flounder, *Paralichthys dentatus;* and butterfish, *Peprilus triacanthus*, and a few harvestable invertebrates, squid (*Loligo* and *Illex*) and American lobster, *Homarus americanus* (Chang 1990, Able and Kaiser 1994).

In the warmer months, inshore residency, adult black sea bass are usually found associated with structured habitats, including eelgrass, oyster, and mussel beds, rocky and artificial reefs, cobble and rock fields, shipwrecks, stone coral patches, exposed stiff clay, and around the bases of man-made, submerged coastal structures such as bridge abutments, piers, pilings, jetties and groins, submerged pipes and culvert, navigation aids, anchorages, rip-rap barriers, fish and lobster traps, and rough bottom at the sides of channels and elsewhere; towed-net surveys do not adequately sample this type of habitat. A continual supply of shipwrecks and anthropogenic debris, and many state-supervised artificial reef programs, are increasing the quantity of structured habitat available for use by this and associated species. Richards (1963a,b) and others reported that black sea bass are usually found in structured habitats within areas of sandy sediments and rarely in muddy areas.

Black sea bass share the coastal habitat in the warm months with several other species, including tautog, spotted hake, *Urophycis regia*; red hake, *U. chuss*; conger eel; *Conger oceanicus*; ocean pout, *Macrozoarces americanus*; pinfish, *Lagodon rhomboides;* northern sea robin, *Prionotus carolinus*, and transients off Delaware such as gray triggerfish, *Balistes capriscus* (Eklund and Targett 1991) and Virginia (Chee 1977, Musick and Mercer 1977). Inshore trawl survey results added butterfish; smooth dogfish, *Mustelus canis*; round herring, *Etrumerus teres;* and windowpane flounder, *Scophthalmus aquosus,* to the summer group containing black sea bass (Phoel 1985, Gabriel 1992, Brown *et al.* 1996). North of Maryland, the cunner becomes a dominant member of the reef ichthyofauna. In estuaries, black sea bass are reported to co-occur on oyster shell plantings with summer flounder; spot, *Leiostomus xanthurus*; toadfish, *Opsanus tau*, and other species (Arve 1960).

Growth in mature black sea bass is sexually dimorphic, with faster growth but resulting in a lower maximum size in females (Lavenda 1949, Mercer 1978, Wilk *et al.* 1978). However, Shepherd and Idoine (1993) suggest that the species can have three possible sex-related growth rates: female, male, and transitional. Alexander (1981) found the males grew faster then females off New York based on otolith annuli analysis for yr 1 or older fish. Dery and Mayo (1988), Kolek (1990) and Caruso (1995) reported that black sea bass from southern New England (Massachusetts) had growth rates almost double those reported for New York and Virginia, but different growth estimators were used; this observation is consistent with Mercer (1978) and Wenner *et al.* (1986) who noted that Middle Atlantic Bight fish at age were larger and grew faster than South Atlantic Bight fish. The long-term validity and habitat relationship of this observation is unknown at present. Growth is linear to about age 6, then slows; the Middle Atlantic population is larger at age than the South Atlantic population (Wenner *et al.* 1986).

Reproduction

Like most members of its family, Serranidae, the black sea bass is a protogynous hermaphrodite; i.e., most fish begin maturity as females and with additional growth most change to males (Lavenda, 1949). In the Middle Atlantic Bight, individuals begin to become sexually mature at age 1 yr (8-17 cm TL), but it is not until they grow to about 19 cm SL (age 2-3 yrs) that about 50% of that size group are mature (O'Brien *et al.* 1993). A majority of this size-maturity threshold group are females (Mercer 1978). The average size at which sexual transformation from females to male occurs was reported to be between 10-13 in. (23.9-33.7 cm; Chesapeake Bay Program 1996). In the South Atlantic Bight, Cupka *et al.* (1973) reported that both sexes matured at smaller sizes, between 14 and 18 cm SL, in South Carolina waters. However, Wenner *et al.* (1986) and Alexander (1981) found mature fish at smaller sizes, i.e. about 4.0-4.4 in. (10-11 cm; age 1+) for South Carolina and New York populations, respectively, and a majority were mature at about 19 cm, again corresponding to an age of about 2-3 years, as was found for the Middle Atlantic population. Alexander (1981) reported a decrease in the age and size of sex change since the 1940s with fewer mature males in the population; he associated this decrease with increasing fishing pressure.

Based on collections of ripe fish and egg distributions, the species spawns primarily on the inner continental shelf between Chesapeake Bay and Montauk Pt., Long Island at depths of about 66-165 ft (20-50 m; Breder 1932, Kendall 1972, 1977, Musick and Mercer 1977, Wilk *et al.* 1990, Eklund and Targett 1990, Berrien and Sibunka in press), but eggs frequently occurred or spawning have been reported as far north as Buzzards Bay and Nantucket Sound, Massachusetts (Wilson 1889, Sherwood and Edwards 1902, Kolek 1990). Mercer (1978) reported that 2-5 yr old fish release between 191,000 and 369,500 eggs each. Some larvae have been collected in Cape Cod Bay but these were considered stragglers washed there through the Cape Cod Canal from Buzzards Bay and not the product of local spawning (MAFMC 1996). Gravid females are not generally found in estuaries (Allen *et al.* 1978). Spawning in the Middle Atlantic population is generally reported in the late spring- mid-summer, May to July (Kendall 1972, 1977, Musick and Mercer 1977, Feigenbaum *et al.* 1989, Wilk *et al.* 1990, Eklund and Targett 1990) during inshore migrations, but can extend to October-November (Fahay 1983, Berrien and Sibunka in press). Larval distributions presented in Able *et al.* (1995a) suggest spawning is earliest off Virginia-North Carolina (in the vicinity of the wintering grounds) and progresses northerly and inshore as inner shelf waters warm.

Shepherd and Idoine (1993) noted that the complex social hierarchy of reef fishes during spawning, such as the temperate black sea bass, implies that the number of males may be an important factor limiting reproductive potential. They also noted, however, that theoretical studies suggested that the current relative abundance of males may not yet be limiting in the black sea bass population to the degree that non-dominant males participate in spawning. There are no known reported observations of the actual spawning activity and whether it is near the bottom or water surface; however, in Massachusetts coastal waters, spawning fish have been reported to aggregate on sand bottoms broken by ledges, and after spawning the fish disperse to ledges and rocks in deeper water (Kolek 1990, MAFMC 1996). From tagging studies, Kolek (1990) reported evidence of spawning ground homing, as some tagged adult black sea bass returned annually to the same spawning grounds in northwestern Nantucket Sound. Kolek (1990) also reported this local spawning group spawned earlier and in shallower waters than generally reported (Kendall 1977). Although nothing is known of the mating of this species, distinct pairing is characteristic of the family (Breder and Rosen 1966).

Habitat requirements

The potential sampling biases cited in above section on juvenile also applies to adults.

For adult black sea bass, bottom temperatures about 43-46° F (6-7.5° C) or above are thought to be a critical factor in habitat use and species distribution (Colvocoresses and Musick 1984) and this is supported by the NEFSC Groundfish survey hydrographic data summaries (Figure 34a-b). Adults, like juveniles, were most commonly collected in areas having water temperatures of about 48-54° F (9-12° C) in the winter-spring (Figure 34a). However, in NEFSC survey results there is evidence of a bimodal temperature-abundance pattern for adults in the summer through winter, with prominent peaks at about 50° F (10° C) and 77° F (25° C; Figure 34a) while they inhabit shallow (33-66 ft; 10-20 m) coastal areas. The adults, like the juveniles, were collected during the fall in a wide range of temperatures, i.e., 45-81° F (7-27° C), with most being collected within the 57-70° F (13-21° C) range (Figures 34a), but there is some lingering bimodality in the offshore NEFSC data with a secondary peak at about 77-81° F (25-27° C; Figure 34a); the fall collection are also still mostly in relatively shallow water, less than 165 m (50 m; Figures 34b). The seasonally integrated Hudson-Raritan Estuary monitoring shows similar preferred temperature and depth ranges and adds salinity and DO preferences of adults that are similar to those noted above for juveniles. In the Hudson-Raritan Estuary, adult black sea bass preferred DOs above 5 ppm (mg/l).

Distribution and abundance

The geographic distributions of northern population adults are similar to that of the previously discussed juveniles, but they tend to prefer deeper bays and coastal waters over estuaries. Briggs (1979) believed that tagging results suggested that once black sea bass in New York waters find suitable habitat in the summer they stay there until fall migration; this non-winter habitat fidelity for adults is consistent with similar behavior recently reported for juveniles (Able and Hales 1997). Black sea bass is normally considered a reef fish and in the warmer months its local distribution is usually closely associated with some sheltering habitat in estuarine-coastal areas, generally at depths less than 130 (40 m) in northern areas, but with a wider distribution in the Chesapeake Bight, as is evident in the results from the NEFSC fall groundfish survey (Figures 35a-d). Bigelow and Schroeder (1953) and Collette and Hartel (1988) reported occurrences of black sea bass in Massachusetts Bay at the turn of the century and occasionally since then, but they are rarely caught in New Hampshire, and almost absent in Maine and on Georges Bank (Figures 35a-d); although they were captured by gill net over rocky bottom in Maine (Ojeda and Dearborn 1989). There is no apparent difference in the seasonal distribution patterns (not shown) during recent high (1975-79) and low (1990-present) abundance levels. The Massachusetts DMF survey results for adults differ with those for juveniles in the spring. While few juveniles are collected in the spring survey, adults were relatively common. In Raritan Bay, adult black sea bass were never common at any season.

2.2.1.4 Importance of summer flounder, scup, and black sea bass in state waters

2.2.1.4.1 Summer flounder

Estuaries and inshore habitats are important habitat for larval, juvenile, and adult summer flounder (Packer and Griesbach 1998; Laney 1997). A more detailed description of the use of estuaries by summer flounder can be found in Section 2.2.1.1 and in Packer and Griesbach (1998). The primary data source available to designate EFH for summer flounder in state waters is NOAA's Estuarine Living Marine Resources Program (ELMR; Tables 5 and 6; Figure 36, 37). While not as quantitative as the NEFSC trawl data it does describe the summer flounder spatial (Tables 5) and temporal (Table 6) relative abundance by life stage and month in the various coastal estuaries from Waquoit Bay, Massachusetts to Indian River, Florida (Figure 43a-e).

Currently, the only state data available to NMFS in a consistent electronic format is Massachusetts Inshore Trawl Survey, Connecticut Trawl Survey - Long Island Sound, and the NMFS Trawl Survey - Hudson-Raritan Estuary/Sandy-Hook Bay. These data will not be used to designate EFH within estuaries, because other states' data are not currently available in a format that makes it possible to compare them. Therefore, these data will only be used to confirm ELMR data. These, data generally agree with ELMR presence/absence data for these specific estuaries. Data collected from other states' seine and trawl surveys, as it becomes available, will be incorporated in future iterations of this FMP.

The Council, attempting to coordinate and obtain the best information available in Amendment 2, requested each State from North Carolina to Maine to identify the essential summer flounder habitat under their jurisdiction. The following paragraphs are paraphrased from the responses of the States' summer flounder experts. Comments were specifically be solicited and used to update this information, from EFH identified state data contacts and coastal zone managers.

Summer flounder habitats vary with life stage; the most important habitats are the spawning areas on the continental shelf for summer flounder. The coastal areas that also serve as nursery and feeding areas for summer flounder are essential to their survival. Migratory pathways are recognized as important habitat because of the range of environmental conditions and contaminants to which summer flounder are exposed.

The estuarine waters of North Carolina, particularly those west and northwest of Cape Hatteras (Monaghan 1996) and in high salinity bays and tidal creeks of Core Sound (Noble and Monroe 1991), provide substantial habitat and serve as significant nursery areas for juvenile Mid-Atlantic Bight summer flounder. Powell & Schwartz (1977) found that juvenile summer flounder were most abundant in the relatively high salinities of the eastern and central parts of Pamlico Sound, all of

Croatan Sound, and around inlets. Young-of-the-year disappeared from the catch during late summer, suggesting that the fish are leaving the estuaries at that time (Powell & Schwartz 1977). Upon leaving the estuaries, the juveniles enter the north-south, inshore-offshore migration of Mid-Atlantic Bight summer flounder (Monaghan 1996). (Although North Carolina also provides habitat for summer flounder from the South Atlantic Bight, these fish do not exhibit the same inshore-offshore and north-south migration patterns as do Mid-Atlantic Bight fish [Monaghan 1996]). Summer flounder >30 cm are rarely found in the estuaries of North Carolina, although larger fish are found around inlets and along coastal beaches. Powell & Schwartz (1977) also noted that juvenile summer flounder were most abundant in areas with a predominantly sandy or sand/shell substrate, or where there was a transition from fine sand to silt and clay.

In Virginia, Musick (pers. comm.) states that the most important nursery areas for summer flounder appear to be in the lagoon system behind the barrier islands on the seaside of the Eastern Shore (Schwartz 1961), and the shoal water flat areas of higher salinity (>18 ppt) in lower Chesapeake Bay. Young-of-the-year enter these nursery areas in early spring (March and April) and remain there until fall when water temperatures drop. Then these yearlings move into the deeper channel areas and down to the lower Bay and coastal areas. In most winters these age 1+ fish migrate out in the ocean but in warmer winters some may remain in deep water in lower Chesapeake Bay (Musick pers. comm.). However, the Virginia Institute of Marine Science juvenile finfish survey for 1995 show juvenile (as well as some adult) flounder occurring throughout most of the main stem of Chesapeake Bay and the major Virginia tributaries (Rappahannock, York, and James rivers) over most of the year (Geer & Austin 1996). Lower numbers occurred from December-March. Wyanski (1990) found recruitment to occur from November to April on both sides of Virginia's Eastern Shore and from February to April on the western side of Chesapeake Bay. Peak recruitment occurred in November-December on the Eastern Shore, compared to March-April on the western side of the Bay. Wyanski (1990) and Norcross & Wyanski (1988) also found that young-of-the-year occur in a variety of habitats, including shallow, mud bottomed marsh creeks, shallow sand substrates (including seagrass beds), deep sand substrate, and deep fine-sand substrates.

Adults use the Eastern Shore seaside lagoons and inlets and the lower Chesapeake Bay as summer feeding areas (Schwartz 1961; Musick pers. comm.). These fish usually concentrate in shallow warm water at the upper reaches of the channels and larger tidal creeks on the Eastern Shore in April, then move toward the inlets as spring and summer progress. They are most abundant in the ocean near inlets by July and August. Tagging studies by Desfosse (1995) revealed that fall migration begins out of Chesapeake Bay in October and is completed by December where most recaptures of fish were from the nearshore fishery from Cape Henry south to Cape Hatteras. The majority of tagged returns during January through March came from offshore from the Cigar north to Wilmington Canyon, and were concentrated east of Cape Henry from the Cigar to Norfolk Canyon. A second group came from inshore waters near Oregon Inlet, south to Cape Hatteras. Movement inshore started in March or perhaps as early as February, and continued from April till June.

Virginia's Artificial Reef Program provides additional suitable habitat for summer flounder, with four Atlantic Ocean reef sites and three Chesapeake Bay reef sites. Reef materials include discarded vessels, automobile tires, and fabricated concrete structures. Colonization of reef materials by encrusting marine and estuarine life forms provides food and shelter for many finfish species. Summer flounder were taken in fair abundance (Travelstead pers. comm.).

Maryland's coastal bays, rich in benthic invertebrates which form the bulk of young of year food sources, are excellent summer flounder habitat (Casey, pers. comm.). Casey (pers. comm.) indicated that in areas where notable pollution exists, a lack of proper food sources preclude the presence of summer flounder. Areas which lack sufficient water circulation appear to have considerably reduced populations. Shoreside development and resultant runoff also appear to have reduced some local populations (Casey pers. comm.). Since the early 1970s, Maryland has been conducting trawl and seine surveys around Ocean City inlet. Casey (pers. comm.) reports that over the past few years, however, sharp declines in young of year flounder have been noted in coastal bay trawl samples. The majority of the summer flounder taken in this sampling are between 3" and 4", with larger fish basically absent. Summer flounder are sometimes found in Maryland's portion of the Chesapeake Bay with the majority of these fish in the 8" to 12" range.

Delaware Bay is an important nursery and summering area for adults as well as a nursery area for juveniles (R. Smith pers. comm.). They are abundant in the lower and middle portions of the estuary, and rare in the upper estuary (Ichthyological Associates, Inc. 1980; Seagraves 1981; Weisberg *et al.* 1996; Michels 1997). Smith & Daiber (1977) caught adults from the shoreline to a maximum depth of 25 m, mostly from May through September, while R. Smith (pers. comm.) states that adults have been captured in Delaware Bay during all months of the year, but appear to be most common from April to November. The Delaware Bay Coastal Finfish Assessment Survey for 1996 found adults throughout the April to December sampling period, with the highest catch rate in April and greatest occurrences at mid-bay stations (Michels 1997). Delaware's coastal bays are also used by summer flounder as nursery and summering areas (e.g. Indian River and Rehobeth Bays [Michels 1997]). Smith & Daiber (1977) reported that a few juveniles have been caught in the deeper parts of the Bay in every winter month. The Delaware Bay Coastal Finfish Assessment Survey for 1996 found juveniles throughout their April to October sampling period (Michels 1997).

In New Jersey, nursery habitat includes estuaries and marsh creeks from Sandy Hook to Delaware Bay (Allen *et al.* 1978; Rountree & Able 1992a, b, 1997; Szedlmayer *et al.* 1992; Szedlmayer & Able 1993; Freeman pers. comm.). The juveniles often make extensive use of creek mouths (Szedlmayer *et al.* 1992; Szedlmayer & Able 1993; Rountree & Able 1997). In the Hudson-Raritan estuary, New York and New Jersey, 1992-1997 surveys show the juveniles to be present in small numbers throughout the estuary in all seasons, with slightly higher numbers seen in the spring. In Great Bay, young-of-the-year stay for most of the summer, leaving as early as August and continuing until November-December (Able *et al.* 1990; Rountree & Able 1992a; Szedlmayer &Able 1992; Szedlmayer *et al.* 1992). As stated previously, Allen *et al.* (1978) collected both adult and juvenile summer flounder (200-400 mm) in Hereford Inlet near Cape May where they occurred in all of the major waterways, but were more abundant in the upper embayment from May to July and in the lower embayment from August to October. Most were caught on the channel slopes.

Tagging studies by Murawski (1970) provided recaptured summer flounder from the entire New Jersey coastline. Summer flounder overwinter offshore of New Jersey in 30-183 m of water. Allen *et al.* (1978) collected both adult and juvenile summer flounder in Hereford Inlet near Cape May. They occurred in all of the major waterways, but were more abundant in the upper embayment from May to July and in the lower embayment from August to October. The majority were 200-400 mm and were caught on the slopes of the channels. In Barnegat Bay, an ichthyofauna survey by Vouglitois (1983) from 1976-1980 found a wide range of sizes of summer flounder, but in low numbers. This study was conducted along the western shoreline of the Bay, where muddy sediments predominate, and Vouglitois (1983) suggests that the scarcity of summer flounder is due to their apparent preference for sandy substrates. A hard sandy bottom does predominate in the eastern portion of the Bay and this is where most summer flounder have been caught.

All inshore waters of NY are important summer flounder habitat with shore bays, New York Harbor, near shore ocean waters, all bays between the north and south forks of Long Island and Block Island sound being especially important (Newell pers. comm.). In the Hudson-Raritan estuary, New

York and New Jersey, the summer flounder was the 13th most abundant species in the Wilk *et al.* (1977) survey and it occurred in 21% of all trawls and had a mean annual density in the Lower Bay complex of 1.2/15 min tow (see also reviews by Gaertner 1976 and Berg & Levinton 1985). The 1992-1997 Hudson-Raritan surveys show the adults to be present in moderate numbers throughout the estuary in all seasons except winter. In the fall, they tend to be found in greater numbers in the deeper waters of the Raritan Channel (Wilk, unpublished data). In the spring, the greatest numbers occurred in Sandy Hook Bay. The greatest densities of summer flounder adults occurred in the summer, particularly in the deeper Raritan and Chapel Hill channels and Raritan and Sandy Hook Bays This species was not reported in any trawls in the Arthur Kill-Hackensack River estuary. However, it has been collected in Newark Bay from April-October (Wilk *et al.* 1997). Great South Bay, on the south shore of Long Island, supports an important recreational fishery, particularly around Fire Island inlet (Neville *et al.* 1939; Schreiber 1973).

In Connecticut, E. Smith (pers. comm.) states that the flounder migrate to inshore waters in late April and early May, and are present in Long Island Sound throughout the April-November trawl survey period, and probably occur in limited numbers in winter as well. August through October are often the months of highest relative abundance (Connecticut Division of Marine Fisheries 1990a, b; 1992; Gottchall *et al.*, in review). Although they occur on all bottom types, their abundance does vary by area and depth (Gottchall *et al.*, in review). In April, abundance is similar at all depths, but from May through August abundance is highest in shallow water, especially in depths less than 9 m along the Connecticut shore from New Haven to Niantic Bay, and near Mattituck, New York (Gottchall *et al.*, in review). In September, when abundance peaks, summer flounder are again distributed in all depths throughout the sound. After September, their abundance decreases, and the remaining fish are more common in deeper water. Abundance is highest in depths between 18-27 m in October and depths >27 m in November (Gottchall *et al.*, in review). Abundance indices within the Sound are generally highest in the central Sound (Connecticut to Housatonic Rivers) and lowest west of the Housatonic River (Connecticut Division of Marine Fisheries 1990a, b; 1992). Salinity range appears to be at least to 15 ppt. and greater. The trawl survey usually takes 400-700 fish in 320 tows per year. In 1989, only 47 fish were taken (Simpson pers. comm.). From the Marine Angler Survey, about two-thirds of the sport flounder catch is from east of the Connecticut River, while the trawl survey catches indicate that the greater New Haven area is also important.

Lynch (pers. comm.) states that the coastal waters of Rhode Island, the immediate waters surrounding Block Island, and the waters of Little Narragansett Bay and all of Narragansett Bay are habitat for both adults and juveniles. Based on collections from the 1990-1996 Rhode Island Narragansett Bay survey, adults were distributed throughout the Bay and captured in all seasons except winter and most were caught in summer and autumn. The length frequencies show that similar sizes were captured in each season and lengths ranged from about 25-71 cm with most occurring from 30-50 cm. Abundance in relation to bottom depth shows a preference for depths greater than 12.2-15.2 m (40-50 ft) and that few were captured in depths less than 9.1 m (30 ft).

Summer flounder in Massachusetts migrate inshore in early May and occur along the entire shoal area south of Cape Cod and Buzzards Bay, Vineyard Sound, Nantucket Sound, and the coastal waters around Martha's Vineyard (Howe *et al.* 1997). They also occur in the shoal waters in Cape Cod Bay (Howe pers. comm.). In some years summer flounder are found along the eastern side of Cape Cod and as far north as Provincetown by early May. Howe (pers. comm.) states that Massachusetts considers the shoal waters of Cape Cod Bay and the region east and south of Cape Cod, including all estuaries, bays and harbors thereof, as critically important habitat. Summer flounder begin moving offshore in late September and October and Howe (pers. comm.) believes that spawning occurs within territorial waters south of Cape Cod because occasional ripe and running fish have been taken there. Summer flounder are regularly taken in southern Massachusetts waters as late as December, presumably as fish are dispersing to offshore wintering grounds, which, in most years are well out on the continental shelf from approximately Veatch Canyon to Baltimore Canyon.

Summer flounder in New Hampshire are not abundant (Nelson pers. comm.). New Hampshire does consider various estuaries important as food sources for visiting adults.

In Maine, summer flounder is regarded as a straggler in the Gulf of Maine (Honey pers. comm.).

2.2.1.4.2 Scup

The near shore spawning areas and the inshore nursery areas are essential for the survival of scup. These areas are also utilized for summer feeding by adults. Major alterations to the habitat could be disruptive to the species' life cycle. A more detailed description of the use of estuaries by scup can be found in Section 2.2.1.2 and in Steimle *et al.* (1998a). The primary data source available to designate EFH for scup in state waters is NOAA's Estuarine Living Marine Resources Program (ELMR; Tables 7 and 8; Figure 38). While not as quantitative as the NEFSC trawl data it does describe scup spatial (Tables 7) and temporal (Table 8) relative abundance by life stage and month in the various coastal estuaries from Passamaquaddy Bay, Maine to James River, VA (Figure 38a-d).

Currently, the only state data available to NMFS in a consistent electronic format is Massachusetts Inshore Trawl Survey, Connecticut Trawl Survey - Long Island Sound, and the NMFS Trawl Survey - Hudson-Raritan Estuary/Sandy-Hook Bay. These data will not be used to designate EFH within estuaries, because other states' data are not currently available in a format that makes it possible to compare them. Therefore, these data will only be used to confirm ELMR data. These, data generally agree with ELMR presence/absence data for these specific estuaries. Data collected from other states' seine and trawl surveys, as it becomes available, will be incorporated in future iterations of this FMP.

The Council, attempting to coordinate and obtain the best information available in Amendment 7, requested each State from North Carolina to Maine to identify the essential scup habitat under their jurisdiction. The following paragraphs are paraphrased from the responses of the States' scup experts. Comments will specifically be solicited and used to update this information, from EFH identified state data contacts and coastal zone managers.

Large quantities of scup are not found inshore of about 120 feet off of North Carolina (Ross pers. comm.). Scup are traditionally harvested during the deep water component of the trawl fishery in 180 to 420 ft of water from December through April. They are commonly caught around the Cigar off Virginia, around Norfolk Canyon, and the shelf edge north of Norfolk Canyon to Washington and Wilmington Canyons.

Scup were previously considered common to Virginia's Territorial Sea, seaside bays and lower Chesapeake Bay during spring, summer and fall months, moving offshore during winter (Travelstead pers. comm.). Although still consistently caught in some areas of the Chesapeake Bay, the occurrence of large numbers of scup in State waters is now infrequent. Commercial landings of this species from 1989-1992 have declined to approximately one tenth the poundage of scup caught between 1980 and 1984 (Davis pers. comm.). Trawl surveys conducted by the Virginia Institute of Marine Science collected scup from Chesapeake Bay waters primarily during the months of June through October (Bonzak *et al.* 1991, 1992, and 1993). Peak population abundances occur north of Virginia during warmer months (Musick pers. comm.). Young of the year scup occur annually in the Chesapeake Bay, but apparently not in large numbers. Adults prefer smooth to rocky bottoms, usually schooling in summer months at depths between 6 and 120 ft; overwintering occurs off Virginia and North Carolina from 120 to 300 ft, sometimes to 500 ft (Johnson 1978).

The use of coastal bay habitat by scup in Maryland appears minor (Casey pers. comm.). The vast majority of commercial scup landings occurs from beyond 12 miles and primarily by otter trawl. In 16 years of research trawl sampling in the coastal bay habitat by Maryland Department of Natural Resources personnel, only 18 individuals have been caught. Because of this and the low commercial landings, little is known of their use of Maryland coastal bay and near shore habitat (Casey pers. comm.).

Scup are collected in a large portion of Delaware Bay with the northern most limit just off Port Mahon and the southern limit extending into the Atlantic Ocean (Cole pers. comm.). Generally 15 - 32‰ salinity regimes are considered suitable for scup. Cole (pers. comm.) reports that numbers of one and two year old scup taken in samples during 1990 and 1991 were among the highest recorded during the past two decades indicating that Delaware Bay can be an important summer nursery area. In addition, survey data collected from Indian River and Rehobeth Bays in 1989 indicated record catches of scup. The entire Delaware Bay and lower Delaware River to the C & D Canal serve as both nursery areas for juveniles and summer feeding areas for adult scup (Cole pers. comm.).

Scup migrate from offshore, overwintering grounds to inshore coastal and estuarine waters of New Jersey in April and May (Scarlett pers. comm.). Important summering, nursery or spawning habitat include inshore ocean waters out to the 120 ft contour along the shores of New Jersey and estuaries from Sandy Hook Bay to Delaware Bay. Sandy Hook Bay and Delaware Bay are probably more important than other smaller, shallower coastal estuaries. Scup begin an offshore migration in the fall and congregate within a migratory corridor inside the 60 ft contour off coastal New Jersey (Scarlett pers. comm.).

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

Scup are found throughout New York marine waters with large concentrations found around eastern Long Island (eastern Long Island Sound, Gardiner's Bay, Peconic Bays, and near shore waters around Montauk; Newell pers. comm.). Scup are among the most common species taken in Long Island Sound (LIS), occurring in local waters between May and November, with greatest numbers found from June through October (Simpson pers. comm.). Scup are found at all depths sampled (15 - 150 ft) and exhibit a strong preference for transitional sediments (mixed sand/mud). Young-of-year are also taken in large numbers on shallow sand/shell bottom along the north shore of Long Island, New York. Outside the geographic range of the trawl survey large numbers of scup are also taken by anglers in Fishers Island Sound located in eastern Connecticut near the borders with New York and Rhode Island. Limited numbers of young-of year scup have also been recorded from small (three foot) beam trawl samples in inshore estuaries where salinities are above 20 ppt. Eggs and larvae have been collected in eastern LIS in the course of power plant impact monitoring by Northeast Utilities Company providing evidence of spawning in LIS. Food habits have been reported by Richards (1963) who found that scup in LIS feed principally on polychaetes, amphipods, other crustaceans and mollusks. Copepods were most common in young-of-year, whereas mollusks were more common in age one and older fish.

Scup begin to move from offshore waters, into the coastal waters of Rhode Island and into Narragansett Bay and Mt. Hope Bay in April (Gray pers. comm.) and remain there through

November until the fall migrations have begun (Jeffries *et al.* 1988). All life stages of scup have been observed within Rhode Island waters, which provides critical habitat for each stage. Scup eggs have been collected in the waters of Narragansett Bay from May through August (Herman 1963, Bourne and Govoni 1988, Klein-MacPhee pers. comm.). Larval scup have been collected from May through September (Herman 1963 and Sisson *et al.* 1994). Indices of relative abundance indicate that Rhode Island coastal waters, especially Narragansett Bay, constitute a nursery area for 0 - 1 year old scup (Lynch and Karlsson 1990). Sisson (1974) found that Narragansett Bay provides important summer habitat for scup in age classes one through four. Young of the year scup have been collected over intertidal/subtidal sand, marine silty sand, mussel beds, eelgrass beds, and mud (Lynch pers. comm., Sisson *et al.* 1994, and Powell 1989). Adult scup have been collected throughout Narragansett Bay over hard to soft sandy bottoms, marine silty sand usually associated with or near submerged obstructions, rock piles, shoals and ledges (Lynch pers. comm., Satchwill and Gray 1994).

In Massachusetts, scup migrate to spawning and feeding grounds located in Buzzards Bay, Nantucket Sound, Vineyard Sound, and coastal waters south of Martha's Vineyard beginning in April (Figure 5). Larger individuals are the first to arrive from offshore wintering grounds. Schools of successively smaller fish arrive through May and June. Spawning fish are found in shoal areas (<30 ft) until late June when they move into deeper waters (between 30 and 60 ft). Recreational shore-based anglers capture juvenile scup from early July through September. In most years, commercial scup landings from Massachusetts waters peak in May, decrease in June, and continue to decline at a lower rate through October. Dates of larval capture range from May through September (Collings *et al.* 1981). Scup larvae decreased in density with sampling stations proceeding west to east from Buzzards Bay to Cape Cod Bay. Scup larvae were collected in Buzzards Bay at water temperatures ranging from 57 to 75 °F with greatest densities between 60 and 68 °F. Scherer (1984) collected scup eggs and larvae in Cape Cod Bay from June through August. He thought that scup did not spawn in Cape Cod Bay but rather their eggs and/or larvae were transported into the Bay via the Cape Cod Canal. However, eggs and larvae were captured north of Boston in the Beverly - Salem Harbor area (Elliot and Jimenez 1981) indicating that some spawning occurs north of Cape Cod. Southern Massachusetts estuaries, coastal embayments and near shore waters are primary nursery grounds for age 0 scup. The appearance of 0 age group scup (0.6 - 1.2 inches) in shoal waters in early July indicate that some end their pelagic post larval life at that time. They remain throughout the summer. Their departure to deeper water coincides with sharp drops in water temperature (Lux and Nichy 1971). Most scup leave inshore Massachusetts waters during late October and early November, although some individuals remain in local waters until at least December (Currier pers. comm.).

Scup are virtually unknown in New Hampshire waters (Grout pers. comm.).

Scup are also nearly absent from Maine waters (Langton pers. comm.).

2.2.1.4.3 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. A more detailed description of the use of estuaries and inshore areas by black sea bass can be found in Section 2.2.1.3 and in Steimle *et al.* (1998b). The primary data source available to designate EFH for black sea bass in state waters is NOAA's Estuarine Living Marine Resources Program (ELMR; Tables 9 and 10; Figure 39). While not as quantitative as the NEFSC trawl data it does describe scup spatial (Tables 9) and temporal (Table 10) relative abundance by life stage and month in the various coastal estuaries from Waquoit Bay, Massachusetts to James River, VA (Figure 39a-d).

Currently, the only state data available to NMFS in a consistent electronic format is Massachusetts Inshore Trawl Survey, Connecticut Trawl Survey - Long Island Sound, and the NMFS Trawl Survey - Hudson-Raritan Estuary/Sandy-Hook Bay. These data will not be used to designate EFH within estuaries, because other states' data are not currently available in a format that makes it possible to compare them. Therefore, these data will only be used to confirm ELMR data. These, data generally agree with ELMR presence/absence data for these specific estuaries. Data collected from other states' seine and trawl surveys, as it becomes available, will be incorporated in future iterations of this FMP.

The Council, attempting to coordinate and obtain the best information available in Amendment 9, requested each State from North Carolina to Maine to identify the essential black sea bass habitat under their jurisdiction. The following paragraphs are paraphrased from the responses of the States' black sea bass experts. Comments will specifically be solicited and used to update this information, from EFH identified state data contacts and coastal zone managers.

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 (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 (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. 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 (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 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.

Important 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 are found throughout New York marine waters of Gardiners Bay, around Montauk Point and the major inlets along the south shore of Long Island. Likewise, they are found associated with hard structure in the near ocean waters off Long Island Sound. Black sea bass occur in low numbers from at least April through November in trawl survey catches 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. 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.).

2.2.2 Description and Identification of Essential Fish Habitat

2.2.2.1 Methodology for description and identification

According to section 600.815 (a)(1), FMPs must describe EFH in text and with tables that provide information on the biological requirements for each life history stage of the species. These tables should summarize all available information on environmental and habitat variables that control or limit distribution, abundance, reproduction, growth, survival, and productivity of the managed species. The EFH background documents (Packer and Griesbach 1998, Steimle *et al.* 1998a-b) are considered the best scientific information available in order to meet National Standard 2 of the MSFCMA and will be relied upon heavily throughout this section.

As defined in section 3 (10) of the MSFCMA, essential fish habitat is "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." NMFS interprets "waters" to include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Matrices of habitat parameters (i.e. temperature, salinity, light, etc.) for summer flounder, scup, and black sea bass were developed in the EFH background documents and are included in this FMP as Tables 1, 3, and 4. Also included are the ELMR data for the three species by life stage in major Atlantic coast estuaries (Tables 5, 6, 7, 8, 9, and 10; Figures 37a-d, 38a-d, and 39a-d). Researchers at James J. Howard Marine Sciences Laboratory are currently in the process of assembling numerous state survey data that can be used to identify EFH more quantitatively than the somewhat subjective means of how the ELMR data were derived. Currently, the Massachusetts Inshore Trawl Survey, Connecticut Trawl Survey of Long Island Sound, and NMFS Trawl Survey of the Hudson-Raritan Estuary are the only state inshore survey data available in the consistent format being compiled by the personnel at James J. Howard Marine Sciences Laboratory. Due to the strict time constraints of the October-Sustainable Fishery Act deadline, it is unlikely that all the state data will be incorporated in this Amendment. However, as these and other data and information become available on these species EFH designations can be reconsidered. In fact, every FMP must be reviewed at least every five years. It is important to understand that this EFH is a "work in progress", and that the process will evolve. The identification and description of EFH is a frameworked management provision (section 2.2.8 for process description).

Section 600.815 (a)(2)(i)(C) identifies the four levels of data and the approach that should be used.

All the summer flounder, scup, and black sea bass data are either Level 1 (presence/absence) or perhaps at best Level 2 (habitat related densities). No data are at Level 3 (growth, reproduction, and survival rates within habitats) or Level 4 (production rates by habitat types). The Council encourages NMFS and the scientific community to collect more habitat associated data and to strive towards assembling data that can be precisely used for the quantitative identification and description of EFH.

In section 600.815 (a)(2)(ii)(A) the Councils are given direction that they should "interpret this information in a risk-averse fashion". In the next section, (B) it states "if a species is overfished, and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species should be considered essential in addition to certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible."

The Council has interpreted the above direction of interpreting the information in a "risk-averse" fashion as the same as the NMFS policy on risk aversion as expressed by Schaefer (1995). Schaefer (1995) states that, although there is no formal agency (NMFS) definition of risk-averse decision making, it is discussed in several NMFS publications. A succinct agency statement regarding the rationale and objectives of this type of decision making was presented publicly in the *Strategic Plan of the National Marine Fisheries Service -- Goals and Objectives* dated 10 June 1991. This statement, according to Schaefer (1995) still represents the formal agency position on this issue. Under Goal 2 -- Maintain Currently Productive Fisheries, there is a discussion of risk-prone and risk-averse decision making. This clearly explains that the agency advocates risk-averse fishery management decisions because they reduce the risk of overfishing and give the benefit of the doubt to conservation, particularly in the face of uncertainty about the effects of management actions on the managed fishery resources. Also, in *Our Living Oceans,* December 1993, page 24, NMFS indicates that risk-averse decision making is a key element in the development of any improved management system, and that this policy means that managers should err on the side of caution with respect to long-term resource health when making fishery management decisions. Making such decisions based on short-term objectives often places the resource's long-term health at risk.

Currently, four data sets are available for determining summer flounder, scup, and black sea bass EFH. These data sets are Level 1 or, at best, Level 2 data. The data sets are: 1) MARMAP ichthyoplankton survey (Level 2); 2) NEFSC trawl survey (Level 2); 3) ELMR data (Level 1); and 4) SEAMAP survey. The limited state data in the background documents (Packer and Griesbach 1998, Steimle et. al. 1998a-b) were also evaluated and in general, agree with the ELMR data. Again, the available state data will not be used to designate EFH because the same level of data is not available to NEFSC, at the James J. Howard Marine Sciences Laboratory, for all states at this time.

To identify and describe EFH offshore, the Mid-Atlantic Council is relying primarily on data and information derived from the MARMAP ichthyoplankton and NMFS bottom trawl surveys. These surveys provide the best available information on the distribution and relative abundance of Council-managed species in offshore waters. Precise information on the distribution and relative abundance in inshore areas, especially in estuaries and embayments, has been sparse and incomplete in most cases.

To identify and describe EFH in state water for summer flounder, scup, and black sea bass, NOAA's Estuarine Living Marine Resources (ELMR) data will be used. The ELMR program has been conducted jointly by the Strategic Environmental Assessments (SEA) Division of NOAA's Office of

Ocean Resources Conservation and Assessment (ORCA), NMFS, and other agencies and institutions. The goal of this program is to develop a comprehensive information base on the life history, relative abundance, and distribution of fishes and invertebrates in estuaries throughout the nation. The nationwide ELMR database was completed in 1994 and includes information for 135 species found in 122 estuaries and coastal embayments. The Jury *et al.* (1994) report summarizes information on the distribution and abundance of 58 fish and invertebrate species in 17 North Atlantic estuaries. The Stone *et al.* (1994) report summarizes information on the distribution and abundance of 61 fish and invertebrate species in 14 Mid-Atlantic estuaries. The Nelson *et al.* (1991) report covers 40 fish and invertebrate species in 20 estuaries between North Carolina and Florida. Until all the remaining state data are completely available in a uniform format, the ELMR data for adults and amended ELMR data for juveniles will be used to designate EFH in estuarine areas.

Reid *et. al.* (1998) produced an appendix for all the species' habitat background documents produced by James J. Howard Marine Sciences Laboratory, that describes the methods used in NEFSC, state, and other surveys. Data were collected in these surveys on distribution and abundance of all life stages and environmental variables. The Appendix document covers the data sets from MARMAP and NEFSC trawl surveys as identified in the above paragraph, but does not describe the ELMR data.

The NEFSC ran the MARMAP (Marine Resources Monitoring, Assessment and Prediction) program that sampled fish eggs and larvae on monthly to bimonthly surveys covering the continental shelf form Cape Hatteras, NC to Cape Sable, Nova Scotia from 1977 through 1987 (Reid *et. al.* 1998). A total of 81 surveys was made and Reid *et. al.* (1998) documents all the dates and numbers of tows for each survey where eggs and larvae were collected.

The NEFSC bottom trawl surveys have been conducted in the fall since 1963 and in the spring since 1968, with season surveys also being conducted in summer and winter on an intermittent basis. Distribution of juvenile and adult fish have been identified through trawl stations that were selected in a stratified random design that provides unbiased estimates of fish availability to the trawl gear in relation to the distribution of the species. Strata were defined based on water depth, latitude, and historical fishing patterns. Station allotments were approximately one station per 200 square nautical miles. At each station, the total catch was sorted by species, and the catch of each species was weighed and measured; very large catches were sub-sampled. Geographic range extends throughout the US Atlantic EEZ north of Cape Hatteras. Full details of this survey are described in Reid *et. al.* (1998).

The objective of NOAA's ELMR program is the development of a consistent database on the distribution, abundance, and life history characteristics of important fishes and invertebrates in the Nation's estuaries. The nationwide database is divided into five study regions of which summer flounder, scup, and black sea bass are included in a total of three (North Atlantic, Mid-Atlantic, Southeast) Atlantic study regions. The database contains the monthly relative abundance of each species' life stage by estuary for three salinity zones (seawater, mixing, and tidal fresh). Data collection was extensive, peer reviewed, evaluated relative to its reliability, but is also somewhat subjective. This subjectivity has generated some anxiety on the part of research scientists and is the reason that, when the compilation of all the state data is completed in a consistent format, the quantitative state survey data will likely replace the ELMR data. However, at this time, ELMR data do meet National Standard 2 and are very important in describing essential fish habitat for summer flounder, scup, and black sea bass in the estuaries.

Currently, there are virtually no data on these species south of Cape Hatteras. Scup and black sea bass are managed by the SAFMC and will not have any areas south of Cape Hatteras designated by MAFMC. The Southeast Area Monitoring and Assessment Program (SEAMAP) is a NMFS-sponsored survey conducted by the South Carolina Department of Natural Resources. Data were collected from trawl surveys of coastal habitats between Cape Hatteras and Cape Canaveral from 1986 through 1996. Collections were made at randomly selected sites in predefined strata. During the 1986 through 1989 pilot phase of the survey, 19 strata were sampled. In 1989, five additional strata were added to the southern end of the study area, and each of the 24 strata was divided into an inshore and offshore stratum. Reid *et. al.* (1998) details the SEAMAP program. The average catch of juvenile and adult summer flounder from 1986 through 1996, by region, in the SEAMAP survey is presented in Figure 15 (Boylan pers. comm.).

2.2.2.1.1 Five alternative approaches for describing EFH considered by the Mid-Atlantic Technical Team

The Mid-Atlantic EFH Technical Team developed alternatives to designate EFH for consideration by the Council, as a result of a meeting with several bluefish ecologists at the James J. Howard Marine Sciences Laboratory in February 1998. The alternatives were initially developed for bluefish, because the Bluefish Fishery Management Plan was the first plan to be amended with the EFH requirements of the reauthorized Magnuson-Stevens Act. However, the same concepts will apply to all other Council-managed species. At this meeting five alternatives for EFH identification recommendations were discussed for bluefish, these alternatives were to provide the basis for evaluation of the other Council managed species. These five bluefish alternatives were: 1) no action (NEPA requirement); 2) 100% of area where overfished resources occur; 3) the "bottleneck" concept as identified in the bluefish EFH background document where a critical area may restrict recruitment, 4) identification of EFH based on temperature or other key environmental requirement, and 5) a threshold or cutoff point using some percentage of the survey distribution i.e. 50%, 75%, 90% or 100% (Reid *et. al.* 1998). The following is a discussion of the various alternatives and how they were approached with the Level 2 data (NEFSC trawl and MARMAP ichthyoplankton surveys) for summer flounder scup, and black sea bass.

1. The "no action" alternative is included in the FMP because it is required by NEPA (National Environmental Policy Act) but it is not viewed by the Council as defensible. This alternative, or no EFH designation, could not meet the Congressional mandate identified in the 1996 reauthorized Magnuson-Stevens Act. With this alternative, there would be no stock improvement associated with the conservation of essential fish habitat.

2. The second alternative (100% of the distribution) would conform with the 1997 proposed EFH rule's criteria of listing all habitat of an overfished resource as EFH. This alternative is supportable under the Interim Final Rule (1998) because summer flounder, scup, and black sea bass are overfished. This alternative is also defensible if an association between the overfished status of the resource and the loss of essential habitat can be identified.

3. The third alternative, identify bottlenecks in a history stage or to recruitment, is not applicable because no such bottlenecks are identified in the EFH background documents for these species.

4. Alternative 4 approach, of identifying EFH based on key environmental requirements is not possible because of the lack of good quantitative habitat and environmental data corresponding to relative abundance of summer flounder, scup, and black sea bass.

5. Finally, the use of some threshold or cutoff point of the survey distributions, e.g. identifying

some distributional percentage of the catches by area, seemed the only logically defensible position. For EFH designations based on Level 2 data, it is assumed that high value areas are those that support the highest density or relative abundance. This approach is supported by the technical guidance manual when Level 2 data (e.g., NEFSC Atlantic trawl survey) are available (USDC 1998).

2.2.2.1.2 Viable alternatives from the five alternatives identified above

Alternatives 1, 3, and 4, above were eliminated by the Council from consideration. Alternative 1 simply because the no action alternative would not meet the Congressional mandate. Alternatives 3 and 4 may prove useful in the future, but were presently eliminated because of the lack of data (Packer and Griesbach 1998, Steimle *et al.* 1998a-b). Public comment was solicited during the public hearing process on any of the above considered five alternatives, or any other means of identifying EFH; however the Council considered only alternative 5 viable. In actuality, alternative 2 (100% of the distribution) is one of the options under alternative 5.

The Council seriously considered using Alternative 2 (100% of the distribution) because summer flounder, scup, and black sea bass have been identified as overfished. When the initial EFH guidelines were proposed in 1997, EFH for overfished species was to be identified as wherever the resource occurred. The Council, commenting on those guidelines in 1997, suggested that the Secretary should establish rules on how much of the total habitat should really be declared EFH. The relevant, nation-wide question is how much habitat is necessary to maintain a healthy stock. The Council also considered using 100% because of the language in section 600.815 (a)(2)(ii)(B), where it states, "if a species is overfished, and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species should be considered essential in addition to certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible."

The Council felt that designating 100% of distribution in the available surveys as EFH for summer flounder, scup, and black sea bass would be too extensive; thus they endorsed the concept of the Technical Team to use some threshold or cutoff point of less than 100% of the survey distributions (Alternative 5) when supported by Level 2 data. The Technical Team, after meeting with the bluefish experts, suggested that, for overfished species, 90% of the area where they occur be designated EFH, while, when the resource is fully utilized or under utilized, that 75% be designated as EFH. Where only Level 1 or no data are available (as in the South Atlantic), the Council has decided to identify 100% of the area in order to be risk averse. The Guidelines instruct that, when using Level 1 data, "EFH can be inferred on the basis of distributions among habitats where the species has been found and on information on its habitat requirements and behavior."

The Technical Team, bluefish experts, Habitat Committee, Habitat Advisors, and Scientific and Statistical Committee all considered the five alternatives and concluded that the thresholds or cutoff points of some percentage of the survey distributions (Alternative 5) was the most reasonable means for identifying and describing EFH for bluefish, and this same logic was applied to summer flounder, scup, and black sea bass. The Council deems this approach to be reasonable until delineation with Level 3 and Level 4 data can be available. As more information is amassed, the EFH areas delineated can be increased or reduced, as necessary, since the description and identification provision of EFH is one of the provisions of the FMP that is frameworked (section 2.2.8).

2.2.2.1.3 Options for calculation of EFH under the threshold alternative (Alternative 5)

Options under Alternative 5, the preferred alternative, are based on the relative densities and areas of higher concentrations. Maps of EFH designation options are provided for each life history stage of each species (Figures 40-42). The maps presented display the distribution and abundance data by ten-minute squares. This is the most efficient and understandable spatial scale. The data can easily be compared to other data sets, information from the fishing industry, and existing management analyses. Although these thresholds are subjective for two reasons: 1) the cutoff points could have just as well been 40%, 60% 80%, and 100% rather than 50%, 75%, 90%, and 100%, and 2) the choice of one particular cutoff for designating EFH is based on the best professional judgements of the people involved (there is no *a priori* reason to choose 50% over 75% or 90% over 50%). However, these alternatives reflect a reasonable range of designation alternatives. The New England Fishery Management Council is approaching the identification and description of EFH in a similar manner with the assistance of the NEFSC. Four options were considered for Level 2 data (offshore areas north of Cape Hatteras) using a threshold, for each lifestage for each species (Figures 40a-d, 41a-b, and 42a-c):

1. The top two quartiles (50% of the observations);

2. The top three quartiles (75% of the observations);

3. 90% of the observations; or

4. 100% of the observations, or the entire observed range of the resource from the surveys.

To create habitat related density maps, Level 2 data from the MARMAP ichthyoplankton and/or NEFSC trawl survey were binned into ten-minute square maps. (Actually a ten-minute square is a ten-minute quadrangle but common practice has labeled them squares for numerous other fishery discussions.) Data were assigned to a ten-minute square based on the location of the sample. Only those squares that had more than three samples and one positive catch were selected (Cross pers. comm.) The ten-minute squares were ranked from high to low based on three methods: 1) mean catch per unit effort (CPUE); 2) ln CPUE; 3) ln CPUE by area. A total abundance index was calculated for the entire data set by summing the mean catch for all squares. The cumulative portion of the total abundance index was calculated for the ranked ten-minute squares beginning with the lowest rank (equals highest catch). Cutoff points at 50%, 75%, 90%, and 100% of the total abundance index, were identified, and the squares at each of these cutoff points for each life stage were mapped. These groupings (50%, 75%, 90%, and 100%) represent areas of decreasing average density and increasing area. The ten-minute squares contained in the top 50%, 75%, 90% and 100% of all the ranked squares based on the ln CPUE by area were mapped separately for each life stage of summer flounder, scup, and black sea bass (Figures 40a-d, 41a-b, and 42a-c).

Although this approach has some limitations for these species, it is a scientifically objective approach that is based on the best available information. Structure-oriented species such as black sea bass are not sampled well by bottom trawl type gear, therefore the survey may be biased low. The MARMAP survey is also biased low for eggs, because of the patchy distribution. State and inshore surveys for the most part, either do not exist or are not in a format comparable currently to NMFS data. Few of the surveys collect the habitat information that is most needed (habitat type, substrate, biological associations, etc.). Additional sources of information (fishermen, historical, etc.) are sparse, difficult to verify, and largely anecdotal; however, public involvement in identifying and describing EFH was solicited during the public hearing process and will be welcomed for future iterations of this work.

Despite the limitations of this approach, it is premised on the assumption that high relative abundance of summer flounder, scup, and black sea bass is indicative of high value habitat. This is the first step toward a complete designation of EFH. Thus, for the current Amendment, the Council can designate EFH based on the limited information available and set the stage for gathering new and better information. This additional information will help us eliminate the limitations of the current process and either verify or discredit the assumptions used.

One important thing to remember is that this is not the last step in the process, but that the public, Habitat Advisors, Habitat Committee and the Council will have the opportunity to review and modify, if necessary, these EFH designations in the future through the framework process. During the public hearing process, the public was asked to comment on these designations and was able to provide additional available information. Following public review, the Council had the opportunity to modify the EFH designations based on input gathered during this process. No changes were made by the Council at the October 1998 meeting when the FMP was approved for submittal.

The Council chose the preferred alternative to be the highest 90% of the area (for the offshore Level 2 data, NEFSC and MARMAP) because it is the most inclusive and thus the most risk-averse, without going to 100% of the summer flounder, scup, and black sea bass distribution. Remember that these species are habitat oriented species that are significantly overfished. The Council made the decision on the description of EFH (the highest 90% of where summer flounder, scup, and black sea bass were collected) with the above factors in mind at the June Council meeting. The Council also decided to use the highest 90% of the area for all life stages of all three species since there was no readily apparent significant differences by life stage. The Council solicited comments from the public on the appropriate percentages used for describing EFH where Level 2 data are available. Maps of all life stages of summer flounder, scup, and black sea bass with the associated percentages of offshore EFH designation are in Figures 40a-d, 41a-b, and 42a-c.

The actual area (number of ten-minute squares) for each of the standardized percentage (50%, 75%, 90%, and 100%), as well as corresponding variable percentages with catch for all life stages (eggs, larvae, juveniles and adults) for summer flounder, scup, and black sea bass are presented in Tables 11a-d, 12a-d, 13a-d. For example, Table 11 shows that the highest 90% of the catch of summer flounder eggs were caught within 60% of the area (approximately 108 out of the 120 ten-minute squares), where summer flounder were caught, while the highest 90% of the area would encompass 118 out of the 120 ten-minute squares and 90% of the catch of summer flounder. The logged catch analysis was not included in Tables 11-13 because its area is consistently between the area and catch analyses (Figure 43-45). The guidelines [Section 600.815 (a)(2)(C)(2)] state that "Density data should reflect habitat utilization, and the degree that a habitat is utilized is assumed to be indicative of that habitat value." The Technical Guidance manual (USDC 1997a) continues to explain that "EFH is the area of moderate to high abundance. However under certain conditions, habitats of low to moderate abundance may contribute to enough of the overall species productivity (e.g., reduced population size, when current population size of the species or stock is below historic levels)."

The "preferred" alternative for EFH designation using these data was chosen to be the highest 90% of all the squares ranked based on ln CPUE by area where eggs, larvae, juvenile, and adult summer flounder, scup, and black sea bass were caught in the MARMAP and/or NEFSC trawl surveys. This more inclusive, risk-averse approach was chosen because these are three species that are somewhat habitat oriented and significantly overfished. In the case of summer flounder, habitat degradation has been attributed at least partially for the poor status of the stock.

The only data for summer flounder, scup, and black sea bass south of Cape Hatteras are the SEAMAP data, which have not been summarized or analyzed in EFH background documents. As mentioned earlier, the state data are now being put into a consistent, usable electronic format by the NEFSC and should be available for the next iteration of EFH amendments. The guidelines instruct that when using Level 1 data, "EFH can be inferred on the basis of distributions among habitats where the species has been found and on information about its habitat requirements and behavior." Therefore, in an effort to be risk averse and to follow the guidelines for Level 1 data, all waters with the same habitat parameters that are important to summer flounder north of Cape Hatteras (i.e., pelagic or demersal waters with same depth, temperature, and salinity) from Cape Hatteras, North Carolina to Florida will be designated as EFH (Figure 46). The purpose of identifying a broad area south of Cape Hatteras as EFH is so that any project proponents should document the distribution and abundance of summer flounder, scup, or black sea bass in the areas that may be impacted with their activities. The Council solicited public comments on EFH designation in the South Atlantic because the offshore SEAMAP data are much less complete than offshore trawl data for the area north of Cape Hatteras.

The best available data to identify EFH for summer flounder scup, and black sea bass in estuarine areas are the ELMR data (Tables 5-10; Figures 37-39). The Council concluded that all estuaries on the western Atlantic coast where summer flounder larvae and juveniles are listed as "rare," "common," "abundant," or "highly abundant" are designated as EFH (Table 14); all estuaries from Cape Hatteras, North Carolina and north, where scup, or black sea bass are listed as "common," "abundant," or "highly abundant" will be designated as EFH (Tables 15 and 16). ELMR data show that summer flounder, scup, and black sea bass eggs, larvae, juveniles, and adults are "highly abundant," "common," and/or "abundant" in many New England and Mid-Atlantic, and/or South Atlantic estuaries and thus the "mixing" and "seawater" (defined by ELMR as 0.5 to 25ppt and >25 ppt, respectively) portion of the estuaries will be designated as EFH. ELMR data are not available for the North Atlantic estuaries therefore Table 2 from the summer flounder EFH background document will be used to designate EFH for summer flounder there. Maps of the salinity zones for the individual estuaries are presented in Figure 36.

NOTE: Council chose 100% of the estuaries where summer flounder have been collected for both the larvae and juvenile stages because as stated in Able and Kaiser (1994) summer flounder are "estuarine dependent" (i.e. these life stages can not use the coastal waters in place of the estuaries like bluefish). Estuaries are most likely to be affected by human activities. The larvae's entrance into the estuaries effectively forms a "bottleneck" that is critical to this species' health. Adult summer flounder, because they are they are not really estuarine dependent, and therefore EFH is where they are "common," "abundant," or "highly abundant."

2.2.2.2 Specific description and identification of summer flounder, scup, and black sea bass essential fish habitat

Summer flounder

Eggs: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of the all the ranked ten-minute squares for the area where summer flounder eggs are collected in the MARMAP survey (Figure 47a). 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral, Florida, to depths of 360 ft (Figure 46). In general, summer flounder eggs are found between October and May, being most abundant between Cape Cod and Cape Hatteras, with the heaviest concentrations within 9 miles of shore off New Jersey and New York. Eggs are most commonly collected at depths of 30 to 360 ft.

Larvae: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where summer flounder larvae are collected in the MARMAP survey (Figure 47b). 2) South of Cape Hatteras, EFH is the nearshore waters of the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Hatteras, North Carolina to Cape Canaveral Florida, in nearshore waters (out to 50 miles from shore; Figure 46). 3) Inshore, EFH is all the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database (Table 14), in the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as greater than 25 ppt) salinity zones (Figure 36). In general, summer flounder larvae are most abundant nearshore (12-50 miles from shore) at depths between 30 to 230 ft. They are most frequently found in the northern part of the Mid-Atlantic Bight from September to February, and in the southern part from November to May.

Juveniles: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey (Figure 47c). 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida (Figure 46). 3) Inshore, EFH is all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database (Table 14) for the "mixing" and "seawater" salinity zones (Figure 36). In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37 °F and salinities from 10 to 30 ppt range.

Adults: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey (Figure 47d). 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida (Figure 46). 3) Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database (Table 14) for the "mixing" and "seawater" salinity zones (Figure 36). Generally summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer Continental Shelf at depths of 500 ft in colder months.

Scup

Eggs: EFH is estuaries where scup eggs were identified as common, abundant, or highly abundant in the ELMR database (Table 15) for the "mixing" and "seawater" salinity zones (Figure 36). In general scup eggs are found from May through August in southern New England to coastal Virginia, in waters between 55 and 73 °F and in salinities greater than 15 ppt.

Larvae: EFH is estuaries where scup were identified as common, abundant, or highly abundant in the ELMR database (Table 15) for the "mixing" and "seawater" salinity zones (Figure 36). In general scup larvae are most abundant nearshore from May through September, in waters between 55 and 73 °F and in salinities greater than 15 ppt.

Juveniles: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where juvenile scup are collected in the NEFSC trawl survey (Figure 48a). 2) Inshore, EFH is the estuaries where scup are identified as being common, abundant, or highly abundant in the ELMR database (Table 15) for the "mixing" and "seawater" salinity zones (Figure 36). Juvenile scup, in general during the summer and spring are found in estuaries and bays between Virginia and Massachusetts, in association with various sands, mud, mussel and eelgrass bed type substrates and in water temperatures greater than 45 °F and salinities greater than 15 ppt.

Adults: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where adult scup are collected in the NEFSC trawl survey (Figure 48b). 2) Inshore, EFH is the estuaries where scup were identified as being common, abundant, or highly abundant in the ELMR database (Tables 15) for the "mixing" and "seawater" salinity zones (Figure 36). Generally, wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45 °F.

Black sea bass

Eggs: EFH is the estuaries where black sea bass eggs were identified in the ELMR database as common, abundant, or highly abundant (Table 16) for the "mixing" and "seawater" salinity zones (Figure 36). Generally, black sea bass eggs are found from May through October on the Continental Shelf, from southern New England to North Carolina.

Larvae: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all ranked ten-minute squares of the area where black sea bass larvae are collected in the MARMAP survey (Figure 49a). 2) EFH also is estuaries where black sea bass were identified as common, abundant, or highly abundant in the ELMR database (Table 16) for the "mixing" and "seawater" salinity zones (Figure 36). Generally, the habitats for the transforming (to juveniles) larvae are near the coastal areas and into marine parts of estuaries between Virginia and New York. When larvae become demersal, they are generally found on structured inshore habitat such as sponge beds.

Juveniles: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey (Figure 49b). 2) Inshore, EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database (Table 16) for the "mixing" and "seawater" salinity zones (Figure 36). Juveniles are found in the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 43 °F with salinities greater than 18 pp and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during the wintering.

Adults: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where adult black sea bass are collected in the NEFSC trawl survey (Figure 49c). 2) Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database (Table 16) for the "mixing" and "seawater" salinity zones (Figure 36). Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 43 °F seem to be the minimum requirements. Structured habitats (natural and man-made), sand and shell are usually the substrate preference.

Finally, the MAFMC solicited input from the public and state personnel on where they perceive EFH should be designated for summer flounder, scup, and black sea bass. Only one response in the form of a map was received from the state of Massachusetts and those comments were incorporated into the EFH. Additional comments on Figures 50 and 51 will be welcomed in future iterations of this FMP.

2.2.2.2.1 Identification of Habitat Areas of Particular Concern (HAPC)

According to section 600.815 (a)(9), FMPs should identify habitat areas of particular concern (HAPC) within EFH where one or more of the following criteria must be met: (i) ecological function, (ii) sensitive to human-induced environmental degradation, (iii) development activities stressing habitat type, or (iv) rarity of habitat.

The MAFMC identified SAV and macroalgae beds in the nursery habitats (for larvae and juvenile summer flounder) as HAPC because as is identified in the Packer and Griesbach document (page 41) "flounder appeared to utilize aquatic vegetation (eelgrass) as a 'blind;' i.e., they lie-in-wait along the vegetative perimeter, effectively capturing prey which moved from within the grass." The report continues "in the absence of the eelgrass, the spot visually detected and avoided the flounder; the flounder therefore consumed fewer spot on average in the non-vegetated treatment than in the vegetated treatments."

The MAFMC identified SAV and macroalgae beds as HAPC because of its ecological importance as shelter from predators, as well as in predation. Packer and Griesbach (1998) give an extensive review of the importance of SAV to juvenile and adult summer flounder. SAV has also been identified as refugia for juvenile and adult summer flounder, possibly important habitat for spawning summer flounder, important for prey of juvenile and possibly adult flounder (Laney 1997). Laney (1997) concluded that any loss of these areas along the Atlantic Seaboard may affect stocks. SAV as defined by ASMFC (1997) is rooted, vascular, flowering plants that, except for some flowering structures, live and grow below the water surface. In areas where SAV is absent, for example Delaware Bay, macroalgae can serve the same ecological function.

The specific designation of HAPC for summer flounder is as follows:

> All native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is HAPC. If native species of SAV are eliminated then exotic species should be protected because of functional value, however, all efforts should be made to restore native species.

The Council envisions that the designation of SAV as HAPC will give their recommendations on protecting SAV more weight during the consultation process. The Council is unable to regulate fishing gear in State waters. The states are encouraged through ASMFC to develop a concerted effort to protect SAV. The states of Virginia and Maryland are already considering actions. Due to lack of quantitative data on gear effort and impacts, management measures to protect SAV will not be implemented at this time, as information becomes available management measures may be considered through the framework provisions, as explained in Section 2.2.4. For more information on SAV, a list of state contacts involved with SAV is provided in Table 17.

The MAFMC is not recommending any portions of EFH as HAPC for scup and black sea bass at this time. This is because no strong associations between habitat type or location and recruitment for these species have been identified in the EFH background documents (section 2.2.1). The information in the EFH background documents appear inadequate at this time to put a high priority on specific habitat. However, the Council is recommending the Secretary identify HAPCs for summer flounder in the FMP and the Council expects to designate additional HAPCs for other species as more data become available. Designation of HAPCs is a frameworked measure so the Council will have the flexibility to establish or modify HAPC designations as further information becomes available. The Council intends to use the framework process identified in section 2.2.8 and work through the Habitat Monitoring Committee for future consideration of HAPCs.

2.2.3 Fishing Activities that May Adversely Affect EFH

According to section 600.815 (a)(3), adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. FMPs must include management measures that minimize adverse effects on EFH from fishing, to the extent practicable, and identify conservation and enhancement measures. Councils must act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH.

The following is a summary of general impacts of mobile fishing gear from the report "Indirect Effects of Fishing" (Auster and Langton 1998).

The discussion of the wide range of effects of fishing on EFH is based on the definition of EFH within the Act and the technical guidance produced by NMFS to implement the Act. The Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition (and for defining the scope of this report), "waters" is interpreted by NMFS as "aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate" and "substrate" is defined to include sediment, hard bottom, structures, and associated biological communities. These definitions provide substantial flexibility in defining EFH based on our knowledge of the different species, but also allows EFH to be interpreted within a broader ecosystem perspective. Disturbance has been defined as "any discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment" (Pickett and White 1985). From an ecological perspective, fishing with fixed and mobile gear is the most widespread form of direct disturbance in marine systems below depths which are affected by storms (Watling and Norse 1997). Disturbance can be caused by many natural processes such as currents, predation, iceberg scour (Hall 1994). Human caused disturbance can result from activities such as harbor dredging and fishing with mobile gear. Disturbance can be gauged by both intensity (as a measure of the force of disturbance) and severity (as a measure of impact on the biotic community). Table 18 summarizes the relative effects of the range of agents which produce disturbances in marine communities.

One of the most difficult aspects of estimating the extent of impacts on EFH is the lack of high resolution data on the distribution of fishing effort. Fishers are often resistant to reporting effort based on locations of individual tows or sets (for the obvious reason of divulging productive locations to competitors and regulators). Effort data in many fisheries are apportioned to particular statistical areas for monitoring purposes. Using this type of data it, has been possible to obtain averages of effort, and subsequent extrapolations of area impacted, for larger regions.

Trawling effort in the Middle Atlantic Bight off the northeast U.S. was summarized by Churchill (1989). Trawled area estimates were extrapolated from fishing effort data in 30 minute latitude x 30 minute longitude grids. The range of effort was quite variable, but the percent area impacted in some blocks off southern New England was over 200% with one block reaching 413%. Estimating the spatial impact of fixed gears is even more problematic. For example, during 1996 there were 2,690,856 lobster traps fished in the state of Maine (Maine Department of Marine Resources unpublished data). These traps were hauled on average every 4.5 d, or 81.4 times $year^{-1}$. Assuming a 1 m^2 footprint for each trap, the area impacted was 219 km^2. If each trap was dragged across an area three times the footprint during set and recovery, the area impacted was 657 km^2. A lack of data on the extent of the area actually fished makes analysis of the impacts of fishing on EFH in those fisheries difficult.

Auster and Langton (1998) summarize and interpret the current scientific literature on fishing impacts as they relate to fish habitat. These studies are discussed within three broad subject areas: effects on structural components of habitat, effects on benthic community structure, and effects on ecosystem level processes. The interpretation is based on commonalities and differences between studies. Fishing gear types are discussed as general categories (e.g., trawls, dredges, fixed gear). The necessity for these generalizations is based on two over-riding issues: (1) many studies do not specify the exact type and configuration of fishing gear used, and (2) each study reports on a limited range of habitat types. However, their interpretation of the wide range of studies is based on the type and direction of impacts, not absolute levels of impacts. Auster and Langton (1998) do not address the issues of bycatch (Alverson *et al.* 1994), mortality of gear escapees (Chopin and Arimoto 1995), or ghost fishing gear (Jennings and Kaiser 1998, p. 11-12 and references therein), as these issues do not directly relate to fish habitat, and recent reviews have been published which address these subjects.

Impacts of fishing on fish habitat (Auster and Langton 1998) include the following:

1. Effects on structural components of habitat;

2. Effects on community structure; and

3. Effects of ecosystem processes.

2.2.3.1 Effects on structural components of habitat

Habitat has been defined as "the structural component of the environment that attracts organisms and serves as a center of biological activity" (Peters and Cross 1992). Habitat in this case is defined as the range of sediment types (i.e., mud through boulders), bed forms (e.g., sand waves and ripples, flat mud), as well as the co-occurring biological structures (e.g., shell, burrows, sponges, seagrass, macroalgae, coral). A review of 22 studies (Table 19) all show measurable impacts of mobile gear on the structural components of habitat (e.g., sand waves, emergent epifauna, sponges, coral), when defining habitat at this spatial scale. Results of each of the studies show similar classes of impacts despite the wide geographic range of the studies (i.e., tropical to boreal). In summary, mobile fishing gear reduced habitat complexity by: (1) directly removing epifauna or damaging epifauna leading to mortality, (2) smoothing sedimentary bedforms and reducing bottom roughness, and (3) removing taxa which produce structure (i.e., taxa which produce burrows and pits). Studies which have addressed both acute and chronic impacts have shown the same types of effects.

Some species with demersal life history stages have obligate habitat requirements or recruitment bottlenecks (without the specific structural components populations of fishes with these habitat requirements would not persist). Few published accounts of the impacts of fixed gears on habitat have been written. Eno *et al.* (1996) studied the effects of crustacean traps in British and Irish waters. One experiment assessed the effects of setting and hauling pots on emergent epifaunal species (i.e., sea pens) on soft bottom. Both impacts from dragging pots across the bottom, and pots resting for extended periods on sea pens, showed the group was able to mostly recover from such disturbances. Limited qualitative observations of fish traps, longlines, and gill nets dragged across the seafloor during set and recovery showed results similar to mobile gear such that some types of epibenthos was dislodged, especially emergent species such as erect sponge and coral (High 1992, SAFMC 1991). While the area impacted per unit of effort is smaller for fixed gear than with mobile fishing gear, the types of damage to emergent benthos appear to be similar (but not necessarily equivalent per unit effort). Quantitative studies of fixed gear effects, based on acute and chronic impacts, have not been conducted.

The issue of defining pelagic habitats and elucidating effects of fishing is difficult because these habitats are poorly described at the scales that allow for measurements of change based on gear use. While pelagic habitat can be defined based on temperature, light intensity, turbidity, oxygen concentration, currents, frontal boundaries, and a host of other oceanographic parameters and patterns, there are few published data that attempt to measure change in any of these types of parameters or conditions concurrently with fishing activity and associations of fishes. Kroger and Guthrie (1972) showed that menhaden (*Brevoortia patronus* and *B. tyrannus*) were subjected to greater predation pressure, at least from visual predators, in clear versus turbid water, suggesting that turbid habitats were a greater refuge from predation. This same type of pattern was found for menhaden in both naturally turbid waters and in the turbid plumes, generated by oyster shell dredging activities (Harper and Hopkins 1976). However, no work has been published that addresses the effects of variation in time and space of the plumes or the effects using turbid water refugia on feeding and growth. There are also examples of small scale aggregations of fishes with biologic structures in the water column and at the surface. Aggregations of fishes may have two effects on predation patterns by: (1) reducing the probability of predation on individuals within the aggregation, and (2) providing a focal point for the activities of predators (a cue that fishermen use to set gear). For example, small fishes aggregate under mats of *Sargassum* (e.g., Moser *et al.* 1998) where high density vessel traffic may dis-aggregate mats. Also, fishes have been observed to co-occur with aggregations of gelatinous zooplankton and pelagic crustaceans (Auster *et al.* 1992, Brodeur in press). Gelatinous zooplankton are greatly impacted as they pass through the mesh of either mobile or stationary gear (unpublished observations), which may reduce the size and number of aggregations and disperse associated fishes. These changes could reduce the value of aggregating, resulting in increased mortality or reduced feeding efficiency.

Lack of information on the small scale distribution and timing of fishing make it difficult to ascribe the patterns of impacts observed in field studies to specific levels of fishing effort. Auster *et al.* (1996) estimated that between 1976 and 1991, Georges Bank was impacted by mobile gear (i.e., otter trawl, roller-rigged trawl, scallop dredge) on average between 200-400% of its area on an annual basis and the Gulf of Maine was impacted 100% annually. However, fishing effort was not homogeneous. Sea sampling data from NMFS observer coverage demonstrated that the distribution of tows was nonrandom. While these data represent less than 5% of overall fishing effort, they illustrated that the distribution of fishing gear impacts is quite variable.

Recovery of the habitat following trawling is difficult to predict as well. Timing, severity, and frequency of the impacts all interact to mediate processes which lead to recovery (Watling and Norse 1997). For example, sand waves may not be reformed until storm energy is sufficient to produce bedform transport of coarse sand grains (Valentine and Schmuck 1995), and storms may not be common until a particular time of year or may infrequently reach a particular depth, perhaps only on decadal time scales. Sponges are particularly sensitive to disturbance because they recruit aperiodically and are slow growing in deeper waters (Reiswig 1973, Witman and Sebens 1985, Witman *et al.* 1993). However, many species such as hydroids and ampelescid amphipods reproduce once or twice annually, and their stalks and tubes provide cover for the early benthic phases of many fish species and their prey (e.g., Auster *et al.* 1996, 1997b). Where fishing effort is constrained within particular fishing grounds, and where data on fishing effort is available, studies which compare similar sites along a gradient of effort have produced the types of information on effort-impact that will be required for effective habitat management (e.g., Collie *et al.* 1996, 1997; Thrush *et al.* in press).

The role these impacts on habitat have on harvested populations is unknown in most cases. However, a growing body of empirical observations and modeling demonstrate that effects can be seen in population responses at particular population levels. For example, Lindholm *et al.* (1998) have modeled the effects of habitat alteration on the survival of 0-year cohorts of Atlantic cod. The model results indicate that a reduction in habitat complexity has measurable effects on population dynamics when the adult stock is at low levels (i.e., when spawning and larval survivorship does not produce sufficient recruits to saturate available habitats). At high adult population levels, when larval abundance may be high and settling juveniles would greatly exceed habitat availability, predation effects would not be mediated by habitat, and no effect in the response of the adult population to habitat change was found.

Empirical studies that most directly link changes due to gear impacts changes on habitat structure to population responses are being carried out in Australia. Sainsbury (1987,1988, and 1991) and Sainsbury *et al.* (In press) have shown a very tight coupling between a loss of emergent epifauna and fish productivity along the north west continental shelf. In these studies, there was a documented decline in the bycatch of invertebrate epifauna, from 500 kg/hr to only a few kg/hr, and replacement of the most commercially desirable fish associated with the epifaunal communities by less valuable species associated with more open habitat. By restricting fishing, the decline in the fish population was reversed. This corresponded to an observed recovery in the epifaunal community, albeit the recovery for the larger epifaunal invertebrates showed a considerable lag time after trawling ceased. This work is based on a management framework which was developed to test hypotheses regarding the habitat dependence of harvested species. The hypotheses, described in Sainsbury (1988 and 1991), assessed whether population responses were the result of: (1) independent single-species (intraspecific) responses to fishing and natural variation, (2) interspecific interactions such that, as specific populations are reduced by fishing, non-harvested populations experienced a competitive release, (3) interspecific interactions such that, as non-harvested species increase from some external process, their population inhibits the population growth rate of the harvested species, and (4) habitat mediation of the carrying capacity for each species, such that gear induced habitat changes alter the carrying capacity of the area.

2.2.3.2 Effects on community structure

An immediate reduction in the density of non-target species is commonly reported following impact from mobile gear (Table 20). In assessing this effect, it is common to compare numbers and densities for each species before and after trawling and/or with an undisturbed reference site.

Time series data sets that allow for a direct long-term comparison of before and after fishing are essentially nonexistent, primarily because the extent to which the worlds oceans are currently fished was not foreseen, or because time series data collection focused on the fish themselves rather than the impact of fishing on the environment. Nevertheless, there are several benthic data sets that allow for an examination of observational or correlative comparisons before and after fishing (Table 21). Long-term effects of fishing included reduced densities of certain types of macrobenthos including sponges, coelenterates, bivalves, as well as seagrass meadows and increases in taxa such as polychaete. Other shifts occurred; for example, a decline in sea urchins to an increase in brittle stars, a decline in deposit feeders and an increase in suspension feeders and carnivores, as well as a decline in animal size.

Data sets on the order of months to a few years are more typical of the longer term studies on trawling impacts on benthic community structure. Otter trawl door marks were visible for 2 to 7 months with no sustained significant impact on the benthic community noted at high energy locations. In the lower energy muddy sand location, there was a loss in surficial sediments and lowered food quality of the sediments. The subsequent variable recovery of the benthic community over the following six months correlated with the sedimentary food quality which was measured as microbial populations, chlorophyll "a" and enzyme hydrolizable amino acids. While some taxa recolonized the impacted areas quickly, the abundances of some taxa (i.e., cumaceans, phoxocephalid and photid amphipods, nephtyid polychaetes) did not recover until food quality also recovered.

The most consistent pattern in fishing impact studies at shallow depths is the resilience of the benthic community to fishing. Most studies demonstrate that most taxa recover from the effects of trawling within months to years. These taxa include worms, bivalves, sea grass, and crustacea. In the case of the most intense trawling, seagrass beds did not recover after two years. Sometimes the community may shift to less commercially desirable species. In experimentally closed areas, there has been a recovery of fish and an increase in the small benthos but, based on settlement and growth of larger epifaunal animals, it may take 15 years for a system to recover. Two studies in the intertidal, harvesting worms and clams using suction and mechanical harvesting gear demonstrated a substantial immediate effect on the macrofaunal community but from seven months to two years later, the study sites had recovered to pre-trawled conditions (Beukema 1995, Kaiser and Spencer 1996). In a South Carolina estuary, Van Dolah *et al.* (1991) found no long term effects of trawling on the benthic community. The study site was assessed prior to and after the commercial shrimp season and demonstrated variation over time, but no trawling effects *per se*. Other studies of pre and post impacts from mobile gear on sandy to hard bottoms have generally shown similar results (Currie and Parry 1996, Gibbs *et al.* 1980, MacKenzie 1982), with either no or minimal long term impact detectable.

Clearly, the long-term effects of fishing on benthic community structure are not easily characterized. The pattern that does appear to be emerging from the available literature is that communities that are subject to variable environments, and are dominated by short-lived species, are fairly resilient. Depending on the intensity and frequency of fishing, the impact of such activity may well fall within the range of natural perturbations. In communities which are dominated by long-lived species in more stable environments, the impact of fishing can be substantial and longer term. In cases such as described in Auster and Langton (1998) for Strangford Loch and the Australian shelf, recovery from trawling will be on the order of decades. In many areas, these patterns correlate with shallow and deep environments. However, water depth is not the single variable that can be used to characterize trawling impacts.

There are few studies that describe fishing impacts on soft muddy bottom communities or deep areas at the edge of the continental shelf. Such sites would be expected to be relatively low energy zones, similar to Strangford Loch, and might not recover rapidly from fishing disturbance. Studies in these relatively stable environments are required to pattern fishing impacts over the entire environmental range but, in anticipation of such results, it is suggested here that one should expect a tighter coupling between fish production and benthic community structure in the more stable marine environments.

2.2.3.3 Effects on ecosystem processes

A number of studies indicate that fishing has measurable effects on ecosystem processes. Disturbance by fishing gear in relatively shallow depths (i.e., 98 - 131 ft [30-40 m] depth) can reduce primary production by benthic microalgae. Recent studies in several shallow continental shelf habitats have shown that primary production by a distinct benthic microflora can be a significant portion of overall primary production (i.e., water column plus benthic primary production; Cahoon and Cooke 1992, Cahoon *et al.* 1990 and 1993). Benthic microalgal production supports a variety of consumers, including demersal zooplankton (animals that spend part of each day on or in the sediment and migrate regularly into the water; Cahoon and Tronzo 1992). Demersal zooplankton include harpacticoid copepods, amphipods, mysids, and other animals that are eaten by planktivorous fishes and soft bottom foragers (Thomas and Cahoon 1993).

The disturbances caused by fishing to benthic primary production and organic matter dynamics are difficult to predict. Semi-closed systems such as bays, estuaries, and fjords are subject to such effects at relatively small spatial scales. Open coastal and outer continental shelf systems can also experience perturbations in these processes. However, the relative rates of other processes may minimize the effects of such disturbances depending upon the level of fishing effort.

Mayer *et al.* (1991) discussed the implications of organic matter burial patterns in sediments versus soils. Their results are similar to organic matter patterns found in terrestrial soils. Sediments are essentially part of a burial system while soils are erosional. While gear disturbance can enhance remineralization rates by shifting from surficial fungal dominated communities to subsurface communities with dominant bacterial decomposition processes, burial caused by gear disturbance might also enhance preservation if material is sequestered in anaerobic systems. Given the importance of the carbon cycling in estuaries and on continental shelves to the global carbon budget, understanding the magnitude of effects caused by human disturbances on primary production and organic matter decomposition will require long term studies as have been conducted on land.

2.2.3.3.1 Direct alteration of food web

In heavily fished areas of the world, it is undebatable that there are ecosystem level effects (Gislason 1994, Fogarty and Murawski 1998) and that shifts in benthic community structure have occurred. The data to confirm that such shifts have taken place is limited at best (Riesen and Reise 1982) but the fact that it has been documented at all is highly significant. If the benthic communities change, what are the ecological processes that might bring about such change?

One of these is an enhanced food supply, resulting from trawl damaged animals and discarding both nonharvested species and the offal from fish gutted at sea. The availability of this food source might affect animal behavior, and this energy source could influence survival and reproductive success. There are numerous reports of predatory fishes and invertebrate scavengers foraging in trawl tracks after a trawl passes through the area (Medcof and Caddy 1971, Caddy 1973, Kaiser and Spencer 1994, Ramsey *et al.* 1997a-b). The prey available to scavengers is a function of the ability of animals to survive the capture process, either being discarded as unwanted by-catch or having been passed through or over by the gear (Meyer *et al.* 1981, Fonds 1994, Rumhor *et al.* 1994, Santbrink and Bergman 1994, Kaiser and Spencer 1995). Stomach contents data demonstrate that fish not only feed on discarded or damaged animals, and often eat more than their conspecifics at control sites, they also consume animals that were not damaged but simply displaced by the trawling activity, or even those invertebrates that have themselves responded as scavengers (Kaiser and Spencer 1994, Santbrink and Bergman 1994).

It is of interest to note that Kaiser and Spencer (1994) make the comment, as others have before them, that it is common practice for fishermen to re-fish recently fished areas to take advantage of the aggregations of animals attracted to the disturbed benthic community. The long term effect of opportunistic feeding following fishing disturbances is an area of speculation.

Another process that can indirectly alter food webs is alteration of the predator community by removing keystone predators. In the northwest Atlantic, Witman and Sebens (1992) showed that onshore-offshore differences in cod and wolffish populations reduced predation pressure on cancrid crabs and other megafauna in deep coastal communities. They suggest that this regional difference in predation pressure is the result of intense harvesting of cod, a keystone predator, with cascading effects on populations of epibenthos (e.g., mussels, barnacles, urchins), which are prey of crabs. Other processes (e.g., annual variation in physical processes effecting survivorship of recruits, climate change, El Nino, recruitment variability of component species caused by predator induced mortality) can also result in food web changes; while it is important to understand the underlying causes of such shifts, precautionary approaches should be considered, given the strong inference of human caused effects in the many cases where studies were focused on identifying causes.

2.2.3.4 Summary

This review of the literature by Auster and Langton (1998) indicates that fishing, using a wide range of gear, produces measurable impacts. However, most studies were conducted at small spatial scales, and it is difficult to apply such information at a regional levels where predictive capabilities would allow us to manage at an ecosystem scale (Jennings and Kaiser 1998). Our current understanding of ecological processes related to the chronic disturbances caused by fishing make results difficult to predict (Auster and Langton 1998).

The removal of fish for human consumption from the world's oceans has effects not only on the target species, but also on the associated benthic community. The size specific, and species specific, removal of fish can change the system structure, but, fortunately, the regions of the continental shelf which are normally fished appear to be fairly resilient. The difficulty for managers is defining the level of resilience, in the practical sense of time/area closures or mesh regulations or overall effort limits, that will allow for the harvest of selected species without causing human induced alterations of the ecosystem structure to the point that recovery is unduly retarded or community and ecosystem support services are shifted to an alternate state (Steele 1996). Natural variability forms a backdrop against which managers must make such decisions, and, unfortunately, natural variability can be both substantial and unpredictable (Auster and Langton 1998).

2.2.3.5 Ghost fishing

Stationery gear may also cause adverse impacts to fish habitat by becoming ghost fishing gear. This occurs when storms, mobile gear, or boats rip traps, gill nets, and pots from their lines. This lost gear cannot be retrieved and may continue to fish for years (Rhodes 1995). In addition, ghost gill nets, traps, and pots change the structural component of the habitat. This can be a problem with commercial and recreational gear. This problem is currently impossible to quantify and the ecosystem effects are difficult to predict.

2.2.3.6 Fishing gear used within summer flounder, scup and black sea bass range

Commercial fishing gear used in 1995 for fisheries prosecuted from Maine to Virginia is characterized in Table 22. Fishing gear which caught 1% or more of the landings for the Mid-Atlantic Council-managed species from Maine to Virginia in 1995 is presented in Table 23. These data were summarized from the 1995 Unpublished NMFS Weighout data. While total pounds of all species landed is not necessarily an indication of effort, it is some indication of the relative use of various fishing gears in both state and federal waters. Bottom gear used from Maine to Virginia include bottom otter trawls, clam dredges, sea scallop dredges, and other dredges. Fishing gear that is managed by the South Atlantic Council is presented in Table 24.

2.2.3.7 Fishing impacts to summer flounder, scup, and black sea bass EFH

Summer flounder, scup, and black sea bass are demersal species that have associations with substrates, SAV, and structured habitat (Packer and Griesbach 1998, Steimle *et al.* 199a-b). Effort of mobile gear in federal and state waters throughout the entire summer flounder, scup, and black sea bass range is unquantified. Therefore, it is difficult to predict the exact impact that mobile gear in contact with the bottom will have on habitat. Although there is no way to gauge the intensity and severity of mobile gear in contact with the bottom (bottom otter trawl, clam dredge, scallop dredge, and dredge-other), these gears are characterized as having a "potential adverse impact" on EFH (Table 25).

2.2.4 Options for Managing Adverse Effects from Fishing

According to section 600.815 (a)(4), fishery management options may include, but are not limited to: (i) fishing equipment restrictions, (ii) time/area closures, and (iii) harvest limits.

According to section 600.815 (a)(3) Councils must act to prevent, mitigate, or minimize adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH. Evidence of various gear impacts on bottom in the Mid-Atlantic Region has been presented to the Council over the past several years. It is because of this anecdotal information that the Council is considering that

All mobile gear coming into contact with the seafloor within summer flounder, scup, and black sea bass EFH is characterized as having a potential impact on their EFH. However, the effort of these bottom tending gears is largely unquantified from data that are presently collected by the NEFSC, as summarized by Auster and Langton (1999) and therefore no management measures will be proposed at this time.

The requirement concerning gear impact management is to the extent practicable given the evidence that the fishing practice is having an identifiable adverse effect. The Council feels strongly that very little evidence was provided in the synthesis document of Auster and Langton

(1998) relative to identifiable adverse effects to EFH in FMPs managed by this Council at this time. Fishing gear impacts along with the description and identification of EFH are frameworked management measures which can easily and readily be changed as more information becomes available. The Council's Habitat Monitoring Committee (section 2.2.8) will be meeting annually and can provide recommendations concerning gear impacts that NMFS and the Council can act on in the future. The Council feels it would be premature, given the lack of identifiable adverse effects of gear impacts to these managed species EFH, to propose gear management measures at this time. It is simply not practicable to impose unwarranted management measures that are unjustifiable. The Council will consider implementing management measures to protect EFH if and when adverse gear impacts are identified.

Currently there is not enough information available on gear impacts to SAV (HAPC for summer flounder), so for the same reasons stated above, no management measures will be implemented to protect SAV at this time. In October 1998 ASMFC held a workshop concerning gear impacts to SAV. The goals of this workshop were to (1) develop technical guidelines and standards to objectively determine fishing gear and fishing activity (including prop scarring and anchoring) impacts and (2) develop standard mitigation strategies where appropriate. When the results become available the Council will reconsider implementing management measures to protect SAV through framework measures.

2.2.5 Identification of Non-Fishing Activities and Associated Conservation and Enhancement Recommendations

NOTE: Sections 600.815(a)(5), 600.815(a)(6), and 600.815(a)(7) are all combined here, in order to better clarify the cause and effect association of actions.

According to section 600.815 (a)(5), FMPs must identify activities that have the potential to adversely affect EFH quantity or quality, or both. Broad categories of activities which can adversely affect EFH include, but are not limited to: dredging, fill, excavation, mining, impoundment, discharge, water diversions, thermal additions, actions that contribute to non-point source pollution and sedimentation, introduction of potentially hazardous materials, introduction of exotic species, and the conversion of aquatic habitat that may eliminate, diminish, or disrupt the functions of EFH.

Estuarine and coastal lands and waters are used for many purposes that often result in conflicts for space and resources (USDC 1985a). Some 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 biota and their associated habitats (USDC 1985a).

Multiple-use issues are constantly changing, as are the impacts of certain activities on living marine resources (USDC 1985a). Activities that occur on estuarine and coastal lands and waters and offshore waters may affect living marine resources directly and/or indirectly through habitat loss and/or modification. These effects, combined with cumulative effects from other activities in the ecosystem, may contribute to the decline of some species (USDC 1997a). The following discussion identifies and describes each multiple use issue and the potential threats associated with that issue. The adverse effects to marine organisms and their habitats resulting from any given threat are demonstrable, but usually not completely quantifiable. Environmental and socio-economic issues remain to be satisfactorily resolved with regard to impacts on marine organisms and their habitats.

The threats addressed in this section are germane to the entire Atlantic coast. All Mid-Atlantic

Council managed species exist outside the geographic boundaries of Mid-Atlantic Council. Knowledgeable NMFS/Council individuals were asked to identify and prioritize non-fishing "perceived" threats. Once this list was complete, the resulting paper was distributed for review via mail, workshops, and conferences. The list is prioritized in regards to (1) perceived threats of habitat managers and others in the environmental community and (2) potential impact to summer flounder, scup, and black sea bass (Table 26). Information from the ASMFC workshop (Stephan and Beidler 1997) for habitat managers, which included a broad spectrum of constituents, was also used to identify threats.

Measures for conservation and enhancement of EFH

According to section 600.815 (a)(7), FMPs must describe options to avoid, minimize, or compensate for the adverse effects identified in the non-fishing threats section including cumulative impacts (section 2.2.5). The Councils are deeply concerned about the effects of marine and estuarine habitat degradation on fishery resources.

The MSFCMA provides for the conservation and management of living marine resources (which by definition includes habitat), principally within the EEZ, although there is concern for management throughout the range of the resource. Additionally, the MSFCMA provides [305(b)(3)(A)] that "Each Council may comment on, and make recommendations to the Secretary and any federal agency concerning, any activity authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by any federal or state agency that, in the view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority." [305(b)(4)(B)] "Within 30 days after receiving a comment under subparagraph (A), a federal agency shall provide a detailed response in writing to the Council commenting under paragraph (3)."

The Councils have a responsibility under the MSFCMA to consider the impact of habitat degradation on summer flounder, scup, and black sea bass. The following recommendations are made in light of that responsibility.

The goal of the Council is to preserve all available or potential natural habitat for summer flounder, scup, and black sea bass by encouraging management of conflicting uses to assure access by the three species and maintenance of high water quality to protect these species migration, spawning, nursery, overwintering, and feeding areas. Non-water dependent actions should not be authorized in summer flounder, scup, and black sea bass if they adversely affect that habitat. Those non-water dependent actions in adjacent upland areas, such as agriculture, should be managed to minimize detrimental effects. Water dependent activities that may adversely affect theses species EFH, should be designed using environmentally sound engineering and best management practices to avoid or minimize those impacts. Regardless, the least environmentally damaging alternatives available should be employed to reduce impacts, both individually and cumulatively to summer flounder, scup, and black sea bass EFH. Finally, compensatory mitigation should be provided for all unavoidable impacts to these species EFH.

Also, in general, the EPA and States should review their water quality standards relative to summer flounder, scup, and black sea bass EFH areas and make changes as needed in estuarine and coastal areas. The EPA should establish water quality standards for the EEZ sufficient to maintain edible summer flounder, scup, and black sea bass. Finally, water quality standards in these species EFH 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.

Specific recommendations for the conservation and enhancement of summer flounder, scup, and black sea bass EFH are found following discussion of individual habitat threats. The permitting/licensing authority should ensure that the project proponents adhere to the following recommendations.

2.2.5.1 Habitat threats prioritized for summer flounder, scup, and black sea bass EFH

Many anthropogenic (caused by man) actions may threaten the integrity of summer flounder, scup, and black sea bass EFH. These threats have been prioritized based on the following:

Summer flounder, scup, and black sea bass are demersal species located across the Continental Shelf, into the estuaries (Figures 37-39). Most of the nearshore waters of the western Atlantic are designates as EFH for some or all of the species (Figures 47-49). A total of 43 estuaries on the Atlantic coast are designated as EFH for these three species. Summer flounder, scup and black sea bass utilize estuaries for nursery habitat (Packer and Griesbach 1998, Stemle *et al.* 1998a-b). Many prey items of these species are estuarine dependent (Section 2.2.6). Summer flounder utilize wetlands (Table 27; Minton 1998). Finally, sea grass beds are known to be important to summer flounder, scup, and black sea bass (Laney 1997). Cumulative impacts from estuarine and land-based activities can have negative effects on summer flounder, scup and black sea bass EFH in nearshore and offshore waters.

Based on these considerations, threats that impact estuaries, inshore areas, and water quality are priority concerns in summer flounder, scup, and black sea bass EFH (Table 26). The threats may be primary, direct (e.g., physically removing habitat by dredging or filling) or secondary, indirect (e.g., water quality degradation caused by urban or agricultural runoff). Many of the threats associated with these species EFH result in both primary and secondary impacts (e.g., coastal development, dredging and spoil disposal). Collectively, these impacts are "cumulative", which are often synergistic (i.e., the whole is greater than the sum of its parts). Some of the more challenging cumulative impacts are discussed in Section 2.2.5.14.

A more detailed discussion of the habitat threats affecting summer flounder, scup, and black sea bass EFH and other Atlantic coast habitats follows. The described threats, and associated enhancement or mitigative recommendations, are related to both direct and indirect impacts. Again, their priority with respect to these species EFH is identified in Table 26

2.2.5.2 Coastal development

Coastal development involves changes of land use; these activities include urban, suburban, commercial, and industrial, along with the construction of corresponding infrastructure. Coastal development also includes clearing of forestlands and filling of wetlands for agricultural use. Development first occurred in the coastal areas, and this historical trend continues. Approximately 80 percent of the Nation's population lives in coastal areas (USEPA 1993). The U.S. Census Bureau estimates the 1997 world population to be 267.7 million in the United States and 5.84 billion in the world (Zero Population Growth Reporter pers. comm.). 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 1994). The US Census Bureau projects that by the year 2000, the US population will reach 275 million, more than double its 1940 population.

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." However, Ehrlich (1990) may have stated 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."

During development, vegetated and open forested areas are converted to land uses that usually have increased areas of impervious surface resulting in increased runoff volumes and pollutant loadings (USEPA 1993). Eventually, changes to the physical, chemical, and biological characteristics of the watershed result. Vegetative cover is stripped from the land and cut-and-fill activities that enhance the development potential of the land occur. As population density increases, there is a corresponding increase in pollutant loadings generated from human activities (USEPA 1993).

Everyday household activities also generate numerous pollutants that affect water quality, including (USEPA 1993): improper disposal of used oil and antifreeze; frequent fertilization, pesticide application; improper disposal of yard trimmings; litter and debris; and pet droppings (USEPA 1993). Runoff from commercial land areas such as shopping centers, business districts, office parks, and large parking lots or garages may contain high hydrocarbon loadings and metal concentrations contributing more pollutants such as heavy metals, sediments, nutrients, and organics, including synthetic and petroleum hydrocarbons (USEPA 1993).

In addition to habitat impacts associated with the primary effects of coastal development, such as wetland filling, forest clearing, land grading, and construction, many secondary impacts resulting from changes in land use and population growth may occur. For example, urban/suburban development in low lying coastal areas and floodplains often causes a need for flood control that results in channel relocation, channelization, and impoundment of streams, rivers, and wetlands. Loss of natural wildlife habitats lead to wildlife management practices that promote wetland impoundment and filling shallows for bird breeding islands that deleteriously affect living marine resources. As population growth continues, the demand for nuisance insect control, such as ditching of tidal marshes and the spraying of insecticides for mosquito abatement, also continues.

Measures for conservation and enhancement

A). Filling of wetlands and shallow coastal water habitat should not be permitted in or near summer flounder, scup, or black sea bass EFH. Mitigating or compensating measures should be employed where filling is totally unavoidable. Project proponents must demonstrate that project implementation will not negatively affect summer flounder, scup, or black sea bass EFH, their habitat, or their food sources.

B). Coastal development traditionally involved dredging and filling of shallows and wetlands, hardening of shorelines, clearing of riparian vegetation, and other activities that adversely affect the habitats of living marine resources. Mitigative measures are imperative for all development activities in and adjacent to summer flounder, scup, or black sea bass EFH to prevent further degradation.

C). Adverse impacts resulting from construction should be avoided whenever practicable alternatives are identified. For those impacts that cannot be avoided, minimization through implementation of best management practices should be employed. For those impacts that can neither be avoided nor minimized, compensation through replacement of equivalent functions and values should be required.

D). Flood control projects in waterways draining into summer flounder, scup, or black sea bass EFH should be designed to include mitigative measures and constructed using Best Management Practices (BMPs). For example, stream relocation and channelization should be avoided whenever practicable. However, should no practicable alternatives exist, relocated channels should be of comparable length and sinuosity as the natural channels they replace to maintain the quality of water entering receiving waters (i.e., summer flounder, scup, and black sea bass EFH).

E). Wildlife management projects should not adversely affect summer flounder, scup, and black sea bass EFH. No impoundment of tidal wetlands or creation of islands should be authorized in summer flounder, scup, and black sea bass EFH.

F). Mosquito control in summer flounder, scup, and black sea bass EFH should be implemented using BMPs. Ditching should be in accordance with the principles of Open Marsh Water Management (e.g., restricting ditching to only those areas that are actively breeding mosquitoes; using specialized equipment, such as the rotary ditcher that slurries marsh peat thereby eliminating spoil disposal problems). Insecticides that are used should be selected to minimize impacts to non-target species (e.g., Abate: a short-lived insecticide that inhibits mosquito larvae from pupating).

2.2.5.2.1 Water withdrawal and diversion

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 activities such as dam and reservoir construction or some other method of freshwater diversion. The consumptive use or redistribution of significant volumes of surface freshwater causes reduced river flow that can affect 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 influences physicochemical variables (e.g. salinity, temperature, and turbidity) directly affecting physiological processes in organisms. Salinity is also a primary factor regulating estuarine primary production. In addition, salinity governs fish distribution by secondarily restricting predator distribution (Turek *et al.* 1987).

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 planktonic transport can be modified. Such changes can expand the range of estuarine diseases and predators associated with higher salinities that affect commercial shellfish.

Measures for conservation and enhancement

A). Water withdrawals should be regulated to provide flows adequate to maintain the biological, chemical, and physical integrity of waters flowing into summer flounder, scup, and black sea bass EFH. For example, under low flow conditions, flows should be maintained to prevent shifts in salinity regimes or changes in fish distribution.

B). The transfer of water from one basin to another is discouraged. Interbasin transfers can cause hydrological imbalances in rivers flowing into estuaries that can adversely affect summer flounder, scup, and black sea bass EFH.

C). Dams constructed for reservoir development should not be sited in sensitive habitats. Dams that block anadromous rivers and streams (into which fish migrate from the sea) adversely affect directly by impairing prey production (e.g., river herrings) or indirectly by reducing flows that downstream salinity changes.

2.2.5.2.2 Construction

Construction activities within watersheds and in coastal marine areas often impact fish habitat. Some 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 losses or disruptions to organisms and environment. The significance of small scale projects lies in the cumulative effects resulting from the large number of these activities (USDC 1985a).

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 (USDC 1985a). The projects range from small scale recreational endeavors to large scale commercial ventures to revitalize urban waterfronts (USDC 1985a).

Runoff from construction sites is by far the largest source of sediment in urban areas under development (USEPA 1993). Eroded sediment from construction sites creates many problems in coastal areas, including adverse impacts on water quality, sensitive habitats, SAV beds, recreational activities, and navigation (USEPA 1993). Other potential pollutants associated with construction activities include: pesticides (insecticides, fungicides, herbicides, and rodenticides); fertilizers used for vegetative stabilization; petrochemicals (oils, gasoline, and asphalt degreasers); construction chemicals such as concrete products, sealers, and paints; wash water associated with these products; paper; wood; garbage; and sanitary wastes (USEPA 1993). The variety of pollutants present and the severity of their effects are dependent on a number of factors (USEPA 1993):

1. The nature of the construction activity;

2. The physical characteristics of the construction site; and

3. The proximity of surface waters to the nonpoint pollutant source.

Construction impacts can also include hydrological changes and water quality changes. Hydrologic and hydraulic changes occur in response to site clearing, grading, and the addition of impervious surfaces and maintained landscapes (USEPA 1993).

In addition, construction in and adjacent to waterways often involves dredging and/or fill activities which result 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 (USDC 1985a).

Measures for conservation and enhancement

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

A). Watershed protection/site development should be encouraged. Comprehensive planning for development on a watershed scale and for small-scale site development, including planning and designing to protect sensitive ecological areas, minimize land disturbances and retain natural drainage and vegetation whenever possible.

B). Pollution prevention activities, including techniques and activities to prevent nonpoint source pollutants from entering surface waters, should be implemented. Primary emphasis should be placed on public education to promote methods for proper disposal and/or recycling of hazardous chemicals, pet waste management strategies, management practices for lawns and gardens, onsite disposal systems (OSDSs), and commercial enterprises such as service stations and parking lots.

C). Construction erosion/sediment control measures should reduce erosion and transport of sediment from construction sites to surface water. A sediment and erosion control plan should be developed and approved prior to land disturbance for construction sites of less than 5 acres.

D). Runoff from new development should be managed so as to meet two conditions: (1) The average annual total suspended solid (TSS) loadings after construction is completed are reduced, a) by 80 percent or b) so that they are no greater than pre-development loadings; and (2) To the extent practicable, post-development peak runoff rate and average volume are maintained at levels that are similar to pre-development levels.

E). Construction site chemical control measures should address the transport of toxic chemicals to surface water by limiting the application, generation, and migration of chemical contaminants (i.e., petrochemicals, pesticides, nutrients) and providing proper storage and disposal.

F). Watershed management programs of existing developments should be developed that identify the sources, specify appropriate controls such as retrofitting or the establishment of buffer strips, and provide a schedule by which these controls are to be implemented.

G). New onsite disposal systems should be built to reduce nutrient/pathogen loadings to surface water. OSDS are to be designed, installed and operated properly, and to be situated away from open waterbodies and sensitive resources such as wetlands, and floodplains. Protective separation between the OSDS and the groundwater table should be established. The OSDS unit should be designed to reduce nitrogen loadings in areas where surface waters may be adversely affected.

H). Operating onsite disposal systems should prevent surface water discharge and reduce pollutant loadings to ground water. Inspection at regular intervals and repair or replacement of faulty systems should occur.

2.2.5.2.3 Construction of infrastructure

Construction activities of infrastructure, such as highways, bridges, and airports, can result in permanent loss or long-term disruption of habitat (USEPA 1993). For instance, highway construction often involves stream straightening or relocation. 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 water where the effects were temporary (both short- and long-term) or permanent in terms of its degradation or destruction. Shoreline stabilization can cause gross impacts when intertidal and sub-tidal habitats are filled, or when benthic habitats are scoured by reflective wave energy. Stabilization can also cause subtle effects that result in gradual elimination of the ecosystem between the shore and the water (USEPA 1993).

Construction of bridges in coastal areas can cause significant erosion and sedimentation, resulting in the loss of wetlands and riparian areas (USEPA 1993). Additionally, since bridge pavements are extensions of the connecting highway, runoff waters from bridge decks also deliver loadings of heavy metals, hydrocarbons, toxic substances, and deicing chemicals to surface waters. Bridge maintenance can also contribute heavy loads of lead, rust particles, paint, abrasive, solvents, and cleaners into surface waters. Bridge structures should be located to avoid crossing over sensitive fisheries and shellfish-harvesting areas to prevent washing polluted runoff into the waters below. Also, bridge design should account for potential scour and erosion, which may affect shellfish beds and bottom sediments (USEPA 1993).

Wetland and riparian areas will need special consideration if affected by highway and bridge construction, particularly in areas where construction involves depositing fill, dredging, or installing pilings (USEPA 1993). Highway development is most disruptive in wetlands because it may cause increased sediment loss, alteration of surface drainage patterns, changes in the subsurface water table, and loss of wetland habitat (USEPA 1993).

Measures for conservation and enhancement

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

A). Roads, highways, bridges and airports should be situated away from areas that are sensitive ecosystems and susceptible to erosion and sediment loss. The siting of such structures should not adversely impact water quality, minimize land disturbances, and retain natural vegetation and drainage features.

B). Construction projects of roads, highways, bridges and airports should implement approved erosion and sediment control plans prior to construction, which would reduce erosion and improve retention of sediments onsite during and after construction.

C). Construction site chemical control measures for roads, highways, and bridges should limit toxic and nutrient loadings at construction sites by ensuring the proper use, storage, and disposal of toxic materials to prevent significant chemical and nutrient runoff to surface water.

D). Operation and maintenance should be developed for roads, highways, bridges, and airports to reduce pollutant loadings to receiving waters during operation and maintenance.

E). Runoff systems should be developed for roads, highways, bridges, and airports to reduce pollutant concentrations in runoff from existing roads, highways, and bridges. Runoff management systems should identify priority pollutant reduction opportunities and schedule implementation of retrofit projects to protect impacted areas and threatened surface waters.

F). The planning process for new and maintenance channel dredging projects should include an evaluation of the potential effects on the physical and chemical characteristics of surface waters and riparian habitat that may occur as a result of the proposed work and reduce undesirable impacts. The operation and maintenance programs for existing modified channels should identify and implement any available opportunities improve the physical and chemical characteristics of surface waters in those channels.

G). Bridges should be designed to include collection systems which convey surface water runoff to land-based sedimentation basins.

2.2.5.2.4 Shoreline stabilization

The erosion of shorelines and stream banks is a natural process that can have either beneficial or adverse impacts on the creation and maintenance of riparian habitat (USEPA 1993). Beaches are dynamic, ephemeral land forms that move back and forth onshore, offshore and along shore with changing wave conditions. Although bulkheads and seawalls protect the upland area against further land loss, they often create a local problem. Downward forces of water produced by waves striking a wall can produce a transfer of wave energy and rapidly move sand from the wall, causing scouring and undermining, and increased erosion downstream (USEPA 1993).

Groins are structures that are built perpendicular to the shore and extend into the water (USEPA 1993). Jetties are structures that are built perpendicular to shore to stabilize a channel. Groins and jetties trap sand in littoral drift and halt longshore movement. Sand traps created by these structures often result in inadequate supply of sand to replace that which is carried away. The "downdrift" beaches are often sand depleted, and severe erosion results (USEPA 1993).

Stabilization of eroding shorelines can be beneficial to living marine resources by reducing turbidity and subsequent sedimentation. However, some stabilization techniques can have secondary adverse impacts. Bulkheads harden shorelines, thereby eliminating the interaction between organisms and intertidal habitats during high tides. Wave energy reflecting off vertical bulkhead faces destabilize adjacent benthic habitats rendering them less productive. Additionally, bulkheads are often constructed with chemically treated timber which contain toxic compounds that leach into adjacent waters through time.

Alternatives to vertical bulkheads are stone revetments (riprap) and vegetative stabilization. Unlike bulkheads, stone revetments are not vertical, and consequently, do not reflect wave energy. Also, the hard surfaces and interstitial spaces between the stones adds heterogeneity to local habitats. Vegetative stabilization provides the most natural means of erosion control, as well as, enhancing local habitats. Marsh creation and stream bank "bioengineering" are two methods of vegetative stabilization that have proven effective in many circumstances.

Other types of shoreline stabilization, such as beach nourishment and groin fields, do not prevent erosion. Beach nourishment is the replacement of lost sediments with new sediments. Traditional beach nourishment is not structurally stabilized, but erosion abatement is accomplished through engineering design using appropriate grain-sized sand. Depending on the source of material for beach nourishment, ecological impacts are frequently greater at the borrow site than at the nourishment area.

Groins are vertical structures constructed of rock or wood that are placed at equidistant intervals along eroding shorelines, perpendicular to the shore. Groin fields generally do not incorporate additional sediments to the system, but depend on the trapping of suspended sediments carried by longshore currents. Groins characteristically accrete sediments on the updrift side and become sediment starved on the downdrift side. This problem can be prevented by constructing low-profile groins (i.e., the top of the structure being constructed at an elevation between mean high and mean low tide) that allow sediments to accumulate on both sides of the structure. Jetties are structures similar to groins, but are used to stabilize inlets, not curtail erosion. However, the accretion/starvation sediment patterns displayed by groins are also demonstrated by jetties.

Measures for conservation and enhancement

A). To stabilize eroding stream banks, vegetative methods such as marsh creation and vegetative bank stabilization ("bioengineering") are the preferred methods. Stream bank and shoreline features such as wetlands and riparian areas with the potential to reduce nonpoint source (NPS) pollution should be protected (USEPA 1993).

B). Vegetative shoreline stabilization should be implemented in summer flounder, scup, and black sea bass EFH whenever feasible.

C). When wave energy is sufficient to preclude vegetative stabilization, stone revetments should be constructed in summer flounder, scup, and black sea bass EFH. Revetments reduce reflected wave energy and provide habitat for benthic organisms.

D). Bulkheads, or shoreline hardening structures, should not be constructed in summer flounder, scup, and black sea bass EFH when practicable alternatives exist.

E). Beach nourishment in summer flounder, scup, and black sea bass EFH should only be considered when an acceptable source of borrow material is identified.

F). When groin fields are considered acceptable for construction in summer flounder, scup, and black sea bass EFH, low-profile design should be employed.

G). When jetties intercept sediments in summer flounder, scup, and black sea bass EFH, sand should be "by-passed". By-passing is the transfer of sediments from the accreted side of the jetties to the starved side thereby maintaining longshore sediment transport.

2.2.5.3 Nonpoint source (NPS) contamination

Nonpoint pollution generally results from land runoff, atmospheric deposition, drainage, groundwater seepage, or hydrologic modification (USEPA 1993). Technically, the term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) (40 CFR 122.2) of the Clean Water Act. That definition states:

> The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Nonpoint pollution is the pollution of our nation's waters caused by rainfall or snowmelt moving over and through the ground. Ground water is an important source of surface water and nutrients. The U.S. Geologic Survey (USGS) has determined that 50% of the water in streams comes from ground water. The amount of ground water varies according to the type of rock and sediment beneath the land surface (USGS 1997). Up to one-half of the nitrogen entering the Chesapeake Bay travels through the ground water (USGS 1997). It is possible that about 10% to 20% of the phosphorous entering the Chesapeake Bay also travels through ground water (USGS 1998). Atmospheric deposition transports about 9% of the nitrogen and 5% of the phosphorous loads to the Chesapeake Bay (Alliance for Chesapeake Bay 1993).

As the runoff moves, it picks up and transports natural and anthropogenic pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters. Major pollutants in runoff include pathogens, nutrients, sediments, heavy metals, oxygen demanding substances, road salts, hydrocarbons, and toxics. Acid precipitation from nonpoint sources are demonstrable problems in Atlantic coastal and estuarine waters (USEPA 1993, USDC 1985a). In addition, hydrologic modification is a form of nonpoint source pollution that often adversely affects the biological, physical and chemical integrity of surface waters (USEPA 1993). The alteration of natural hydrology due to urbanization, and the accompanying runoff diversion, channelization, and destruction of natural drainage systems, have resulted in riparian and tidal wetland degradation or destruction. Temperature changes result from increased flows, removal of vegetative cover, and increases in impervious surfaces. NPS can be divided into three components, each of which will be discussed separately. Conservation measures will be offered for each component.

2.2.5.3.1 Urban NPS

Urban construction is not limited to the shore but also includes inland development that 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 of terrestrial and wetland vegetation facilitate runoff loaded with soil particles, fertilizers, biocides, heavy metals, grease and oil products, polychlorinated biphenyls (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 anadromous and fresh water sections of tidal streams. Nonpoint pollution is incorporated in water, sediments, and living marine resources (USDC 1985a).

Cumulatively, the effects of this environmental insult may have far reaching implications for fisheries resources. Estuarine and riverine plumes entering coastal waters are influenced by global and other dynamic forces. These plumes may remain as discrete water masses flowing close to the coast for hundreds of miles.

The purpose of vegetated filter strips is to remove sediment and other pollutants from runoff and wastewater by filtration, deposition, infiltration, absorption, adsorption, decomposition, and volatilization, thereby reducing the amount of pollution entering adjacent waterbodies. The ability of a wetland to act as a sink for phosphorus and the ability to convert nitrate to nitrogen gas through de-nitrification are two examples of the important nonpoint source pollution abatement functions performed by constructed wetlands.

Measures for conservation and enhancement

A). Watershed protection/site development should be encouraged. Comprehensive planning for development on a watershed scale and for small-scale site development, including planning and designing to protect sensitive ecological areas, minimize land disturbances and retain natural drainage and vegetation whenever possible.

B). Pollution prevention activities, including techniques and activities to prevent nonpoint source pollutants from entering surface waters, should be implemented. Primary emphasis should be placed on public education to promote methods for proper disposal and/or recycling of hazardous chemicals, pet waste management strategies, management practices for lawns and gardens, onsite disposal systems (OSDSs), and commercial enterprises such as service stations and parking lots.

C). Watershed management programs of existing developments should be developed that identify the sources, specify appropriate controls, such as retrofitting or the establishment of buffer strips, and provide a schedule by which these controls are to be implemented.

D). Best Management Practices (BMPs) should be employed during urban construction to minimize impacts to summer flounder, scup, and black sea bass EFH. Numerous specific conservation measures are provided at the end of Section 2.2.5.2.2 Construction.

E). The release of harmful chemical contaminants should be sequestered at their source thereby preventing their entering the atmosphere and subsequently being deposited in summer flounder, scup, and black sea bass EFH.

F). BMPs should be implemented to manage stormwater to minimize the discharge of contaminants that degrade summer flounder, scup, and black sea bass EFH or waters flowing into these species EFH. Stormwater should not be allowed to mix with sewage effluents (i.e., combined sewage/stormwater outfalls or CSOs). Where CSOs exist, the systems should be retrofitted to separate the two discharges.

2.2.5.3.2 Agricultural NPS

Agricultural development can affect fisheries habitat directly through physical alteration and indirectly through nutrient enrichment and chemical contamination. Fertilizers, herbicides, insecticides, and other chemicals are washed into the aquatic environment via uncontrolled nonpoint source runoff draining agricultural lands. These nutrients and 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 degrade water quality and benthic substrate. 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 1985a). Excessive uncontrolled or improper irrigation practices also contribute to nonpoint source pollution and often exacerbate the contaminant flushing, as well as deplete and contaminate ground water.

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 1985a).

Animal waste (manure) includes fecal and urinary waste of livestock and poultry; process water (e.g., from a milking parlor); excess feed, bedding, litter, and soil (USEPA 1993). Pollutants associated with animal wastes include: oxygen-demanding substances; nitrogen, phosphorous, and other nutrients; organic solids; bacteria, viruses, and other microorganisms; salts; and sediments (USEPA 1993). Runoff transporting these wastes and pollutants may result in fish kills; dissolves oxygen depletion; unpleasant odors, taste and appearance; eutrophication; and shellfish contamination (USEPA 1993).

Another source of nonpoint source pollution from livestock is atmospheric deposition. Recent analyses by Dr. Joe Rudek clearly demonstrate that more than two-thirds (65-90%) of nitrogen excreted by the huge swine concentration in coastal North Carolina is evaporated as ammonia and redeposited within about 65 miles maximum - typically into nutrient sensitive waters, including the Neuse River and Tar-Pamlico Sounds (Rader pers. comm.).

Many agricultural fields are poorly drained. To facilitate crop planting and cultivation, elaborate systems of drainage ditches are excavated. These drainage systems are frequently excavated through wetlands and ultimately discharged into natural waterways. Drainage systems serve as conduits transporting fertilizers, pesticides, sediment, and other contaminants that degrade habitat and water quality.

Measures for conservation and enhancement

A). EPA and appropriate agencies should establish and approve criteria for vegetated buffer strips in agricultural areas adjacent to summer flounder, scup, and black sea bass EFH to minimize pesticide, fertilizer, and sediment loads to these areas critical for these species survival. The effective width of these vegetated buffer strips should vary with slope of terrain and soil permeability.

B). The Natural Resources 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 on summer flounder, scup, and black sea bass EFH areas.

The following measures were taken mainly from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

C). Delivery of sediment from agricultural lands to receiving waters should be minimized. Land owners have a choice of one of two approaches: (1) apply the erosion component of the U.S. Department of Agricultures Conservation Management System through such practices as conservation tillage, strip cropping, contour farming, and terracing, or (2) design and install a combination of practices to remove settleable solids and associated pollutants in runoff for all but the larger storms.

D). New confined animal facilities and existing confined animal facilities over a certain size should be designed to limit discharges to waters of the U.S. by storing wastewater and runoff caused by all storms up to and including the 25-year frequency storms. For smaller existing facilities, the management systems that collect solids, reduce contaminant concentrations, and reduce runoff should be designed and implemented to minimize the discharge of contaminants in both facility wastewater and runoff caused by all storms up to and including 25-year frequency storms.

E). Stored runoff and solids should be managed through proper waste utilization and use of disposal methods which minimize impacts to surface/ground water. Confined animal facilities required to obtain a discharge permit under the National Pollutant Discharge Elimination System (NPDES) permit program should not be subject to these recommendations.

F). Development and implementation of comprehensive nutrient management plans should occur. The fundamentals of a comprehensive nutrient management plan include a nutrient budget for the crop, identification of the types and amounts of nutrients necessary to produce a crop based on realistic crop yield expectations, and an identification of the environmental hazards of the site. Other items include soil tests and other tests to determine crop nutrient needs and proper calibration of nutrient equipment.

G). Pesticide and herbicide management should minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow of pesticides into water supplies, and improving calibration of pesticide spray equipment. Strategies such as integrated pest management (IPM) should be used. IPM strategies include evaluating current pest problems in relation to the cropping history, previous pest control measures, and applying pesticides only when an economic benefit to the producer will be achieved, i.e., application based on economic thresholds. If pesticide applications are necessary, pesticides should be selected based on consideration of their environmental impacts such as persistence, toxicity, and leaching potential.

H). Livestock grazing should protect sensitive areas, including streambanks, wetlands, estuaries, ponds, lake shores, and riparian zones. Protection is to be achieved with improved grazing management that reduces the physical distance and direct loading of animal waste and sediment caused by livestock by restricting livestock access to sensitive areas through a range of options.

I). Upland erosion is to be reduced by either: (1) applying the range and pasture components of a Conservation Management System, or (2) maintaining the land in accordance with the activity plans established by either the Bureau of Land Management or the Forest Service. Such techniques include the restriction of livestock from sensitive areas through locating salt, shade, and alternative drinking sources away from sensitive areas, and providing livestock stream crossings.

J). Irrigation systems that deliver necessary quantities of water, yet reduce nonpoint pollution to surface waters and groundwater, should be developed and implemented. To achieve this, uniform application of water based upon an accurate measurement of cropwater needs and the volume of irrigation water applied should be calculated. When applying chemicals through irrigation (a process known as chemigation), special additional precautions apply. In state waters, conflicting laws may take precedence. In no case should irrigation be practiced to the point that runoff occurs from the field.

K). Best Management Practices should be implemented to minimize habitat impacts when agricultural ditches are excavated through wetlands that drain to summer flounder, scup, and black sea bass EFH.

L). NPDES/ State Pollutant Discharge Elimination System (SPDES) permits in consultation with state fishery agency should be required for agricultural ditch systems that discharge into summer flounder, scup, and black sea bass EFH.

M). Acceptable swine waste treatment technologies should be developed to replace current practices which rely upon evaporation or movement through groundwater to dispose of nitrogen (Rader pers. comm.).

N). Nitrogen reduction programs should account for airborne delivery (Rader pers. comm.).

2.2.5.3.3 Silvicultural NPS

Federal land management has allowed activities to occur which have degraded riparian and riverine habitat in the national forests, thereby contributing to the decline of marine and anadromous fishes (USDC 1997a). The impacts of forest activities conducted within the framework of these land use plans include effects on marine and anadromous species and significant habitat degradation from timber harvest, road construction, grazing, mining, outdoor recreation, small hydropower development, and water conveyance permitting. These actions have: reduced physical, biological and channel connectivity between streams and riparian areas, floodplains, and uplands; increased sediment yields (leading to pool filling and elimination of spawning and rearing habitat); reduced or eliminated large woody debris; reduced or eliminated the vegetative canopy (leading to increased temperature fluctuations); altered peak flow timing; increased water temperature; decreased dissolved oxygen; caused streams to become straighter, wider, and shallower; and degraded water quality by adding toxic chemicals through mining and pest control. These effects, combined with cumulative effects from activities on nonfederal lands, have contributed to the decline of marine and anadromous fish species (USDC 1997a).

Silvicultural contributions to water pollution has been recognized by all states with significant forestry activities (USEPA 1993). On a national level, silviculture contributes approximately 3% to 9% of nonpoint source pollution to the nation's waters (USEPA 1993). Local impacts of timber harvesting and road construction on water quality can be severe, especially in smaller headwater streams. Studies on forest land erosion have concluded that surface erosion rates on roads often equaled or exceeded rates reported for severely eroding agricultural lands (USEPA 1993). These effects are of greatest concern where silvicultural activity occurs in high-quality watershed areas that provide municipal water supplies or support cold-water fisheries. The USEPA (1993) reported that 24 states have identified silviculture as a problem source contributing to nonpoint source pollution. Some states report up to 19% of their river miles impacted by silviculture. On federal lands, such as national forests, many water quality problems can be attributed to the effects of timber harvesting and related activities (USEPA 1993).

Measures for conservation and enhancement

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

A). Preharvest planning should ensure that silvicultural activities take into account potential nonpoint source pollutant delivery to surface waters. Key aspects of forestry operations relevant to water quality protection that should be addressed include: the timing, location, and design of harvesting and road construction; the identification of sensitive areas or high-erosion-hazard areas; and the potential for additional cumulative contributions to existing water quality impairments.

B). Streamside management areas (SMA) should be established along summer flounder, scup, and black sea bass EFH and should be managed to protect the water quality of the adjacent waterbody.

C). Delivery of sediment from road construction or reconstruction should be reduced. This is to be accomplished by following the preharvest plan layouts.

D). Existing roads should be managed to prevent sedimentation and pollution from runoff-transported materials. Measures taken can include the use of inspections and maintenance actions to prevent erosion of road surfaces and ensure the continued effectiveness of stream crossing structures. Appropriate actions for closing roads that are no longer in use should also be taken.

E). NPS pollution resulting from timber harvesting operations should be reduced by taking into account the location of landings, the operation of ground-skidding and cable yarding equipment, and preventing of pollution from petroleum products. Harvesting practices that protect water quality and soil productivity can also reduce total mileage of roads and skid trails, lower equipment maintenance costs, and provide better road protection and reduce road maintenance. Appropriate skid trail location and drainage, and proper harvesting in SMAs should be addressed.

F). Impacts of mechanical site preparation and regeneration operations should be reduced, and on-site potential nonpoint source pollution should be confined. Measures such as keeping slash materials out of drainages, operating machinery on the contour, and protecting the ground cover in ephemeral drainages and SMAs should be implemented.

G). Potential nonpoint source pollution and erosion resulting from prescribed fire for site preparation and from methods for suppression of wildfire should be reduced. Prescribed fires should be conducted under conditions to avoid the loss of litter and incorporated soil organic matter. Bladed firelines should be stabilized to prevent erosion, or practices such as handlines, firebreaks, or hose lays should be used where possible.

H). Erosion and sedimentation by the rapid revegetation of areas of soil disturbance from harvesting and road construction should be reduced. The disturbed areas to be revegetated are those localized areas within harvest units or road systems where mineral soil is exposed or agitated such as road cuts, fill slopes, landing surfaces, cable corridors, or skid trails.

I). Pesticide and herbicides should be managed to minimize water quality problems by reducing pesticide use, improving the timing and efficiency of application (not within 24 hours of expected rain or irrigation), preventing backflow into water supplies, and improving calibration of spray equipment.

2.2.5.4 Dredging and disposal of dredged material

Dredging and disposal of dredged material can create significant impacts in aquatic ecosystems. The purpose of dredging in nearshore and offshore areas include: creation and maintenance for shipping and recreational boating, construction of infrastructure, and marine mining. During dredging operations, bottom sediments are removed, disturbed, and resuspended (Chytalo 1996). Historically, dredged material was disposed of by being discharged in designated open-water disposal areas near the dredging site. Because of concern about environmental damage, disposal of dredged material has begun to be tightly regulated (Chytalo 1996). Environmental impacts of dredging include:

1. Direct removal/burial of organisms as a result of dredging and placement of dredged material;

2. Turbidity/siltation effects, including increased light attenuation from turbidity, alteration of bottom type, and physical effects of suspended sediments on organisms;

3. Contaminant release, and uptake, including nutrients, metals, and organics from interstitial water and the resuspended sediments;

4. Release of oxygen-consuming substances, such as sulfides;

5. Noise/disturbance to terrestrial organisms;

6. Alterations to the hydrodynamic regime and physical habitat; and

7. Loss of wetland, SAV beds, and riparian habitat.

Excluding the potential of new work being authorized in sensitive habitats, the major problem associated with dredging is disposal of dredged material (spoil). Almost 60 percent of the spoil generated nationally (approximately 310 thousand metric wet tons) is discharged into estuarine and marine habitats (OTA 1987). This volume can be anticipated to increase as the trend for deeper channels and port expansions escalate.

Although alternatives to in-water disposal have been proposed, such as transporting spoil to inland areas to reclaim strip mines and use as a raw material for manufacturing bricks, only upland disposal in adjacent coastal areas has proven to be practicable. However, as the demand for coastal development increases, the amount of available uplands is diminishing, while the cost of those lands is increasing. Additionally, mounting evidence indicates that long-term use of upland spoil sites cause adverse impacts, such as salinity intrusion in shallow aquifers.

Diked containment islands in estuaries have been effective, cost efficient methods to dispose of dredged material. However, these islands, such as Craney Island in Virginia and Hart-Miller Island in Maryland, require hundreds of acres each for construction. This is an irreversible commitment of estuarine habitat. Consequently, sensitive areas must be identified and avoided. Construction of spoil islands must be restricted to those areas that will have the least impact on estuarine and marine ecosystems. Compensatory mitigation to increase the carrying capacity within the affected estuaries to offset these impacts must also be a requirement of island construction.

More recently, there has been a trend toward the "beneficial use" of dredged material. Some uses of dredged material can be truly beneficial, while some are merely a trade-off of one habitat type for another, usually at the expense of living marine resources. Some examples of true beneficial uses are by-passing sediments removed from natural littoral processes to down-drift, starved beaches, restoration of structure to depleted oyster reefs, and restoration of eroded wetlands to abate erosion. However, other proposed beneficial uses, such as creating bird breeding islands in shallow water habitats, only deplete valuable fish habitats (Goodger pers. comm.).

Measures for conservation and enhancement

A). Filling of wetlands or coastal shallow water habitat should not be permitted in or near EFH areas. Mitigating or compensating measures should be employed where filling is totally unavoidable. Project proponents must demonstrate that project implementation will not negatively affect summer flounder, scup, and black sea bass, their EFH, or their food sources.

B). No dredging or dredge spoil placement should take place in SAV beds.

C). 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 summer flounder, scup, and black sea bass their EFH, or their food sources.

D). Construction of spoil containment islands should be avoided in summer flounder, scup, and black sea bass EFH, except when no practicable alternatives are available. In those exceptional cases when island construction is necessary, sites should be selected that result in the least damaging impacts to these species EFH.

E). "Beneficial Use" proposals in summer flounder, scup, and black sea bass EFH should be compatible with existing uses by these species. Conflicting uses, such as construction of bird breeding islands, should not be authorized.

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993).

F). When projects are considered and in review for open water disposal permits for dredged material, state and federal permitting agencies should identify the direct and indirect impacts such projects may have on EFH.

G). No unconfined disposal of contaminated dredge material, sewage sludge, or industrial waste should ever be allowed in EFH.

H). Disposal sites should be located in uplands when possible.

I). The creation of new habitat at the expense of another naturally functioning system (e.g. marsh creation with dredge material placed in shallow water habitat) should be fully justified and documented, given best available information, through a demonstrated net gain in EFH.

2.2.5.5 Port development, utilization, and shipping

Major ports along the Atlantic coast include those at Miami Florida, Jacksonville Florida, Savannah Georgia, Charleston South Carolina, Wilmington North Carolina, Norfolk Virginia, Baltimore Maryland, Wilmington Delaware, Philadelphia Pennsylvania, New York New York, Providence Rhode Island, Boston Massachusetts, Portsmouth New Hampshire, and Portland Maine. These ports handle primarily grains, coal, ores, and manufactured commodities. Some of these ports and many other ports along the Atlantic seaboard (e.g. Gloucester and New Bedford Massachusetts, Rockland Maine, Newport and Point Judith Rhode Island, Hampton-Norfolk Virginia, Ocean City Maryland) also support major commercial and recreational fisheries (USDC 1985a).

All ports require shoreline 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 adverse impacts to living marine resources and habitat.

The introduction of exotic species and contaminated materials through ballast water release and exchange is an impact of port utilization. Ballast water is used by most ships for stability and maneuverability (Moyle 1991). The water is typically pumped into separate tanks used just for ballast or in empty cargo tanks when departing from port, and discharged when the ship takes on a cargo at another port. Evidence shows that hundreds of species of invertebrates have become established in exotic locales after being transported in ballast water (Moyle 1991). An infamous Atlantic coast example of a ballast water introduction is the zebra mussel (*Orreissena polymorha*).

Another hazard of port utilization is the potential for shipping accidents. Transportation of fossil fuels and other materials may result in major spills of oils and other hazardous materials (Hill 1996). Tributyl-tin, used in commercial anti-fouling paints, was formerly a major concern and has been largely banned, with the notable exception of aluminum hauled vessels (Foerster pers. comm.).

Construction activities associated with port development result in a loss of habitat diversity along the water's edge. Bulkheading, filling, and construction of port features result in general water quality degradation that reduces biotic diversity of important productive areas (USDC 1985a). Habitat types that are destroyed by construction of port infrastructure include: shallow bay bottom; shoreline wetlands; seagrass meadows; and intertidal wetlands (Fearing 1983). The effect of loss of these habitats include loss of nursery area, reduction in water clarity, and shifts in primary productivity (Fearing 1983).

Measures for conservation and enhancement

The impacts of port development and utilization are caused by a need for infrastructure (i.e. filling of wetlands) and adequate channel depths (i.e. dredging and shoreline stabilization). Recommendations to minimize these impacts are located in sections 2.2.5.2.3, 2.2.5.2.4, and 2.2.5.3, respectively.

Impacts that are a result of shipping are addressed in the following recommendations:

A). To avoid introducing exotic species and toxic materials, ballast water should be exchanged beyond 200 miles or treated with chlorine or other toxicants. Procedures should be developed for monitoring ballast water. Factors controlling introduced species should be studied in species' native ecosystems (Moyle 1991).

B). All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill.

C). Dispersants should not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard after consultation with fisheries agencies.

2.2.5.6 Marinas and recreational boating

As residential and commercial use of coastal lands increase, 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.

Based on an annual average of 40 hours of cruising, the 10 million outboard and inboard/outboard powered pleasure boats in the U.S. impact as much water, fish eggs, larval and juvenile fish, and shellfish, as 800 nuclear and fossil fueled generating stations would in a year. Unfortunately, boating activity is concentrated in a short boating season that also occurs during the period of maximum biological activity in many estuaries (Stolpe 1997).

Marinas and recreational boating are increasingly popular uses of coastal areas. The growth of recreational boating, along with the growth of coastal development in general, has led to a growing awareness of the need to protect waterways. In the Coastal Zone Management Act (CZMA) of 1972, as amended, Congress declared that state coastal management programs provide for public access to the coasts for recreational purposes. Clearly, boating and adjunct activities (e.g., marinas) are an important means of public access. When these facilities are poorly planned or poorly managed, however, they may pose a threat to the health of aquatic systems (and may pose other environmental hazards; USEPA 1993). Since marinas are located right at the water's edge, there is often no buffering of the release of pollutants to waterways. Adverse environmental impacts may result from the following sources of pollution and activities associated with marinas and recreational boating (USEPA 1993):

1. Poorly flushed waterways where dissolved oxygen deficiencies exist;

2. Pollutants discharged from boats;

3. Pollutants transported in storm water runoff from parking lots, roofs, and other impervious surfaces;

4. The physical alteration or destruction of wetlands and of shellfish and other bottom communities during the construction of marinas, ramps, and related facilities; and

5. Pollutants generated from boat maintenance activities on land and in the water.

Impacts on the ecosystem that are caused by marinas include lowered dissolved oxygen, increased temperature, bioaccumulation of pollutants by organisms, water contamination, sediment contamination, resuspension of sediments, loss of SAV and estuarine vegetation, change in photosynthesis activity, change in the nature and type of sediment, loss of benthic organisms, eutrophication, change in circulation patterns, shoaling and shoreline erosion. Pollutants that result from marinas include nutrients, metals, petroleum hydrocarbons, pathogens, and PCBs (USEPA 1993). Other contaminants introduced into surface waters originate from chemically treated timber used for piers and bulkheads. Commonly used chemicals are creosote and CCA (copper, chromium, and arsenic salts).

Other impacts of recreational boating are a result of improper sewage disposal, fish waste, fuel and oil spillage, cleaning fluids, and boat operation and maintenance (USEPA 1993).

According to the 1989 American Red Cross Boating Survey, there were approximately 19 million recreational boats in the United States (USEPA 1993). About 95 percent of these boats were less than 26 feet in length. A very large number of these boats used a portable toilet, rather than a larger holding tank. Given the large percentage of smaller boats, facilities for the dumping of portable toilet waste should be provided at marinas that service significant numbers of boats under 26 feet in length (USEPA 1993).

The propellers from boats can also impact fish and fish habitat by direct damage to multiple life stages of organisms, including eggs, larvae, juveniles, and adults, as well as submerged aquatic vegetation (e.g., prop scarring); de-stratification (temperature and density which is characteristic of some estuaries; e.g., Pamlico Sound, North Carolina); elevated heat; and resuspension of sediments increasing turbidity (Stolpe 1997, Goldsborough 1997). The resuspension of bottom sediment can result in the reintroduction of toxic substances into the water column. This may lead to an increased turbidity, which can affect photosynthetic activity of algae and submerged aquatic vegetation (USEPA 1993). The SAV provides habitat for fish, shellfish, and waterfowl and plays an important role in maintaining water quality through assimilating nutrients. It also reduces wave energy, protecting shorelines and bottom habitats from erosion (USEPA 1993).

Fish waste can result in water quality problems at marinas with large numbers of fish landings or at marinas that have limited fish landings but poor flushing (USEPA 1993). The amount of fish waste disposed of into a small area such as a marina can exceed that existing naturally in the water at any one time. As fish waste decomposes, it requires oxygen, thus sufficient quantities of disposed fish waste can be a cause of dissolved oxygen depression, as well as odor problems (USEPA 1993).

Fuel and oil are commonly released into surface waters during fueling operations through the fuel tank air vents, during bilge pumping, and from spills directly into surface waters and into boats during fueling. Oil and grease from the operation and maintenance of inboard engines are a source of petroleum in bilges (USEPA 1993).

Marina employees and boat owners use a variety of boat cleaners, such as teak cleaners, fiberglass polishers, and detergents (USEPA 1993). Boats are cleaned over the water or onshore adjacent to the water. This results in a high probability of some of the cleaning material entering the water. Copper-based antifouling paint is released into marina waters when boat bottoms are cleaned in the water (USEPA 1993).

A workshop on the environmental impacts of boating held at Woods Hole Oceanographic Institute, December 1994, summarizes the substantiated impacts of boating activity. These include: sediment and contaminant resuspension and resultant turbidity; laceration of aquatic vegetation with loss of faunal habitat and substrate stability; toxic effects of chemical emissions of boat engines; increased turbulence; shearing of plankton; shorebird disturbance; and the biological effects of chemically treated wood used in dock and bulkhead construction. Many of these issues and concerns remain inadequately described. Sufficient hard data was referred to or presented at the workshop, that recreational and commercial motor boat operation is far from a benign influence on aquatic and marine environments. This is particularly so in temperate climes due to the unfortunate synchrony, with only a few exceptions, of vertebrates and invertebrates in estuaries and coastal waters. Therefore, the chance of plants and organisms being affected by power boat operation ought to be regarded as privilege which requires due consideration of environmental impacts, and should be conducted and managed in such a manner.

Measures for conservation and enhancement

The following measures were taken mainly from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993), unless otherwise specified.

A). Marina siting and design should allow for maximum flushing of the water supply for the site. Adequate flushing reduces the potential for the stagnation of water in a marina, helps to maintain the biological productivity, and reduces the potential for toxic accumulation in bottom sediment.

B). Water quality must be considered in the siting and design of both new and expanding marinas.

C). Marinas should be designed and located so as to protect against adverse impacts on shellfish resources, wetlands, submerged aquatic vegetation, and other important habitat areas as designated by local, state, or federal governments.

D). Where shoreline erosion is a nonpoint source pollution problem, shorelines should be stabilized. Vegetative methods are strongly preferred.

E). Runoff control strategies, which include the use of pollution prevention activities and the proper design of hull maintenance areas, should be implemented at marina sites. At least 80% of suspended solids must be removed from stormwater runoff coming from the hull maintenance areas. Marinas which obtain a NPDES permit for their hull maintenance areas are not required to conform to this hull maintenance area provision.

F). Fueling stations should be located and designed so that, in the case of an accident, spill contaminants can be contained in a limited area. Fueling stations should have fuel containment equipment, as well as a spill contingency plan.

G). To prevent the discharge of sewage directly to coastal waters, new and expanding marinas should install pumpout, pump station, and restroom facilities where needed.

H). Solid wastes produced by the operation, cleaning, maintenance, and repair of boats should be properly disposed of to limit their entry to surface waters.

I). Sound fish waste management should be promoted through a combination of fish cleaning restrictions, public education, and proper disposal.

J). Appropriate storage, transfer, containment, and disposal facilities for liquid materials commonly used in boat maintenance, along with the encouragement of recycling of these materials, should be required.

K). The amount of fuel and oil leakage from fuel tank air vents should be reduced.

L). Potentially harmful hull cleaners and bottom paints, and their release to marinas and coastal waters, should be minimized.

M). Public education/outreach/training programs should be instituted for boaters, as well as marina operators, to prevent improper disposal of polluting materials.

N). Pumpout facilities should be maintained in operational condition, and their use should be encouraged to reduce untreated sewage discharges to surface waters.

O). In shallow areas, intense boating activities may contribute to shoreline erosion. Increased turbidity and physical destruction of shallow-water habitat resulting from boating activities should be minimized.

P). Emissions from outboard motors should be monitored, and emissions standards should be enforced (Stolpe 1997).

Q). Dry stack storage marinas are recommended, as opposed to wet marinas, in summer flounder, scup, and black sea bass EFH. Unlike wet marinas that require extensive dredging and other physical disruptions to physical habitats, dry stack storage facilities are located on uplands thereby minimizing the need for dredging and dependence on the use of timber treated with toxic chemicals. Additionally, land storage allows the use of polymer-based bottom paints, eliminating the need for toxic treatments containing copper or tributyl-tin.

2.2.5.7 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, and fossil fuel stations. These facilities compete for space along the coastal zone and require water for cooling. 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 1985a).

2.2.5.7.1 Hydroelectric

Hydropower plants may alter the following characteristics of water bodies:

1. Dissolved oxygen concentrations and temperature;

2. Create artificial destratification;

3. Withdraw or divert water;

4. Change sediment load;

5. Change channel morphology;

6. Accelerate eutrophication;

7. Change nutrient cycling; and

8. Contaminate water and sediment (Hill 1996).

Water quality contaminants of major concern include mercury, PCBs and organochlorine pesticides. Dams and the need for altered flows may substantially affect anadromous fish runs and/or restoration programs (Hill 1996). In addition, impingement of juvenile and adult fish may occur on trash racks that protect turbines from mechanical damage and turbine entrainment causes mortality of eggs and juvenile fishes. Altered dissolved oxygen levels can cause gas bubble disease to fishes (Hill 1996).

Habitat alterations include dams, which create reservoirs and tailwaters. Tailwaters can scour substrate and benthic organisms, as well as fish and fish eggs, create bank erosion, displace sediment downstream, and limit the establishment of riparian vegetation. In addition, clearing for hydropower projects requires disruption of wetlands and riparian habitat and control of some aquatic vegetation (Hill 1996).

2.2.5.7.2 Nuclear

A major adverse impact of nuclear power plants is water withdrawal and thermal pollution, due to the use of cooling water (Hill 1996). Once-through cooling which requires withdrawal of large volumes of water causes significant impingement of juveniles and larger size classes, and entrainment of eggs and larvae. Reverse thermal shock can also occur when plant operation ceases, causing fish mortality to organisms that are adapted to the warmer outflow. As an alternative to once-through large-water volume usage, cooling towers can be constructed which reduce both impingement/entrainment and thermal pollution. Incidental use of biocides to reduce biofouling also introduces pollutants to the surface waters. Another problem is storage and disposal of nuclear wastes which will last centuries.

2.2.5.7.3 Fossil fuels

Coal- and oil-fired plants and shore based refineries are served by various sized vessels, which transport those fuels. Additional navigational channels may be required, which could result in habitat disruption initially and periodically, and the need to find appropriate sites for placement of dredged materials (USDC 1985a). Transportation of fossil fuels may risk the chance of major oil spills or release of other hazardous materials, increases in automotive emissions, and habitat loss from construction of pipelines (Hill 1996). Coal fired plants generate voluminous amounts of fly ash, sulfur dioxide, nitrogen oxides, carbon dioxide, and traces of mercury contributing to acid rain (USDC 1985a, Hill 1996). The excavation of fossil fuels may have adverse effects on biota, as well (Hill 1996). Mining can contribute to acid mine drainage, human health impacts, vegetation and associated wildlife losses, erosion and stream sediments (Hill 1996). In addition, water withdrawal and diversion may cause impingement and entrainment of fish, as well as thermal pollution (Hill 1996).

2.2.5.7.4 Offshore oil and gas operations

The Outer Continental Shelf (OCS) exploratory and production drilling and transport may affect biota and their habitats. Oil spills resulting from well blowouts, pipeline breaks, and tanker accidents are of major concern. Contaminants from oil exploration include mostly petroleum hydrocarbons and heavy metals. Effects of hydrocarbon contamination in the water column and sediments may include: mortality of larval fish; mortality from predation due to slower avoidance behavior; bioaccumulation in fish; migration interference for salmon and other anadromous species; and slower maturation of larvae (Howarth 1991). Sublethal effects can cause a decrease in recruitment, as well as complex ecological interactions (Howarth 1991). Cumulative effects of oil on ecosystems include changes in benthic community structure and possible changes in planktonic community structure (Howarth 1991). Oil and gas exploration in the Mineral Management Service's (MMS) Mid-Atlantic, North Atlantic, and South Atlantic lease areas may result in loss or degradation of benthic habitat from the deposition of discharged drilling muds and cuttings. Should production of oil and gas occur in these areas, the transport of the products to onshore storage and processing facilities would pose additional threats to coastal zone and estuarine ecosystems (USDC 1985a).

Measures for conservation and enhancement

A). Appropriate measures should be taken to reduce acid precipitation and runoff into estuaries and nearshore waters.

B). Prior to pipeline construction, less damaging, alternative modes of oil and gas transportation should be explored (Penkal and Phillips 1984).

C). State natural resource agencies should be involved in the preliminary pipeline planning process to prevent violations of water quality and habitat protection laws and to minimize impact of pipeline construction and operation on aquatic resources (Penkal and Phillips 1984).

D). Potential effects of proposed and existing tidal power projects should be estimated; state and federal agencies, regardless of their regulatory jurisdiction, should become involved in this process (Rulifson *et al.* 1986).

E). All vessels transporting fuels and other hazardous materials should be required to carry equipment to contain and retrieve the spill. Dispersants shall not be used to clean up fuels and hazardous materials unless approved by the EPA/Coast Guard and fishery agencies.

F). NPDES permit conditions, such as those relating to dissolved oxygen, temperature, impingement and entrainment, under the Clean Water Act, should be monitored and strictly enforced in summer flounder, scup, and black sea bass EFH.

G). NPDES permits should be reviewed every five years for all energy production facilities.

H). Offshore oil and gas leasing, exploration, and production should be strictly limited and controlled, so as not to degrade summer flounder, scup, and black sea bass EFH. Onshore facilities assisting offshore oil and gas exploration and development, and secondary development stimulated by OCS development, should not degrade EFH. Seismic work should not be carried out with explosives (air bursts only) in EFH.

The following measures were taken from Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (USEPA 1993) and apply to dams 25 feet or more in height and greater than 15 acre-feet in capacity, or to dams six feet or more in height and greater that 50 acre-feet in capacity. They also apply only to those projects and activities that fall outside of existing jurisdiction of the NPDES permit program.

I). Erosion should be reduced and sediment retained onsite, to the extent practicable, during and after construction of dams. An approved erosion and sediment control plan, or similar administrative document that contains erosion and sediment control provisions, should be prepared and implemented prior to land disturbance.

J). Proper storage and disposal of certain chemicals, substances, and other materials that are used in construction or maintenance activities at dams, should be implemented. These include construction chemicals such as concrete additives, petrochemicals, solid wastes, cement washout, pesticides and fertilizers. Application, generation, and migration of toxic substances should be limited and properly stored and disposed of. This measure also ensures that nutrients are applied at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface waters.

K). Operation of dams should be assessed for impacts to surface water quality and instream and riparian habitat, and that the potential for improvement should be evaluated. Significant nonpoint source pollution problems that exist from excessive surface water withdrawals should also be assessed and evaluated.

2.2.5.8 Sewage treatment and disposal

The Atlantic Ocean off the northeastern United States has been used in the past for the disposal of solid wastes and sewage sludge. 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 because of high fecal coliform counts. Dumping of sewage sludge in the Atlantic coastal waters is regulated under Section 102 of the Marine Protection and Sanctuaries Act, while the discharge of treated sewage effluent is permitted under Section 402 of the Clean Water Act.

Organic loading of estuarine and coastal waters is an emerging problem. Ocean disposal of sewage sludge degrades water quality and associated habitats. Symptoms of elevated levels include excessive algae blooms, shifts in abundance of algal species, increased biological oxygen demand (BOD) in sediments of heavily affected sites, and anoxic events in coastal waters. Changes in biological components are frequently 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 1995, 4.9 million acres of shellfish-growing waters was harvest- limited due to water quality (USDC 1997b). The top five pollution sources reported as contributing were urban runoff (40%), upstream sources (39%), wildlife (38%), individual wastewater treatment systems (32%), wastewater treatment plants (24%), and unknown (6%; USDC 1997a).

The Chesapeake Bay and the Hudson-Raritan Estuary are two of the three estuaries with the largest number of point discharges in the US (USDC 1993a). Most of the point sources of nutrient loading into the Hudson-Raritan Estuary are sewage treatment plants. In 1988, it was estimated that 6.8 million gallons per day of raw sewage were discharged into this estuary, mainly from Manhattan, Staten Island, and Brooklyn, contributing to most of the 50,000 tons of total nitrogen and 32,000 tons of total phosphorus added to the region per year. Wastewater treatment plants contributed

43% of the total nitrogen and 90% of the total phosphorus to the New York Bight (USDC 1993a). Toxics metals were added at a rate of 35,700 tons per year. Contributing to this loading was urban runoff (31%), wastewater treatment plants (19%), direct industrial discharge (14%), and various other sources.

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. Sewage treatment pollutant components include solids, phosphorus, and pathogens (USEPA 1993). Eutrophication in surface waters has also been attributed to the low nitrogen reductions provided by conventional onsite-disposal system.

Poorly designed or operating onsite disposal systems can cause ponding of partially treated sewage on the ground that can reach surface water through runoff. In addition to oxygen-demanding organics and nutrients, these surface sources contain bacteria and viruses that present problems to human health. Viral organisms can persist in temperatures as low as -20 °F, suggesting that they may survive over winter in contaminated ice, later becoming available to ground water in the form of snowmelt (USEPA 1993). Although ground-water contamination from toxic substances is more often life-threatening, the majority of ground-water-related health complaints are associated with pathogens from septic tank systems (USEPA 1993).

While a variety of other wastes have been disposed of in coastal waters of the New York Bight for over 50 years, sewage sludge has only been dumped offshore of the New York Bight over the last 20 years (Chang 1993). Species abundances of silver and red hakes (*Merluccius bilinearis* and *Urophycis chuss*), summer flounder (*Paralichthys dentatus*), goosefish (*Lophius americanus*), and black sea bass (*Centropristis striata*) declined significantly over temporal and spatial scales during the disposal of contamination laden sewage sludge at the deepwater 106-Mile Dump Site (Chang 1993). There was also a decline in the array of all aggregated species (Chang 1993).

Congress requested the Office of Technology Assessment (OTA) to assess the status of waste disposal in marine environments (OTA 1987). In general, OTA determined that estuarine and coastal waters were severely degraded across the nation and that "many of the adverse impacts on marine waters and organisms are caused by the introduction of pollutants through the disposal of wastes." These wastes include municipal sewage sludge, industrial wastes, dredged materials, industrial and municipal effluents, and urban and agricultural runoff. Based on their assessment, OTA concluded:

1. "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;"

2. "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);"

3. "In contrast, the health of the open ocean generally appears to be better than that of estuaries and coastal waters. Relatively few impacts from waste disposal have been observed, partly because the open ocean has been subject to relatively little waste disposal and because wastes are typically dispersed and diluted. Uncertainty exists, however, about the ability to discern impacts in the open ocean". (Note, however, that studies which would detect these impacts in the open

ocean have not been conducted.)

OTA (1987) determined that municipal and industrial discharges, sewage sludge, and dredged material accounted for most of the pollutants found in estuary and coastal waters along the Atlantic coast. OTA (1987) identified Buzzard's Bay, Boston Harbor, Narragansett Bay, Long Island Sound, the New York Bight, and Chesapeake Bay as specific areas that were severely polluted or degraded. Contaminated sediments, containing excessive concentrations of organic chemicals, metals and pathogens have been identified in Boston Harbor, New Bedford Harbor, the New York Bight, Raritan Bay, Hudson River Estuary, the Patapsco River around Baltimore, and the James River Estuary. Contaminated water and sediments in the North Atlantic have had adverse impacts on marine organisms. Fish kills, increases in fish diseases and abnormalities, and restrictions on commercial and recreational harvest of both finfish and shellfish have occurred as the result of this pollution (OTA 1987).

The dumping of sewage sludge is no longer allowed in the Atlantic Ocean. Historically, municipal sewage sludge and industrial waste were dumped in two areas along the North Atlantic coast: the New York Bight and deep water sites 100 miles east of Delaware Bay (OTA 1987). In 1985, approximately 7 million wet metric tons (15.4 million pounds) of municipal sewage sludge, several billion gallons of raw sewage, and 8 million wet metric tons (17.6 million pounds) of dredge spoils were dumped in the New York Bight. Routine dumping of municipal sewage sludge and dredge spoils probably contributed to the depletion of oxygen in the New York Bight during the summer and early autumn of 1976. Near anoxic and, in places, anoxic water was located approximately 4 miles off New Jersey and covered an area about 100 miles long and 40 miles wide during the most critical phases of oxygen depletion (Sharp 1976). The most commercially important species affected by the anoxia were surfclams, red hake, lobsters and crabs. Finfish were observed to be driven to inshore areas to escape the anoxia, or were trapped in water with concomitant high levels of hydrogen sulfide (Steimle 1976). Oxygen levels in 1985, in some areas of the Bight, approached the low values observed in 1976 (OTA 1987).

Measures for conservation and enhancement

A). All sewage should go through tertiary treatment (i.e., nutrient removal) when discharged in summer flounder, scup, and black sea bass EFH.

B). Dechlorination facilities or lagoon effluent holding facilities should be used to destroy chlorine at sewage treatment plants and power plants.

C). All NPDES permits of public owned treatment works (POTWs) should be reviewed and strictly enforced in summer flounder, scup, and black sea bass EFH.

2.2.5.9 Industrial wastewater and solid waste

Industrial wastewater effluent is regulated by USEPA through the NPDES/SPDES permitting program. This program provides for issuance of waste discharge permits as a means of identifying, defining, and controlling virtually all point source discharges. However, many 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) wastewater.

Point source discharges can potentially alter the following properties of communities and ecosystems: diversity, nutrient and energy transfer, productivity, biomass, density, stability, connectivity, species richness, and eveness (Cairns 1980). Additionally, point source discharges may alter the following characteristics of fish, shellfish, and related organisms: longevity; fecundity; growth; visual acuity; swimming speed; equilibrium; flavor; feeding rate; response time to stimuli; predation rate; photosynthetic rate; spawning season; migration route; and resistance to parasites. Contamination of water quality is generally due to organics and heavy metals, though other characteristics such as flow, pH, hardness, dissolved oxygen may also be altered (Cairns 1980).

Non-point discharges and solid wastes associated with industrial processes also contribute chemical contaminants to summer flounder, scup, and black sea bass EFH. Chemicals can leak from storage facilities and leach from wastewater lagoons contaminating groundwater that ultimately discharge to rivers and estuaries. Solid wastes historically have been indiscriminately buried and, likewise, have contaminated groundwater with chemical leachates. Although regulatory programs have been enacted to preclude similar actions from occurring today, accidents still occur, and many areas are contaminated from past operations. Consequently, fish that inhabit waters adjacent to these sites, even seasonally, often bioaccumulate contaminants making them unfit for human consumption. Federal and state programs (e.g., Superfund) are designed to remediate hazardous waste sites, thereby reducing the bioavailability of contaminants to fish and other aquatic organisms. Unfortunately, remedial actions sometimes physically modify affected areas so completely that they are no longer suitable habitats for aquatic organisms.

Sediments and biota in specific areas along the Atlantic coast contain elevated levels of PCBs (OOMA 1987). Although PCBs are suspected carcinogens to humans, comprehensive research has not yet been done on the significance of elevated body burdens on the fish themselves, or on reproduction processes and subsequent recruitment of larval, juvenile, and pre-recruits to adult stocks. Whereas laboratory and field effects of a range of organic contaminants have been measured, there is little understanding of how contaminants such as PCBs affect the behavior, biochemistry, genetics, or physiology of these fish at either the lethal or sublethal level. It is significant that where elevated levels of PCBs have been reported in the marine environment they have generally been associated with elevated levels of toxic heavy metals, petroleum hydrocarbons, and other contaminants.

Measures for conservation and enhancement

A). 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 should be required in areas essential for the survival of summer flounder, scup, and black sea bass. Any new potential discharge into these species EFH must be shown not to have a harmful effect on these species.

B). The siting of industries requiring water diversion and large volume water withdrawals should be avoided in summer flounder, scup, and black sea bass EFH. Project proponents should demonstrate that project implementation will not negatively affect summer flounder, scup, and black sea bass , its EFH, or its food supply. Where such facilities currently exist, best management practices must be employed to minimize adverse effects on the environment.

C). All NPDES permits should be reviewed and strictly enforced in summer flounder, scup, and black sea bass EFH.

D). Hazardous waste sites should be cleaned up (i.e., remediated) to prevent contaminants from entering aquatic food chains.

E). Remedial actions affecting aquatic and wetland habitats should be designed to facilitate restoration of ecological functions and values.

2.2.5.10 Marine mining

Mining for sand, gravel, shell stock, and beach nourishment projects in 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 (USDC 1997a). Marine mining elevates suspended materials at mining sites and turbidity plumes may move several miles from individual sites. Resuspended sediments may contain contaminants such as heavy metals, pesticides, herbicides, and other toxins. Mining also results in changes 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. Finfish appear to seek out these warmer pockets in the late fall, possibly as a result of declining water temperatures in surrounding area (Ludwig and Gould 1988). It may be important for beach nourishment projects to avoid areas that are rich in clam shells or near other "reef" habitats (Steimle pers. comm.).

Consumption of sand from offshore shoals is occurring on al large scale along the U.S. Atlantic coast. Although the offshore shoals are actively being modified by waves and currents, they are relict features which formed at times of lower sea level. As such, once lost, they are not expected to be replaced by natural processes. Cumulative environmental impacts to finfish are expected to since loss of offshore shoals will reduce habitat diversity on the U.S. inner continental shelf.

Deep ocean extraction of mineral nodules is a possibility for some non-renewable minerals now facing depletion on land. Such operations are proposed for the deep ocean proper, where nodules are bedded on oceanic oozes. Resuspension of these oceanic oozes can affect water clarity over wide areas and, if roiled to the near-surface, could also affect photosynthetic activity. Nodule concentrations have been located along the slope/ocean deep zone in Georgia and the Carolinas (Ludwig and Gould 1988). Such mining activities could potentially affect benthic organisms and their habitats, as well as pelagic eggs and larvae (USDC 1985a).

Measures for conservation and enhancement

A). Sand mining and beach nourishment should not be allowed in summer flounder, scup, and black sea bass EFH during seasons when these species are utilizing the area.

The following are applicable to freshwater situations and are recommendations taken from the NMFS National Gravel Extraction Policy (USDC 1996a).

B). Gravel extraction operations should be managed to avoid or minimize impacts to bathymetric structure in estuarine and nearshore areas.

C). The cumulative impacts of gravel and sand extraction should be addressed by federal and state resource management and permitting agencies and considered in the permitting process.

D). An integrated environmental assessment, management, and monitoring program should be a part of any gravel or sand extraction operation, and encouraged at federal and state levels.

E). Plan and design mining activities to avoid significant resource areas (such as consolidated sand ledges, sand dollar beds, or algae beds).

F). Plan and design mining activities with minimum area and depth to minimize recolonization times (deep holes should be avoided).

G). Mitigation and restoration should be an integral part of the management of gravel and sand extraction policies.

H). Remove unlike material as part of the mining operation to help restore natural bottom characteristics.

I). Remove material from areas where accumulation is caused by human activities.

2.2.5.11 Aquaculture

Aquaculture is an expanding industry in the US. The annual commercial harvest is over 700 million lbs round weight with a value to producers of nearly $600 million (Robinette *et al.* 1991). The commercial culture of channel catfish, salmonids, and crayfish is very successful, and the potential commercial culture of other species is being explored. Most aquaculture facilities are located in farmland, tidal, intertidal, and coastal areas (Robinette *et al.* 1991). Major potential adverse impacts of aquaculture include disease, genetic pollution of wild stock, escape of exotic species, water contamination, and eutrophication (Robinette *et al.* 1991). Also, the use of low-head dams, weirs, and other obstructions may impede the natural movement of estuarine species (Robinette *et al.* 1991).

Escape of exotic species may result in a restructuring of the native ecosystem through such pathways as gene pool deterioration, trophic alteration, introduction of pathogens and disease, and displacement of native species through competition (these impacts of exotic species are discussed separately in section 2.2.5.12; Robinette *et al.* 1991). Cultured species may be genetically altered and/or have a less genetically diverse background than wild species. The release of the reared stock may have an adverse impact to the wild stock. For example, a reared stock may be less resistant to a disease than a wild stock. When the two stocks begin to mix it may lower the resistance of the native stock to the disease (Sindermann 1992).

Measures for conservation and enhancement

The following recommendations are taken from The American Fisheries Society (AFS) Position Statement of Commercial Aquaculture (Robinette *et al.* 1991).

A). Federal and state agencies should cooperatively promulgate and enforce regulations to ensure both the health of the aquatic organism and quality of the food products. Animals that are to be moved from one biogeographic area to another or to natural waters should be quarantined to prevent disease transmission.

B). To prevent disruption of natural aquatic communities, cultured organisms should not be allowed to escape, and the use of organisms native to each facility's region is strongly encouraged.

C). When commercially cultured fish are considered for stocking in natural waters, every consideration should be given to protecting the genetic integrity of native fishes.

D). Aquaculture facilities should meet prevailing environmental standards for wastewater treatment and sludge control.

2.2.5.12 Ocean disposal

Ocean disposal of industrial waste products, dredged material, and radioactive wastes degrades water quality and associated habitats. Concentrations of heavy metals, pesticides, insecticides, petroleum products, and other toxic contaminants contribute significantly to degradation of waters off the Atlantic coast. 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 inability to meet NPDES/SPDES effluent requirements encourages the attempts for at sea disposal. While fishery byproducts may be nutritive in value, problems of biological oxygen demand (BOD) increase excessive algal blooms, and concentrations of pathogenic bacteria, may all be associated with ocean disposal of fisheries products.

Measures for conservation and enhancement

Note: this threat was a major concern to NMFS habitat researchers and the Council members in the mid to the late 1980s. Through concerted efforts of numerous individuals and agencies, ocean disposal has presently ceased; however, discussions still persist relative to resuming dumping. Should ocean disposal ever become viable again, the Council policy (MAFMC 1990) should be reviewed.

A). Under no circumstances should there be disposal of contaminated material in EFH (section 2.2.5.4.D). All of the other recommendations for dredging and disposal of dredged materials (section 2.2.5.4) apply here as well.

B). Ocean disposal of fresh fish waste (i.e., scallop shells and bodies, fish racks, etc.) shall be permitted in areas that are not environmentally at risk. Monitoring of the disposal area will be the responsibility of the discharger if there is credible scientific information that suggest the area is being negatively impacted by the discharge.

2.2.5.13 Introduced species

Over the past two decades there has been an increase in introductions of exotic species into aquatic habitats (Kohler and Courtenay 1988). Introductions can be intentional (e.g., for purpose of stocking or pest control) or unintentional (e.g., fouling organisms). Five types of negative impacts generally occur due to species introductions: (1) habitat alteration; (2) trophic alteration; (3) gene pool alteration; (4) spatial alteration; and (5) introduction of diseases. Habitat alteration includes the excessive vegetation of introduced aquatic plants (e.g. hydrilla, watermilfoil, and alligator weed (Kohler and Courtenay 1988). This overgrowth interferes with swimming and fishing activities, upsets predator-prey relationships, and causes water quality problems. The introduction of exotic species may alter community structure by predation on native species (e.g. brown trout on brook trout) or by population explosions of the introduced species (e.g. tilapias). Spatial alteration occurs when territorial introduced species compete with native species (e.g. displacement of brook trout by brown trout). Although hybridization is rare, gene pool deterioration may occur between native and introduced species (e.g. brown trout and brook trout). One of the most severe threats to a native fish community is the bacteria, viruses, and parasites that can be introduced with exotic species (Kohler and Courtenay 1988).

Escape of exotic species may result in a restructuring of the native ecosystem through such pathways as gene pool deterioration, trophic alteration, introduction of pathogens and disease, and displacement of native species through competition (Robinette *et al.* 1991). Cultured species may be genetically altered and/or have a less genetically diverse background than wild species. The release of the reared stock may have an adverse impact to the wild stock. For example, a reared stock may be less resistant to a disease than a wild stock. When the two stocks begin to mix it may lower the resistance of the native stock to the disease (Sindermann 1992).

Measures for conservation and enhancement

The following recommendations are taken from the AFS Position Statement on Introductions of Aquatic Species (Kohler and Courtenay 1986).

A). Fish importers, farmers, dealers, and hobbyists should prevent and discourage the accidental or purposeful introduction of aquatic species into their local ecosystems.

B). City, county, state or federal agencies should not introduce species into any waters within its jurisdiction which might contaminate any waters outside its jurisdiction.

C). Only ornamental aquarium fish dealers should be permitted to import such fishes for sale or distribution to hobbyists.

D). The importation of fishes for purposes of research not involving introduction into a natural ecosystem should be made with the responsible government agencies.

E). All species that are considered for release should be prohibited and considered undesirable for any purpose of introduction into any ecosystem unless found to be desirable by federal fisheries agencies, as well as neighboring state agencies .

2.2.5.14 Cumulative impact analysis

According to section 600.815 (a)(6), to the extent feasible and practicable, FMPs should analyze how fishing and non-fishing activities influence habitat function on an ecosystem or watershed scale.

"Cumulative impacts to the environment that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such actions." Several examples of cumulative impacts from non-fishing and fishing threats include wetland losses, nutrient enrichment, eutrophication, toxic algal blooms, and global climate change. These cumulative impacts generally occur in estuarine and inshore areas; the multiple effects can result in adverse impacts to summer flounder, scup, and black sea bass EFH.

Estuaries provide the nation with highly productive habitats and important living resources. Intensive use of these ecosystems for industrial, residential, and recreational activities has had cumulative adverse effects on many estuarine resources. Forty-three estuaries have been designated as summer flounder, scup, and black sea bass EFH (Tables 14, 15, and 16). Minton (1997) demonstrates that summer flounder are wetland dependent (Table 27).

The Mid-Atlantic region extends from New York through North Carolina. However, Mid-Atlantic Fishery Management Council manages species throughout their range, which for summer flounder include the entire U.S. Atlantic coast. The National Estuarine Inventory defines 15 estuaries in the Mid-Atlantic States including Gardiner's Bay, Long Island Sound, Great South Bay, Hudson-Raritan Bay, Barnegat Bay, New Jersey Inland Bays, Delaware Bay, Delaware Inland Bays, Chincoteague Bay, Chesapeake Bay, Albemarele Sound, Pamlico Sound, Bogue Sound, New River, and Cape Fear River (USDC 1990). Mid-Atlantic estuaries account for 44% of the total freshwater discharge to coastal waters along the Atlantic coast. Yearly precipitation amounts to 40 to 48 inches per year. However, peak freshwater flow is a result of spring snow melt (USDC 1990).

Human use of estuaries in the Mid-Atlantic is extensive and described earlier in section 2.2.5. These problems have begun to be addressed. However, conclusions about the cumulative effects of contaminants is lacking on the ecosystem and the 43 estuaries (Tables 14, 15, and 16; Figures 37-39) that were established as summer flounder, scup, and black sea EFH, along with much of the inshore area of the Atlantic coast (Figures 47-49). Unquantified cumulative impacts to estuarine and inshore areas have potential impacts to the sustainability of the summer flounder, scup, and black sea bass fisheries .

2.2.5.14.1 Nutrient loading

Land use intensification threatens efficient nutrient cycling in many watersheds. Excess nutrients from land based activities accumulate in the soil, pollute the atmosphere, pollute ground water, or move into streams. Healthy watersheds have a reasonable balance of nutrient imports and exports (Aschman *et al.* 1997). Physical characteristics and nutrient loadings of eight of the major Mid-Atlantic estuaries are summarized in Table 28. Five of eight of these estuaries have medium to high nutrient loadings. Nutrient inputs include a combination of urban and industrial sources (Mid-Atlantic Regional Research Program 1994). Nutrient to these Mid-Atlantic estuaries include sewage input (septic systems and wastewater treatment), industrial wastewater, urban input, agricultural sources, and atmospheric inputs.

Of course while nutrient overloading is a significant problem in many areas, nutrients are necessary for overall productivity. It is speculated by some that chemosynthesis from deep sea trenches is perhaps the largest input of nutrients into the marine system. (Fletcher pers. comm.). While worldwide, chemosynthesis may be very important in the oceans' productivity, it does not appear that significant nutrients are contributed from deep sea trenches to areas currently designated as summer flounder, scup, and black sea bass EFH.

Measures for conservation and enhancement

Nutrient loading is a cumulative impact that results from the individual threats of coastal development, nonpoint source pollution, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid wastes, ocean disposal and aquaculture. Please refer to the above sections for individual measures for conservation and enhancement.

2.2.5.14.2 Eutrophication

Nutrient inputs are known to have a direct effect on water quality. For example, in extreme conditions excess nutrients can stimulate excessive algal blooms that can lead to increased metabolism and turbidity, decreased dissolved oxygen, and changes in community structure, a condition called eutrophication (NOAA 1996, 1997a-b). Office of Ocean Resources Conservation and Assessment (ORCA) initiated the Estuarine Eutrophication Survey in 1992 to comprehensively assess the scale and scope of nutrient enrichment and eutrophication in the National Estuarine Inventory estuaries. Table 29 illustrates the results of the eutrophication survey for the Atlantic coast, collected through a series of surveys, interviews, and regional workshops. The surveys describe existing conditions and trends of 17 parameters that characterize nutrient enrichment (NOAA 1996, 1997a-b).

Measures for conservation and enhancement

Eutrophication is a cumulative impact that results from the individual threats of coastal development, nonpoint source pollution, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid wastes, ocean disposal and aquaculture. Please refer to the above sections for individual measures for conservation and enhancement.

2.2.5.14.3 Harmful algal blooms

It is believed that nutrient enrichment of estuarine waters has lead to blooms of noxious dinoflagellates and algae (Mid-Atlantic Regional Marine Research Program 1994). Examples of such dinoflagellates or algae include *Gynodinium breve*, the dinoflagellate that causes neurotoxic shellfish poisoning, dinoflagellates of the genus *Alexandrium*, which cause paralytic shellfish poisoning, *Aureococcus anophagefferens*, the algae which causes "Brown tide", and diatoms of the genus *Pseudo-nitzschia*, which cause amnesic shellfish poisoning (Boesch *et al.* 1997).

Brown tide has been a recurrent problem in Peconic/Flanders and South Shore Bays of Long Island, since 1985 (Suffolk County DOHS 1997). It has also occurred in Narragansett Bay, Rhode Island and Barnegat Bay, New Jersey. Among finfish and shellfish that have been impacted by brown tide, the scallop population in the Peconic Estuary has virtually eradicated (Suffolk County DOHS 1997). The causes of the impact of brown tide are still unknown and may be attributed to toxic, mechanical, and/or nutritional aspects of the organism. However, when brown tide blooms exist at concentrations greater than 200,000 to 250,000 cells per 0.06 cu. in. (1 ml), it reduces light penetration, adversely impacting eelgrass beds which are of critical importance to finfish and shellfish (Suffolk County DOHS 1997). Although macro-nutrients do not cause blooms, they may provide optimum conditions for it.

Pfiesteria piscicida is a recently-described toxic dinoflagellate that was originally isolated from North Carolina waters (FDEP 1998). It has been documented in the water column in Delaware, Maryland, and North Carolina. Another *Pfiesteria*-like organism has been documented in St. John's River, Florida. *P. piscicida* has been associated with fish kills in North Carolina and Maryland (FDEP 1997, Hughes Commission 1997). Although *Pfiesteria* has been documented in Maryland waters, and fish with lesions were found in those same waters, etiologies of those lesions is still unknown, and is currently being studied by state, federal, and university pathologists (Driscoll pers. comm.). Additionally, the role of nutrient runoff and other possible causes are being investigated (Driscoll pers. comm).

The role of nutrients in algal blooms around the world is well documented (Hughes Commission 1997). *Pfiesteria* has a complicated life cycle (Figure 50), and the role that nutrients play in that life cycle is still unknown. Dr. Joanne Burkholder, who is credited with the discovery of *Pfiesteria*, has demonstrated in the laboratory that the growth of non-toxic stages of *Pfiesteria* can be stimulated by the addition of inorganic and organic nutrients. Field studies conducted by Burkholder have demonstrated a correlation between phosphorous-rich waste outfalls and high concentrations of non-toxic *Pfiesteria* (Hughes Commission Report 1997). It is important to note that not all outbreaks of *Pfiesteria* occurred in nutrient-enriched waters. Currently, it is not known what triggers *Pfiesteria* to a toxic stage. High nutrient concentrations are not required for *Pfiesteria* or *Pfiesteria*-like dinoflagellates to turn toxic. In fact, if suitable concentrations are present, toxic outbreaks can occur even if nutrient concentrations are relatively low. It appears that excessive nutrient loadings can help to create an environment rich in microbial prey and organic matter that *Pfiesteria* uses as a food supply (Hughes Commission 1997). Some scientists hypothesize that the primary stimuli for the transformation of the dinoflagellate into toxic stages are chemical cues secreted or excreted by the fish. In other words, fish must be present for a toxic outbreak to occur (Hughes Commission 1997).

Measures for conservation and enhancement

A). Federal and state agencies should address the issue of harmful algal blooms and *Pfiesteria*-like toxins which cause adverse effects in summer flounder, scup, and black sea bass EFH.

2.2.5.14.4 Wetland loss

In the late 1970's and early 1980's the country was losing wetlands at an estimated rate of 300,000 acres per year. The Clean Water Act and state wetland protection programs have helped to decrease wetland losses to 117,000 acres per year, between 1985 and 1995 (Dahl *et al.* 1997). Estimates of wetlands loss differ according to agency. USDA estimates attributes 57% wetland loss to development, 20% to agriculture, 13% to deepwater habitat, and 10% to forest land, rangeland, and other uses (USDA 1995). Of the wetlands lost to uplands between 1985 and 1995, USFWS estimates that 79% wetlands were lost to upland agriculture. Urban development and "other" types of land use activities were responsible for 6% and 15%, respectively (Dahl *et al.* 1997). Strong wetland protection must continue to be a national priority; otherwise, fisheries that support more than a million jobs and contribute billions of dollars to the national economy are at risk (Stedman and Hanson 1997).

Despite the urbanized nature of the Mid-Atlantic, it contains more than 3,500 square miles of wetlands (Stedman and Hanson 1997). The Chesapeake and Delaware Bays have the first and second highest areas of wetlands in the region, respectively. Forested wetlands are the most common type of wetland, accounting for nearly 58% of the region's wetlands, followed by salt marsh (28%; Stedman and Hanson 1997).

Measures for conservation and enhancement

Wetland loss is a cumulative impact that results from the individual threats of coastal development, dredging and dredge spoil placement, port development, marinas and recreational boating, sewage treatment and disposal, industrial wastewater and solid wastes, ocean disposal, marine mining, and aquaculture. Please refer to the above sections for individual measures for conservation and enhancement.

2.2.5.14.5 Global climate change

Global warming, an indirect impact of population growth, is an accumulation of carbon dioxide and other gases, such as methane, that trap solar infrared light in the atmosphere causing a warming trend. These gases originate from industrial and residential sources. Although the issue of global warming is controversial, all models predict some warming, especially in the higher latitudes in the northern hemisphere (Thorne-Miller and Catena 1991).

While the rise of the ocean temperature may not be as dramatic or as fast as the atmosphere, only a degree or two can have a dramatic effect on biological communities (Thorne-Miller and Catena 1991). Another potential affect will be sea level rise caused by the melting of the Arctic tundra and ice cap. Among the possible effects on sea life are: (1) a significant loss of coral reefs, salt marshes, and mangrove swamps unable to keep up with a rapid rise in sea level; (2) loss of species whose temperature tolerance range is exceeded (perhaps an even greater threat to corals than sea-level rise); (3) effects from Tundra runoff including runoff of nutrients and suspended sediments; and (4) saltwater intrusion that wreaks havoc with freshwater ecosystems, including rivers, freshwater marshes, and coastal lowland farm acreage (Thorne-Miller and Catena 1991). Other effects that may result from the melting of the Arctic tundra, include: (1) warmer water species would invade formerly cooler habitats confining cooler habitat species farther north; and (2) physical changes in the Arctic Seas that may have repercussions through oceans worldwide by altering the patterns of circulation, food chains that include valuable fisheries, and climate in other part of the world (Thorne-Miller and Catena 1991).

The Department of Commerce reports that human-generated increases in greenhouse gas concentrations have combined with natural forces to cause unprecedented warming in the Arctic in the 20th century, a phenomenon that could lead to significant changes in the earth's natural environment (USDC 1997c). Between 1840 and the mid-20th century, the Arctic warmed to the highest levels of the past four centuries, causing dramatic retreats of glaciers, thawing of permafrost and sea ice, and changes in terrestrial and lake ecosystems (USDC 1997c). Significant warming in the Arctic, particularly after 1920, may also be related to increased solar irradiance, decreased volcanic activity, and factors internal to the climate system (USDC 1997c).

As a result of changing meteorological conditions and sea level rise, fish habitats, fishery yields, and the industry's shoreline infrastructure could change dramatically (Bigford 1991). The projected average range of global sea level rise over the next century has been adjusted down since the mid-1980's, but still ranges from about 20 to 78 in. (50 to 200 cm). At least three factors will determine the severity of impacts from sea-level rise on natural resources and their habitat: (1) physical obstruction to inland habitat shifts from natural or human barriers; (2) resilience of species to withstand new environmental conditions during periods of erosion-induced transition; and (3) the rate of environmental change (Bigford 1991). Also sea-level rise could affect species distributions and abundance, particularly for estuarine-dependent or wetland dependent species.

2.2.5.15 Legislation and regulations that currently address habitat issues

Many federal laws are designed to regulate activities that have the potential to adversely affect the environment. Frequently, state programs complement those of the federal government. However, it is not the intent of this discussion to provide a comprehensive description of all these programs, but rather focus attention on those that most directly affect fisheries resources and their associated habitats. Those programs in which NMFS participate are emphasized because NMFS is specifically charged with conserving, enhancing, and managing living marine resources and, in concert with the Councils, implementing provisions of the MSFCMA.

Consultative authority is conferred to NMFS by several laws [e.g., Fish and Wildlife Coordination Act (FWCA), the National Environmental Policy Act (NEPA), the Marine Mammal Protection Act (MMPA), and the Endangered Species Act (ESA)]. These laws require federal agencies to consult with NMFS when proposing to construct, operate, authorize, or fund any activity that may affect resources within the purview of NMFS (e.g., fisheries resources, some marine mammals and endangered species, and their respective habitats). These mandates are essential to NMFS when reviewing proposals requiring permits to modify estuarine and marine habitats, such as those regulated by the Section 10/404 program.

Section 10 of the River and Harbor Act of 1899 authorizes the Army Corps of Engineers (COE) to regulate activities in navigable waters (to mean high water shoreline). Section 404 of the Clean Water Act (CWA), as amended, authorizes COE to regulate the discharge of dredged or fill materials in waters of the United States, including wetlands. EPA exercises oversight of the corps through establishment of guidelines under Section 404(b)(1) and the ability to veto permit decisions under section 404(c). The COE must consult with NMFS, and consider any recommendation made by them, before making a permit decision. It is through these recommendations that NMFS has the opportunity to alleviate potential adverse impacts associated with project implementation.

NMFS may also use its consultative authorities when reviewing other activities that can affect aquatic habitats. For example, Section 402 of CWA authorizes EPA, or delegated states with approved programs, to regulate the discharge of all industrial and municipal wastes (i.e., point source discharges). The EPA and COE also share regulatory responsibilities under the Marine Protection, Research, and Sanctuaries Act (MPRSA) for the discharge of wastes into ocean waters. The COE specifically regulates the discharge of dredged materials, while EPA regulates other discharges (e.g., municipal sewage sludge, industrial wastes). MPRSA also directs NOAA to conduct research and establish marine sanctuaries, which have habitat applications, as do elements of the Coastal Zone Management Act (CZMA).

Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requires states with approved Coastal Zone Management Programs to address nonpoint pollution in coastal waters. States must submit Coastal Nonpoint Pollution Control Programs for approval to both the EPA and the NOAA. EPA published "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters" to assist states to achieve compliance with CZARA. States failing to comply with Section 6217 may lose part of their federal funding under Section 306 of CZMA and Section 319 of CWA.

Other provisions of CWA enable NMFS to exercise its consultative authorities to conserve and enhance living marine resources and habitat. For example, Section 316 (a) and (b) require power plants to address and abate thermal pollution, and entrainment and impingement of organisms, respectively, and Section 303 requires states to address water quality holistically by watershed. Total Maximum Daily Loads (TMDLs) have been established for key pollutants (e.g., some heavy metals, nutrients) under Section 303. Stream segments within each watershed are then monitored, and abatement plans are developed so that each watershed can be brought into compliance with TMDLs.

Section 320 of the CWA authorizes the National Estuary Program (NEP). Currently, 28 estuaries are included in the NEP nationally; 8 in the Mid-Atlantic. Habitat loss and modification and eutrophication have been identified as major problems affecting Mid-Atlantic estuaries. Comprehensive Conservation and Management Plans (CCMPs) have been developed that address the problems affecting these estuaries, describe measures needed to resolve these problems, and provide implementation strategies. Plans are also developed to monitor the success of plan implementation. NMFS participates on the Scientific and Technical Committees (STACs) and Living Resources Subcommittees (LRSCs) of many of these estuaries recommending research needed to understand estuarine processes and problems, assisting in the development of CCMPs, and facilitating their implementation.

Some laws, such as the Federal Power Act, as amended, provide NMFS with the authority to prescribe mitigative measures (e.g., construction of fish passage facilities) for projects licensed by the Federal Energy Regulatory Commission. In the northeast, prescriptive authority is primarily used to retrofit facilities that injured resources resulting from past actions, such as requiring construction of fishways on existing hydroelectric plants during relicensing evaluations. Other legislation mandating NMFS to mitigate resource injuries through restoration or replacement of equivalent services are found in the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) and Oil Pollution Act.

Additionally, NMFS is involved in programs (e.g., Saltonstall-Kennedy, Anadromous Fish Act) that provide grants for the implementation of studies that contribute to the conservation of fish and habitats, or improve fisheries management.

The MSFCMA interim final rule requires consultation between NMFS and other state and federal agencies regarding EFH. Federal agencies are required to respond to NMFS and Council comments on federal activities, including those that are federally authorized or funded. State and federal agencies are encouraged to coordinate with NMFS and the Council in the early stages of actions to identify potential impacts to EFH.

Other pertinent legislation affecting the protection, conservation, enhancement, and management of living marine resources and habitat can be found in *A Plan to Strengthen the National Marine Fisheries Service's National Habitat Program* (USDC 1996b).

2.2.6 Feeding and Predation

According to section 600.815 (a)(8), actions that reduce the availability of a major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species may be considered adverse effects on a managed species and its EFH.

2.2.6.1 Summer flounder

2.2.6.1.1 Feeding

The timing of peak spawning in October/November coincides with the breakdown of thermal stratification on the continental shelf and the maximum production of autumn plankton which is characteristic of temperate ocean waters of the northern hemisphere, thus assuring a high probability of adequate larval food supply (Morse 1981).

Initiation of feeding is a function of the rate and efficiency at which yolk-sac material is consumed, which in turn is dependent on incubation temperature. As reported previously by Johns & Howell (1980) and Johns *et al.* (1981), total yolk-absorption was complete in 67 h and 105 h at 70° F (21 °C) and 61° F (16 °C), respectively. Within those 3 to 4 days from hatching, summer flounder larvae complete the morphological differentiation of the digestive tract, jaw suspension, and accessory organs necessary for independent exogeneous feeding (Bisbal & Bengtson 1995b).

To repeat the results of the Bisbal & Bengtson (1995a) study: they show the interdependence of temperature and food availability (i.e. delay of initial feeding) and their effects on survival and growth of summer flounder larvae hatched from Narragansett Bay and Long Island Sound broodstock. Their laboratory observations occurred from the time of hatching throughout the period of feeding on rotifers. The larvae withstood starvation for longer times at lower temperatures. They possessed sufficient reserves to survive starvation for 11 to 12 days when temperatures were maintained close to the experimentally determined lower tolerance limit (55° F; 12.5 °C; Johns *et al.* 1981). At temperatures close to the highest thermal limit reported to occur in their environment (70° F; 21 °C; Smith 1973), larvae only survived for 6 to 7 days. At either temperature, best survival occurred when the larvae began to feed at the time of mouth opening, thus survival is also significantly affected by the time at which they first have access to exogenous food. At 55° F (12.5 °C), every treatment group was represented by a low number of survivors which did not grow significantly from the initial figures at mouth opening. Growth of the larvae at 70° F (21 °C) was inversely proportional to the duration of early starvation; the size distribution of the survivors of the 70° F (21 °C) experiment showed an increase in mean size and weight when the initial feeding delay was shorter.

Bisbal & Bengtson (1995c) also determined the nutritional status of lab raised larvae and juveniles from the same areas. Mortality due to starvation occurs later in the older ontogenetic states; i.e., 60 h in 6 day old larvae, 72 h in 16 day old larvae, 8 d in 33 day old larvae, and 10 d in 60 day old juveniles at a temperature of around 66° F (19 °C).

In the laboratory, Peters & Angelovic (1971) reared postlarvae on a diet of zooplankton (mostly copepods) and *Artemia* nauplii; Buckley & Dillmann (1982) also used *Artemia* for their larval feeding experiments. The larvae exhibited an exponential increase in daily ration with age and a linear increase with weight (Buckley & Dillmann 1982). Other investigators have raised larvae on rotifers (e.g., Bisbal & Bengtson 1995a).

Previous studies have inferred that larval and postlarval summer flounder initially feed on zooplankton and small crustaceans (Peters & Angelovic 1971, Powell 1974, Morse 1981, Timmons 1995). Grover (1998) studied the food habits of oceanic larval flounder collected north and east of Hudson Canyon. The diets of all stages of larvae was dominated by immature copepodites. The size of other prey was directly related to larval size. Preflexion larvae (0.076-0.276 in.; 1.9-6.9 mm SL) fed on, in order of importance: immature copepodites, copepod nauplii, and tintinnids, as well as bivalve larvae and copepod eggs. Flexion larvae (0.148-0.288 in.; 3.7-7.2 mm SL) fed on immature copepodites (mostly calanoids) and adult calanoid copepods. Premetamorphic (0.192-0.304 in.; 4.8-7.6 mm SL) and metamorphic (0.232-0.36 in.; 5.8-9.0 mm SL) larvae also fed on immature copepodites, but adult calanoid copepods (mostly *Centropages typicus*) and appendicularians were also prey items.

Food habits studies on late larval and juvenile estuarine summer flounder reveal that while they are opportunistic feeders and differences in diet are often related to the availability of prey, there also appears to be ontogenetic changes in diet. Smaller flounder (usually less than 4 in.; 100 mm) seem to focus on crustaceans and polychaetes while fish become a little more important in the diets of the larger juveniles. In Great Bay-Little Egg Harbor estuary, New Jersey, Grover (1998) found that the primary prey of metamorphic (0.324-0.584; 8.1-14.6 mm SL) summer flounder was the calanoid copepod *Temora longicornis*, indicating pelagic feeding. Evidence of benthic feeding was observed only in late-stage metamorphic flounder (H+ and I), where the prey included polychaete tentacles and harpacticoid copepods. Incidence of feeding, defined as the percentage of frequency of larvae with prey in their guts, in relation to the total number of specimens examined in a time block, declined as metamorphosis progressed, from 19.1% at stage G to 2.9% at stage I. Rountree & Able (1992b) also discovered that young-of-year summer flounder in Great Bay-Little Egg Harbor marsh creeks preyed on creek fauna in order of abundance (Rountree & Able 1992a): Atlantic silversides (*Menidia menidia*), mummichogs (*Fundulus heteroclitus*), grass shrimp (*Paleomonetes vulgaris*), and sand shrimp (*Crangon septemspinosa*) contributed most importantly to their diets. Seasonal shifts in diet reflected seasonal changes in creek faunal composition, and Rountree & Able (1992a) note that the maximum abundance of young-of-year summer flounder in August coincided with the peak in Atlantic silverside abundances. In Little Egg Harbor estuary, New Jersey, Festa (1979) reported that fish, including anchovies, sticklebacks and silversides, comprised 32.6% of the diet volume of 2.34-9.36 in. (6-24 cm) summer flounder. The fish component was supplemented by mysid and caridean shrimp, of which the sand shrimp *Crangon septemspinosa* was of somewhat more importance.

Timmons (1995) reports that juvenile (2.964-9.711 in.; 7.6-24.9 cm TL) summer flounder from Rehobeth Bay, Delaware, fed mostly on the shrimp *Paleomonetes vulgaris* as well as portunid and blue crabs. Flounder from Indian River Bay fed mostly on mysids.

Postlarvae (0.42-0.568 in.; 10.5-14.2 mm SL) in Chesapeake Bay have been found with guts full of the mysid *Neomysis americana* (Olney 1983). In Magothy Bay, Virginia, small summer flounder (1.638-7.722 in.; 4.2-19.8 cm) also fed mainly on *Neomysis americana*, but in addition, consumed larger proportions of amphipods, small fishes, small gastropod molluscs, and plant material than the larger fish (Kimmel 1973). Wyanski (1990) found that mysids were also the dominant prey of 4-8 in. (100-200 mm) TL summer flounder in the lower Chesapeake Bay and Eastern Shore of Virginia. Lascara (1981) reports that larger juveniles and adults (avg. length 10.686 in. [27.4 cm] SL) from lower Chesapeake Bay fed on juvenile spot (*Leiostomus xanthurus*), pipefish (*Syngnathus fuscus*), the mysid *Neomysis americana*, and shrimps (*P. vulgaris, C. septemspinosa*).

Burke (1991, 1995) in his North Carolina field surveys in the Newport and North Rivers discovered that late larval and early juvenile summer flounder are active infaunal predators. Prey of summer flounder during the immigration period (0.44-0.88 in. [11-22 mm] SL) consisted of common estuarine crustaceans including harpactacoid copepods, polychaetes, and parts of infaunal animals such as polychaete tentacles (primarily from the dominant spionid *Streblospio benedicti*) and gills, and clam siphons. The appendages of benthic animals appear to be the most important prey item for postlarval flounders. The increasing importance of polychaetes and clam siphons was suggested with development, while feeding on harpactacoid copepods and amphipods was independent of stage. For juveniles 0.8-2.4 in. (20-60 mm) SL, polychaetes, primarily spionids (*S. benedicti*), were the most important part of the diet. Burke (1991, 1995) suggests that the distribution of these dominant polychaetes may influence the distribution of summer flounder in this estuary and could explain the movement of juvenile summer flounder into marsh habitat (Burke *et al.* 1991, note the Malloy & Targett [1994b] study mentioned in the Substrate section, above). Other prey items for this size class of summer flounder included invertebrate parts, primarily clam siphons; shrimp, consisting of the mysids *Neomysis americana* and palmonid shrimp; calanoid copepods, primarily *Paracalanus*; amphipods of the genus *Gammarus*; crabs, primarily *Callinectes sapidus*; and fish. Powell & Schwartz (1979) reported that larger juvenile (4-8 in. [100-200 mm] TL) summer flounder feed mainly on mysids (mostly *Neomysis americana*) and fishes throughout the year in Pamlico Sound, North Carolina. Mysids were found in relatively greater quantities in the smaller flounder, but as their size increased, the diet consisted of shrimps and fishes in similar quantities.

In South Carolina, Wenner *et al.* (1990a) reported that juveniles between 2-5 in. (50-125 mm) TL consumed only mysids and caridean shrimps (*Paleomonetes* sp., *P. pugio*, *P. vulgaris*). The importance of fish (mostly bay anchovy, *Anchoa mitchilli*, and mummichogs) in the diet increased as summer flounder sized increased.

In Georgia, Reichert and van der Veer (1991) found that juveniles from the Duplin River of around less than 1.6 in. (40 mm) SL fed principally on harpacticoid copepods; they also report that *Paralichthys* species greater than 1 in. (25 mm) fed on increasing numbers of other crustaceans including mysids, crabs, *Paleomonetes*, as well as polychaetes. Summer flounder greater than 4 in. (100 mm) also fed on fish.

Adult summer flounder are opportunistic feeders with fish and crustaceans making up a significant portion of their diet. Differences in diet between habitats or locations may be due to prey availability. The flounder are most active during daylight hours and may be found well up in the water column as well as on the bottom (Olla *et al.* 1972). Included in their diet are: windowpane (Carlson 1991), winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, American sand lance, bluefish, weakfish, mummichog, rock crabs, squids, shrimps, small bivalve and gastropod molluscs, small crustaceans, marine worms and sand dollars (Hildebrand & Schroeder 1928, Ginsburg 1952, Bigelow & Schroeder 1953, Poole 1964, Smith & Daiber 1977, Allen *et al.* 1978, Langton & Bowman 1981).

In Little Egg Harbor estuary, New Jersey, Festa (1979) reports that at least seven species of fish occurred in the stomachs of 1-2.6 in. (25-65 cm) summer flounder. These included silversides, anchovies, sticklebacks, silver perch, searobins, winter flounder and pipefish. Fish remains comprised 74.3% of the diet volume. Brachyuran crabs, primarily *Callinectes*, were of secondary importance in the diet. In Hereford Inlet near Cape May, New Jersey, Allen *et al.* (1978) found that adult and juvenile summer flounder (8-16 in.; 200-400 mm) fed mostly on *Crangon septemspinosa*, mysids and fish.

Smith & Daiber (1977) reported that Delaware Bay adults less than 18 in. (45 cm) TL fed on invertebrates, while those greater than 18in. (45 cm) TL ate more fish. Food items found, in order of percent frequency of occurrence, included decapod shrimp (*Crangon septemspinosa*), weakfish (*Cynoscion regalis*), mysids (*Neomysis americana)*, anchovies (*Anchoa* sp.*)*, squids (*Loligo* sp.*)*, silversides (*Menidia menidia*), herrings (*Alosa* sp.), hermit crabs (*Pagurus longicarpus*), and isopods (*Olencira praegustator*).

In Magothy Bay, Virginia, large summer flounder (7.8-18.6 in.; 20.1-47.6 cm) fed mainly on *Neomysis americana*, as well as large crustaceans such as *Squilla empusa*, xanthid crabs, and squids. The fish from this area are not mainly piscivorous, but the larger specimens (greater than 16 in.; 40.0 cm) did contain a higher percentage of fishes than did the smaller ones (Kimmel 1973). Lascara (1981) reports that larger juveniles and adults (avg. length 10.7 in. [27.4 cm] SL) from lower Chesapeake Bay fed on juvenile spot (*Leiostomus xanthurus*), pipefish (*Syngnathus fuscus*), the mysid *Neomysis americana*, and shrimps (*P. vulgaris*, *C. septemspinosa*).

In South Carolina, Wenner *et al.* (1990a) showed that flounder 2-12.5 in. (50-313 mm) TL consumed mostly decapod crustaceans, especially caridean shrimps (*Paleomonetes* sp., *P. pugio*, *P. vulgaris*). The importance of fish (mostly bay anchovy, *Anchoa mitchilli*, and mummichogs) in the diet increased as summer flounder sized increased.

2.2.6.1.2 Predation

Larval and juvenile summer flounder undoubtedly are preyed upon until they grow large enough to fend for themselves. Results of food habit studies by NMFS from 1969-1972 showed that Pleuronectiformes occurred in the stomachs of the following piscivores: spiny dogfish, goosefish, cod, silver hake, red hake, spotted hake, sea raven, longhorn sculpin, and fourspot flounder (Bowman *et al.* 1976). These data do not indicate the proportion of summer flounder among the flatfish prey taken, but it is likely that they are represented.

Following a thermal shock of 50° F (10 °C) above an acclimation temperature of 59° F (15 °C), larvae were actually less susceptible to predation by striped killifish (*Fundulus majalis*) than control larvae (Deacutis 1978).

Witting & Able (1993), working in the laboratory with 0.43-0.63 (11-16 mm) TL transforming larvae from Great Bay-Little Egg Harbor, New Jersey, suggest that these small summer flounder are vulnerable to predation by a large size range of *Crangon septemspinosa* (around 0.4-2 in. [10-50 mm] TL) in New Jersey's estuaries. Laboratory experiments by Keefe & Able (1994) in New Jersey demonstrated that predation on metamorphic summer flounder influences burying behavior and perhaps substrate preference. The type and abundance of predators could determine whether a metamorphic summer flounder stays in the substrate or the water column. For example, Keefe & Able's (1994) experiments showed that buried *C. septemspinosa* may reduce burying by the flounder, while pelagic mummichogs may cause more burying by the flounder during the day.

Timmons (1995) reports a preference for sand by juvenile (2.9-9.7 in. [7.6-24.9 cm] TL) summer flounder from the south shores of Rehobeth Bay and Indian River Bay, Delaware. In her study, the flounder were captured near large aggregations of the macroalgae *Agardhiella tenera* only when large numbers of their principal prey, the shrimp *Paleomonetes vulgaris*, were present. Timmons (1995) suggests that the summer flounder are attracted to the algae because of the presence of the shrimp, but the flounder remain near the sand to avoid predation ("edge effect"). Indeed, in her laboratory experiments, the juvenile summer flounder did not show a preference for the macroalgae, and in caging experiments, blue crabs were least able to prey on the flounder in cages with sand bottoms only, but had an advantage in capturing the flounder in cages containing macroalgae. Laboratory studies by Lascara (1981) on flounder from lower Chesapeake Bay also suggest that in patchy seagrass/sand habitats, the flounder may avoid predation by staying in the sand near the seagrass beds, rather than in the grass beds themselves.

Lab studies in Georgia by Reichert and van der Veer (1991) on juveniles from the Duplin River found potential predators to be blue crabs (*Callinectes* spp.) and sea robins (*Prionotus* spp.).

All of the natural predators of adult summer flounder are not fully documented, but larger predators such as large sharks, rays, and goosefish probably include summer flounder in their diets.

Spatial co-occurrence and dietary overlap among summer flounder, scup, and black sea bass have been previously documented (Musick & Mercer 1977, Gabriel 1989, Shepherd & Terceiro 1994). For example, the composition and distribution of fish assemblages in the Middle Atlantic Bight was described by Colvocoresses & Musick (1979) by subjecting NMFS bottom trawl survey data to the statistical technique of cluster analyses. Summer flounder, scup, northern sea robin, and black sea bass, all warm temperate species, were regularly classified in the same group during spring and fall. In the spring this group was distributed in the warmer waters on the southern shelf and along the shelf break at depths of approximately 500 ft (152 m). During the fall this group was distributed primarily on the inner shelf at depths of less than 200 ft (61 m) where they were often joined by smooth dogfish.

Laboratory studies by Lascara (1981) on flounder from lower Chesapeake Bay suggest that in patchy seagrass/sand habitats, the flounder may avoid predation by staying in the sand near the seagrass beds, rather than in the grass beds themselves.

2.2.6.2 Scup

2.2.6.2.1 Feeding

Although specific data is unknown, larvae probably feed naturally upon small zooplankters as suggested in larval rearing experiments (Griswold and McKenney 1984).

Juvenile scup in Long Island Sound feed during the daytime, and principally on polychaete worms (e.g., maldanids, nephthids, nereids, and flabelligerids), epibenthic amphipods, other small crustacea, small molluscs, and fish eggs and larvae, with copepods and mysids being especially important to post-larvae and early juveniles, while bivalve molluscs were more commonly eaten by larger fish (Richards 1963b; Bowman *et al.* 1987, Michelman 1988). Allen *et al.* (1978) reported amphipods, polychaetes, copepods and other small crustaceans were eaten by a small sample of juvenile scup in southern New Jersey; this finding is generally consistent with NEFSC data. Michelman (1988) reported that scup only eat when in a school and the relative importance of major prey taxa varied seasonally. Baird (1873) reported prey were "rooted out of the sand or mud". Juvenile and adult scup in lower Delaware Bay, near an artificial reef, ate amphipods (caprellids and others), razor clams, hydroids, blue mussels, anemones, mysids, i.e., a mix of hard-surface epifauna and sand bottom infaunal prey (F. Steimle unpubl. data), while a collection of 3.5-4.7 in. (9-12 cm) FL scup examined seasonally from Raritan Bay ate a diversity of benthic infaunal and epifaunal invertebrates whose composition in the diets varied among areas within the Bay (F. Steimle unpubl. data). Michelman (1988) estimated the daily food ration of juvenile scup to be about 3.49% to 3.99% of dry body weight - depending on method used, or about 5% of their body weight per day.

Adult scup continue to be benthic feeders and eat a wide variety of food, including small crustacea (including zooplankton), polychaete worms, molluscs, small squid, vegetable detritus, insect larvae, hydroids, sand dollars and small fish (Goode 1884, Nichols and Breder 1927, Hildebrand and Schroeder 1928, Bigelow and Schroeder 1953, Oviatt and Nixon 1973, Maurer and Bowman 1975, Morse 1978, Sedberry 1983). Bowman *et al.* (1976) reported differences in the diets of scup collected in southern New England and the Middle Atlantic Bight; polychaetes were more important in southern New England waters and anthozoans more important in the Middle Atlantic Bight. During fall migration off New Jersey, Sedberry (1983) reported that scup fed mainly on amphipods and polychaetes, but also ate decapod crustacea, copepods, snails, and other small invertebrates. There has been a significant decline in the average size of scup since the 1930s and small scup have slightly different habitat and prey requirements than larger scup (Smith and Norcross 1968). Adults also prey upon small benthic invertebrates, although feeding and growth appears to be reduced during the winter. Larger fish were found to eat larger prey.

At times and in certain areas, scup diets overlapped that of red hake *Urophycis chuss*, and, depending on scup length, with silver hake *Merluccius bilinearis* and gulf stream flounder *Citharichthys arctifrons*. Langton (1982) also reported the diets of scup overlap those of several other demersal species. He reported that there is little prey use overlap with cod *Gadus morhua* or silver hake off New England, although they have similar benthic diets. Jeffries and Terceiro (1985) hypothesized that one possible reason for an expanding scup population that seemed to be replacing winter flounder in Narragansett Bay was that both species have similar diets, and a low abundance of winter flounder made more benthic food available for benthic-feeding species such as scup. They also suggested that, since scup and winter flounder, *Pleuronectes americanus*, have similar diets, there can be competition for prey. This diet congruence of similarly sized fish was also found in a recent (1996-1997) fish trophodynamics study in Raritan Bay, NJ (F. Steimle, unpubl. data).

During the inshore residency, there is a gradual accumulation of stored food by scup from the spring into the fall, evident as higher mean caloric content of whole scup per unit total body weight (Steimle and Terranova 1985). This stored energy can support the extra energy demands of migration, possible reduced winter feeding, and gonadal development. Feeding is thought to be minimal during the winter because there is so little growth (Bigelow and Schroeder 1953).

2.2.6.2.2 Predation

Larvae are probably preyed upon by any variety of planktivores that might be present, including medusae, crustaceans and fish. Small or juvenile scup are heavily preyed upon by bluefish *Pomatomus saltatrix*, halibut *Hippoglossus hippoglossus*, cod, sharks, striped bass *Morone saxitilus*, weakfish, goosefish *Lophius americanus*, silver hake and other coastal fish predators (Baird 1873, Smith 1898, Jensen and Fritz 1960, Schaefer 1970, Morse 1978, Sedberry 1983). Baird (1873) reported large numbers of small scup were eaten by cod in late November on Nantucket Shoals. The NEFSC food habits database lists the following species as being documented predators of scup: dusky shark *Carcharhinus obscurus*, sandbar shark *C. plumbeus*, smooth dogfish, spiny dogfish *Squalus acanthias*, Atlantic sharpnose shark *Rhizoprionodon terranovae*, Atlantic angel shark *Squatina dumeril*, Atlantic torpedo ray *Torpedo nobiliana*, bluntnose stingray *Dasyatis say*, silver hake, bluefish, summer flounder, black sea bass, weakfish, northern stargazer *Astroscopus guttatus*, goosefish, inshore lizardfish *Synodus foetens*, and king mackerel *Scomberomorus cavalla*. Other predators are possible, as well, including fish-eating birds in shallow waters.

Another potential source of habitat-related mortality or impairment is some diseases. Scup was listed as a species found with fin rot in the polluted inner New York Bight and Hudson-Raritan Estuary (Mahoney *et al.*, 1975). Disease can be initiated by direct epidermal exposure or through feeding on contaminated prey. Benthic invertebrate prey commonly eaten in the New York Bight have been found contaminated with several toxic heavy metals (Steimle *et al.* 1994).

2.2.6.3 Black sea bass

2.2.6.3.1 Feeding

The diets of black sea bass larvae are poorly known and can be expected to be mostly zooplankton. Tucker (1989) reported that black sea bass larvae are capable of surviving and growing at lower prey densities and resist prey abundance fluctuations better then bay anchovy, *Anchoa mitchilli*, larvae.

Juvenile black sea bass are reported to be diurnal, visual predators and prey often on small benthic crustacea (isopods, amphipods, small crabs, sand shrimp, copepods) and other epi- or semi-benthic, estuarine-coastal taxa, such as mysids or smaller fish (Richards 1963a, Kimmel 1973, Allen *et al.* 1978, Werme 1981). Kimmel (1973) included polychaete worms as significant dietary items and reported a diet shift with juvenile growth, from mysids (55%) and amphipods (15%) at 1.2-3.5 in. (3.0-9.0 cm) SL to xanthid and other crabs (35%), mysids (19%) and polychaetes (14%) for 3.5-5.7 in. (9.1-14.6) cm SL sub-adults. Orth and Heck (1980) reported sub-adults (5.5-6.4 in. [14.0-16.5 cm] TL) using and feeding within eelgrass beds in lower Chesapeake Bay; prey were juvenile blue crabs, eelgrass fragments, isopods, caprellid amphipods, shrimp and pipefish, *Syngnathus* sp.. Festa (1979) also reported various crabs (lady, blue and mud) and caridean shrimp as major diet items in a small sampling from a central New Jersey estuary. Allen *et al.* (1978) reported small bait fish (anchovies and silversides, *Menidia* sp.) became most evident in the diets of southern New Jersey coastal-estuarine black sea bass between 4.3 in. and about 7.0 in. (11 cm and about 18 cm) lengths; but so did an increase in the occurrence of plant detritus, though crustacea were still the most common prey.

While on their summer habitat, adult black sea bass continue to feed on a variety of infaunal and epibenthic invertebrates (especially crustacea, including juvenile lobster) and small fish, and on pelagic squid and baitfish (Bigelow and Schroeder 1953, Miller 1959, Richards 1963a, Mack and Bowman 1983, Steimle and Figley 1996). Feeding was reported heaviest after spawning (Hoff

1970). The diets and feeding while the population is wintering offshore is poorly known. The potential benthic invertebrate macrofaunal prey in the wintering area is known to be variable and can be dominated by echinoderms (sand dollars and sea stars), molluscs such as razor clams, and polychaetes (Wigley and Theroux 1981, Steimle 1990). Some co-wintering guild species, e.g. scup (Austen *et al.* 1994), can be competitors for habitat or food. Other guild species, such as butterfish and squid, can be prey for adult black sea bass.

2.2.6.3.2 Predation

There are a multitude of potential larval black sea bass predators, and "jellyfish" can be a significant source of larval mortality when they are abundant in the coastal zone (Arai 1988).

Hartman and Brandt (1995) included black sea bass, presumably juvenile, in the summer diets of one year old weakfish, *Cynoscion regalis*, and other predators in Chesapeake Bay. Summer flounder, smooth dogfish and toadfish are potential demersal predators of juvenile black sea bass, and exposed juveniles can also be prey to piscivorous bluefish, *Pomatomus saltatrix*, striped bass, *Morone saxatilus,* weakfish and other predators that use the entire water column, including fish-eating diving birds. Steimle (unpubl. data) found juvenile black sea bass in the stomachs of the following predators examined in Raritan Bay during the summer 1997: clearnose skate (*Raja eglanteria*), northern and striped sea robin (*Prionotus evolans*), summer flounder, spot, and possibly others (e.g., weakfish, bluefish, toadfish, smooth dogfish, and four-spot flounder, *Paralichthys oblongus*) whose stomachs contained small unidentified, partially digested fish, similar in size and shape to juvenile black sea bass.

The NEFSC food habits database lists the following as predators of black sea bass: spiny dogfish, *Squalus acanthias*; Atlantic angel shark, *Squatina dumeril*; clearnose skate; little skate, *Raja erinacea*; spotted hake; summer flounder; windowpane, and goosefish, *Lophius americanus*. This predation undoubtedly includes many sizes of black sea bass, but smaller fish are probably most vulnerable.

2.2.7 Research and Information Needs

From section 600.815 (a)(10), it states that each FMP should contain recommendations for research efforts that the Councils and NMFS view as necessary for carrying out their EFH management mandate. There are four sets of recommendations included in this section.

In general, there is a necessity to review the unpublished "grey" literature from organizations such as Sea Grant, state and federal agencies, educational institutions, consulting firms, etc. where significant research has been performed on fisheries related contaminant data. However, the time frame imposed by Congress did not permit for a complete this data. Review of existing information should provide a logical first step for management and better define and prioritize research needs.

The recommendations in this section are simply a compilation of all existing data needs. The Council stands ready to work with NMFS to prioritize these needs on a coastwide basis. The Council is soliciting input from the public during the hearing process as to their view of prioritization.

2.2.7.1 Summer flounder

The first set of recommendations comes from the summer flounder EFH background document (Packer and Griesbach 1998). Obviously, there are many gaps in our understanding of the autecology of summer flounder. Because it is such a highly migratory species and occurs everywhere throughout its range, knowledge of its life history and habitat requirements can vary regionally, and what affects them in one area can easily cause repercussions in the population in another area. Even though summer flounder is managed and assessed as one stock throughout the U.S. EEZ, the question of multiple stocks still needs to be settled from a scientific standpoint. There is a lack of knowledge concerning the habitat requirements for all life history stages, especially the offshore eggs and larvae, but even for the adults within our own estuaries, since much of the current habitat research has focused on the estuarine larvae and juveniles. Of course, more habitat information is needed on the inshore transforming larval and early juvenile stages, especially because their health affects the future growth and survival of the population. Finally, critical habitat preferences must be defined. For example, while it is likely that temperature may drive the seasonal movements of juveniles and adults in and out of the estuaries, it may have less effect on their choice of specific habitats within those estuaries, where substrate, salinity, etc. may be the overriding factors. Once their habitat preferences are defined, their critical habitats can be more thoroughly delineated and mapped.

2.2.7.2 Scup

The second set of recommendations was taken directly from the scup EFH background document (Steimle *et al.* 1998a).

1. Taxonomic status of scup and southern porgy should be resolved.

2. Better characterization of spawning sites, and egg and larvae "nursery" habitat areas are necessary.

3. Degree of Middle Atlantic and South Atlantic Bight population mixing near Cape Hatteras should be determined, and if the Middle Atlantic Bight population migrates into waters south of Cape Hatteras.

4. Affects of anthropogenic alteration of population structure (size compression) on habitat requirements, i.e., does an abundance of smaller fish change the habitat requirements of the species?

5. Effects of long-term and combinations of environmental variables on scup population parameters, such as reproductive capacity, genetics, or suitability as human food.

6. Information on the direct and indirect effects of pollutants on growth, fecundity, survival-mortality, distribution, and human use. Indirect effects should include food web alterations.

7. What is the role of structured habitats, natural of artificial, in the life history, productivity, and fishery management of scup?

8. Better define the effects of the Middle Atlantic Bight winter trawl fishery on spawning stock, juvenile survival, and essential habitat conservation.

9. Do scup juveniles prefer larger and deeper bodies of estuarine waters as primary nurseries, thus explaining their use of larger bays (Chesapeake, Delaware, Raritan, Long Island Sound, etc.) and not smaller ones (Barnegat, Maryland-Virginia seaside)?

10. Are these patchy, inconsistent occurrences of juveniles the product of inadequate monitoring or highly variable year-class recruitment?

11. What specific habitat types or features are used by scup in the Middle Atlantic Bight during offshore wintering?

12. Identify which habitat factors determine patchy distributions of juvenile and adult scup in time and space.

The following habitat-related research needs are from Kline (1997), in order of priority:

13. Conduct research on the trophic relationships of scup.

14. Investigate the long-term, synergistic effects of combinations of environmental variables, e.g. pH and toxics on survival, reproductive capacity, genetic changes, and human health.

15. Continue studies on the importance of factors controlling production and distribution of food items that appear in the diets of young scup.

2.2.7.3 Black sea bass

The third set of recommendations is taken directly from the black sea bass EFH background document (Steimle *et al.* 1998b)

1. Artificial reefs, because of their popular use by fishery managers and by black sea bass, require addition studies of these use relationships. The following are ideas discussed in a number of papers in the special AFS *Fisheries* 22(4), April 1997 issue on artificial reef management (these are by no means all or the most locally urgent artificial habitat-black sea bass issues):

> a) What mechanisms or processes (reducing habitat limitation, enhancing larval settlement, alleviating post-settlement demographic bottlenecks, enhancing reef and near-reef food webs) enhance black sea bass production on artificial reefs?
>
> b) How can artificial reefs/habitats be designed to best enhance survival of juvenile and growth of adult black sea bass?
>
> c) Are there limits to the application of artificial reef/habitat technology to black sea bass fishery management?
>
> d) How can resident black sea bass on artificial and natural habitats be protected from excessive exploitation?
>
> e) Are adult or juvenile black sea bass habitat limited to the degree that requires habitat restoration or enhancement?
>
> f) Are black sea bass habitat refuges needed and their goals reasonably achievable?

2. More general research needs:

> a) In the Middle Atlantic Bight, what is the specific habitat used during the winter for this normally shelter-associated species? Its wintering area of the outer continental shelf

appears to have little sheltering habitat and whatever might have existed would have probably been reduced by 65 years of heavy trawling. The specific wintering areas of one and two year old juvenile fish is unknown, some may remain in estuaries, and others may move to coastal or inner shelf clam shell beds (Able *et al.*, 1995a; Dixon *et al.*, pers. comm.); the distribution and status of this habitat is unknown. b. Diets of this size class in the winter are not well known, although feeding may be reduced with low temperature. c. Nearshore clam shell beds may provide important habitat at all times of the year, but little is known of dead shell bed distributions or spatial or temporal distributional trends. d. Able and Fahay (1998) noted that it would be useful to know if young-of-the-year black sea bass, overwintering offshore, return to their natal estuary in the spring.

3. Adams (1993) posed the following information needs:

a) Tagging studies are needed to better track migrations and seasonal residencies of black sea bass.

b) More marine habitat-specific diet studies are needed to evaluate the value of various macrohabitats to various life stages of black sea bass.

c) The relationship between habitat structural complexity, black sea bass and overall fish community composition needs to be better defined and understood.

d) What habitats are suitable for juvenile black sea bass in coastal marine areas?

e) Are there black sea bass behaviors that could be habitat related, e.g., territoriality?

f) Spawning areas, behaviors and feeding during spawning needs to be better defined for this species.

4. The Chesapeake Bay Program's Black Sea Bass FMP (1996) lists the following habitat-related research needs:

a) Conduct seasonal distribution and migration research to emphasize size distribution and sex ratios from various areas.

b) Determine the spawning areas, extent of spawning production and estimate of optimum size for female and female fish to generate maximum viable egg production.

c) Quantify the composition of the diet and seasonal changes in the diet (i.e., seasonal importance of blue mussels, *Mytilus*, and other reef fauna).

d) Conduct research on the optimum acreage of black sea bass habitat, i.e., determine what size SAV bed or oyster reef is best for nursery and refuge grounds for juvenile black sea bass.

2.2.7.4 Fishing threats

The fourth list comes from Auster and Langton (1998). A number of areas where primary data are lacking, which would allow better monitoring and improved experimentation, ultimately leading to improved predictive capabilities, are:

1. The spatial extent of fishing induced disturbance. While many observer programs collect data at the scale of single tows or sets, the fisheries reporting systems often lack this level of spatial resolution. The available data makes it difficult to make observations, along a gradient of fishing effort, in order to assess the effects of fishing effort on habitat, community, and ecosystem level processes.

2. The effects of specific gear types, along a gradient of effort, on specific habitat types. These data are the first order needs to allow an assessment of how much effort produces a measurable level of change in structural habitat components and the associated communities. Second order data should assess the effects of fishing disturbance in a gradient of type 1 and type 2 disturbance treatments.

3. The role of seafloor habitats on the population dynamics of harvested demersal species. While there is often good time series data on late-juvenile and adult populations, and larval abundance, there is a general lack of empirical information (except in coral reef, kelp bed, and for seagrass fishes) on linkages between EFH and survival, which would allow modeling and experimentation to predict outcomes of various levels of disturbance.

These data, and any resulting studies, should allow managers to regulate where, when, and how much fishing will be sustainable in regards to EFH. Conservation engineering should also play a large role in developing fishing gears which are both economical to operate and minimize impacts to environmental support functions.

2.2.8 Review and Revision of EFH Components of FMP

In section 600.815 (a)(11), it states that Councils and NMFS should periodically review the EFH components of FMPs, including an update of the fishing equipment assessment. Each EFH FMP amendment should include a provision requiring review and update of EFH information and preparation of a revised FMP amendment if new information becomes available.

The Council will amend its FMPs at least every five years as called for in this section, but is also including a habitat framework adjustment provision that can be included in each FMP. Due to the very rapid time constraints of meeting the October-MSFMCA deadline mandated by Congress (with very limited additional funds), it was impossible to include much of the state survey data that will be available in the future, as well as, much of the unpublished literature on contaminants etc. It is important to understand that this EFH is a "work in progress" and that the process will evolve. This framework provision is envisioned to work along the existing framework provisions established for the New England Multispecies FMP by the NEFMC. A similar process is proposed in this FMP for other non-EFH management measures.

The FMP contains descriptions and identification of essential fish habitat and habitat areas of particular concern, estimates of gear impacts on essential fish habitat, and contains recommendations that describe options to avoid, minimize, or compensate for the adverse effects and promote the conservation and enhancement of EFH. In some cases definitions, estimates, and recommendations are made in general terms because the specific content and concentrations of organic and inorganic compounds have not yet been compiled and/or specified by regulatory agencies. The purpose of this framework provision is to incorporate such specifics into the definitions, estimates, and recommendations as specifics are developed via existing data not available when the FMP was adopted. The framework provision is not to be used to add or delete the conservation and enhancement recommendations, but only to adjust description and identification of EFH (boundaries), habitat areas of particular concern, and revise gear management measures (such as degradable panels and lines).

The Council envisions creating a Habitat Monitoring Committee (HMC) made up of at least staff representatives from the NMFS Northeast Fisheries Science Center, the Northeast Regional Office Management and Habitat Sections, the Atlantic States Marine Fisheries Commission, and Chaired by the Council Executive Director or his/her designee. The HMC will meet at the call of the HMC Chair, to develop options for MAFMC consideration on any adjustment or elaboration of any FMP EFH definition or gear impacts of EFH recommendations necessary to achieve the habitat goals and objectives. Based on this review, the HMC will recommend specific measures to revise EFH definitions, revise gear specifications.

The MAFMC, through its Habitat Committee, will review the recommendations of the HMC and all of the options developed by the HMC and other relevant information, consider public comment, and develop a recommendation to meet the FMP's habitat goals and objectives. If the MAFMC does not submit a recommendation that meets the FMP's habitat goals and objectives and is consistent with other applicable law, the Regional Administrator may adopt by regulatory change any option developed by the HMC, unless rejected by the MAFMC or tabled by the MAFMC for additional consideration, provided the option meets the FMP's habitat goals and objective and is consistent with other applicable law. The frameworked process for developing EFH and/or gear impacts will follow the same overall process as that for other non-EFH management measures.

2.3 DESCRIPTION OF FISHING ACTIVITIES

The description of fishing activities for the summer flounder, scup, and black sea bass fisheries are fully described in section 7 of Amendments 2, 8, 9, and 10. There is no additional information available to change this section at the present time.

2.3.1 Port and Community Description

In order to identify the ports important to fisheries managed by the Mid-Atlantic Council and to identify the fisheries relative importance to those ports, the Council retained Dr. Bonnie J. McCay of Rutgers University to prepare a background document (McCay *et al.* 1993). The research covered ports from Chatham, Massachusetts, to Wanchese, North Carolina.

The principal approaches employed to compile the information presented in the report mentioned above were open-ended phone interviews, port visits, data analysis, and interviews of people involved in different aspects of the fishing industry. Landings statistics are from the National Marine Fisheries Service weighout data. Information about the ports is from interviews from key informants and from earlier studies conducted by McCay's research team (McCay *et al.* 1993). The quality of the port descriptions, therefore, depends on the information supplied by the informants. The port descriptions presented in this section are brief summaries of the material in McCay *et al.* (1993), and readers with questions are encouraged to obtain the original document. The port discussion includes a description of the fleet (number of vessels and type of gear employed), a description of the landings (species value) and general description of the community and port characteristics as permitted by the available information. The overall description may vary from port to port due to the confidentiality of data. The McCay *et al.* report (1993) is the best available data for description of port and community involvement and in fact is the only systematic coastwide description currently available.

The 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.

For purposes of orientation, Barnstable County, MA includes all of Cape Cod, including the fishing port of Chatham. New Bedford is located in Bristol County, MA. The port of Newport is located in Newport County, RI. Stonington is located in New London County, CT. Freeport is located in Nassau County, NY. Brooklyn is located in Kings County, NY. Belford, Point Pleasant, Barnegat Light (Long Beach), and Cape May/Wildwood are located in New Jersey. Ocean City is located in Worcester County, MD. Virginia has a system whereby certain cities exist apart from counties. Within the scope of this analysis, the City of Seaford, Hampton, Norfolk, Newport News and Virginia Beach all fall into this category. Wanchese is located in Dare County, NC.

Wanchese, North Carolina

Wanchese is located on the southern end of Roanoke Island in North Carolina. "Wanchese has traditionally been a fishing community with commercial fishing operations since the late 1800s. Many of the current residents of Wanchese are descendants of people who settled here in the late 1600s and early 1700s." Many of the fishers are small, independent owner operators. "Informants have estimated that fifty percent of the men in Wanchese are in a marine related career." Wanchese has never developed the strong tourism sector seen in nearby areas. Wanchese is bounded on three sides by estuarine waters and is twenty minutes (by boat) from Oregon Inlet. Because of the periodic shallowness of Oregon Inlet, many of its larger trawlers stay in Hampton, Virginia or New Bedford, Massachusetts during the winter. "Wanchese is also the site of the Wanchese Seafood Industrial Park (WSIP) which was developed in the 1970s to be a major site for seafood processing activities. However, because of the uncertain nature of Oregon Inlet and the general decline in fisheries since the 1970s, very few businesses actually operate in WSIP. The catch is either sold at retail markets locally or it is packed in ice and sent to other markets. At least one of the Wanchese commercial fishing and packing operations has expanded to other ports such as Hampton, Virginia and New Bedford, Massachusetts." In recent years, some New Bedford vessels have moved south to base in Wanchese in response to shortages of groundfish and scallops in New England.

Much of the ocean fishing occurs in the winter months (November-April), and summer flounder is the principal species sought. However, the boats in Wanchese fish all year round. Summer flounder is caught with otter trawls which fish from shore out to 100 fathoms, and from Ocracoke, North Carolina to Cape May, New Jersey and New York. Alternative species include weakfish and *Illex* squid, but these require different nets. There are a half dozen fish houses and other marine-related businesses that handle species other than crabs, and a couple that handle crabs exclusively. McCay *et al.* (1993) reported that summer flounder (21%) was the most important species in Dare County in terms of landed value in 1991. The value of all species landed in Dare County was over $11 million in 1991. Blue crabs (hard) are second in importance (11%), followed by weakfish (9%). Bluefish accounted for about 4% of the total landed value in Dare County in 1991, sea basses (3%), dogfish (1%), and tilefish, scup, butterfish, squid, and Atlantic mackerel with less than 1%.

Generally, the boats that are owned by local companies are operated by hired captains. However, these boats may be operated by a relative in some instances. Independent boats are usually owner-operated, with family members often serving as crew. "The crew on these vessels are mostly local; 75-80 percent are from within the area. All are paid with some variation of a share system."

The crews are mostly 18 to 40 years of age; captains are usually older, with some over 65. Most crew members are white, though there are some black fishers including black captains. Sometimes, members of a family will own boats and fish houses. In the fish houses, most of the work force is black women, except for the crab houses where Latino workers are more common."

"Recreational fishers use the inshore, offshore, and sound waters around Wanchese and Dare Counties." Those fishing from boats do not predominantly target summer flounder, scup, or black sea bass. Some flounder are targeted by pier and surf fishers, who are primarily local residents and residents of nearby counties.

Hampton/Hampton Roads, Virginia

"The area in Virginia containing Hampton, Newport News, Seaford, and Virginia Beach is know as Hampton Roads. It is difficult to describe fishing in Hampton apart from the rest of the area. Hampton brings in the largest variety of fish species and the most pounds, but it is a small part of Hampton Roads." These ports have historically been fishing communities. The Hampton Roads area included five of the six major offloading ports in Virginia. However, the "fishing industry is but one of the many industries in the Hampton Roads area. While Hampton itself is not a big tourist spot, the town is trying to emphasize its waterfront area and its tourism potential. There is an Air and Space Museum, a marina for pleasure boats, a number of military installations. The military presence in the Hampton Roads area is also a large part of the economy, keeping this area from being totally dependent on tourism and fishing. Other industries in the area include: a large coal port in Newport News, CSX railroad, and shipping freight companies.

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.

Much of the poundage of fish in Virginia is accounted for by menhaden, but other species are also important. Summer flounder is caught by otter trawls and gillnets. Draggers may switch between scallops and summer flounder by season, though small draggers usually specialize in either scallops or fish. Gillnets also target spot, croaker, weakfish, and some black sea bass. Summer flounder is also caught in pound nets, though these are primarily targeting mackerel, harvest fish and industrial fish. Overall, the fishers in this area are very opportunistic, targeting whatever seems available and marketable. As a result, there is generally no off season here, though summer flounder quota limits sometimes lead vessels to tie up for a couple of months.

The Hampton Roads area ports landed ninety-five different species in 1992. In terms of landed value, sea scallops (63%) and summer flounder (17%) were the two most important species landed in the Hampton Roads area in 1992. Black sea bass and scup accounted for approximately 2% and 0.3% of the total landed value by species for the same period, respectively.

In 1992, scallop dredgers accounted for 54% of the total landed value by gear type in Hampton Roads, followed by otter trawls (bottom fish) (20%), otter trawls (scallop) (12%), tong/clam (6%), crab pot (3%). Summer flounder accounted for 84% of the total landed value by species of bottom fish otter trawls in 1992, black sea bass ranked second with 6% of the total landed value, and scup ranked fourth with less than 2% of the total landed value.

Black sea bass are targeted in the EEZ by trawlers, potters, and hook and line fishermen. Draggers landed 66% of the total black sea bass landed in the area in 1992, while handliners landed 32%. For handliners, black sea bass accounts for well over 90 percent of their landings. Black sea bass is also an incidental catch for haul seiners and gill netters in coastal waters. Sea bass are also caught with otter trawl/fly nets. Most of these nets are equipped with rollers on the bottom and buoys on the nets. Commercial fishermen may also catch sea bass with pots or with hook and line at wrecks or other bottom structures. Sea bass pots are relatively new, the fishery having really developed in the early 1990s. They are similar to crab pot and are typically deployed close to wrecks

Many of the boats dragging for black sea bass in the Hampton Roads area are from North Carolina. These fishermen also shrimp in the summer and then flounder fish in the winter. Some commercial fishermen also employ pots and hook and line to catch black sea bass.

Summer flounder has been a major money species in the spring and fall in Hampton Roads. Weakfish is caught all summer and targeted by gill netters in the fall. *Illex* squid is targeted during the summer, *Loligo* squid is mainly targeted in the fall. Atlantic mackerel is mainly caught by draggers, but a small amount are also caught by sink gill nets and pound nets. Most of the scup landed in Hampton Roads are landed by draggers.

Scup are landed almost exclusively by draggers, and are targeted offshore and to the north outside of state waters. Most of the scup are landed in Hampton and Newport News in the winter. "The vessels involved are mostly the multi-gear vessels that in the summer go after scallops with a net or dredge and then flounder fish in the fall and when that is over they switch their net to go after scup. But these fishers must wait until the fish are accessible which usually occurs in the winter beginning in December...In the spring, scup can be a big fishery [but this varies by year]." "Informants have observed a shift toward scup and black sea bass by founder fishers as a result of summer flounder quotas."

The packing houses (fish houses) in the Hampton Roads area, act as wholesale buyers and distributors. One fish house in the area has a government contract and supplies the US Navy with all its seafood. Seafood products are distributed locally and throughout the United States. Some species are shipped overseas to places like Japan, France and England. Most of the black sea bass is sold wholesale to New York. A few are sold locally.

Hampton Roads has a mix of boats that are owner operated or have a hired captain. The fish companies may own a number of boats and will hire captains to run them. The scallop boats are also often operated by hired captains. However, independent boats may be owner operated or a father may have a son or some other male relative running a boat for him.

There is a mix of different age groups in commercial fishing in Hampton Roads. Generally, commercial fishing is not a typical summer job for high school or college students. However, some high school students may work with a relative during the summer. In the Hampton Roads area, there are boats owned and operated by fishermen of Vietnamese ancestry, Mexicans and Mexican-American crews. Women do not fish offshore. Fishermen's wives primarily take care of the "bookwork" and other offshore tasks. Crews are paid with a share system. The share system varies among boats.

Family ties are important in choosing crew members on the smaller vessels. These boats tend to have very stable crews. Larger vessels, especially scallopers have a much higher turnover rate among crew. Crew are paid on a share system. Most of the captains and some of the crew have been fishing for most of their lives. Educational levels vary. "There is a mix of age groups in commercial fishing in Hampton Roads. There is a small but growing contingent of Vietnamese-owned boats, which is generating some resentment from longtime resident fishers. There are also a small number of Mexican-American fishers, most of whom are members of a single extended family.

"Trawlers unload at packing houses and these fish houses often serve as the wholesale buyer and distributor. One of the fish houses has government contracts and supplies the navy with all of its seafood. Summer flounder is distributed all over the United States, both here and in northern cities such as New York City and in Chicago. Many of the flounder are shipped to Japan and to St. Louis as well. Sea bass are mostly sold wholesale to New York. A few are sold locally. Scup and squid are shipped to northern markets. Two of the companies in Hampton own their own trucks and one of these is also a secondary buyer."

"Hampton Roads also has a large recreational fishery. Virginia Beach has a sports fishing center like Ocean City, Maryland but not as big as Oregon Inlet, North Carolina." Summer flounder is an important recreational species with hook and line, with the highest recreational landings in the spring near Chincoteague (eastern shore). Headboats go out for black sea bass, and some recreational fishers target scup. Other recreational species include bluefish and weakfish, with dogfish being an incidental catch.

Ocean City, Maryland

"The principal port in Maryland is Ocean City. Ocean City is a commercial fishing community with families that have been involved in fishing for at least sixty years. It has a permanent population of about 10,000 to 14,000 and a summer population of about 250,000 to 300,000. Many hotels, condominiums and summer homes as well as other service businesses for the summer tourists exist in Ocean City. One informant said that Worcester County is the wealthiest county in Maryland precisely because of the revenue generated by tourism. Major sources of employment such as work in tourist businesses and construction are thus related to the mainstay of the economy--tourism. However, new development is not taking place at the same levels it did in the past. Thus most of the construction jobs involve the maintenance of current structures. In fact, fishermen are also finding it hard to go into other industries such as crabbing or construction because these are depressed as well."

Surf clams and ocean quahogs are the two most important species, but summer flounder, black sea bass, sea scallops, bigeye tuna, swordfish, spiny dogfish, and yellowfin tuna are also species of interest.

Draggers take a variety of species, but primarily summer flounder and spiny dogfish. They trawl year round for summer flounder, black sea bass, and scup. From April through September they target summer flounder almost exclusively. Black sea bass are important species for inshore handline fishers. There has also been a significant sea bass pot fishery, with black sea bass landed value being second only to summer flounder in many years though it has seen some decline recently. The black sea bass pot fishery runs from April to September.

Ocean City has a fishing fleet of longliners, trawlers, gillnetters and potting boats. Its boats are primarily smaller boats; they are either inshore boats or small trawler, day boats. Three of the home ported longline boats home ported in Ocean City are 70 ft and 130 GRT, the others are smaller. There are between 6 to 10 trawlers ranging in size from 62 ft (32 GRT) to 73 ft (103 GRT). These trawlers do not have refrigerated sea water capacity. In 1993, there were five full-time boats involved in the sea bass potting fishery, ranging from 25 ft to 57 ft. Overall, the number of vessels in Ocean City declined in the 1991-1992 period primarily because of changes in the surfclam/ocean quahog fleet. Clam dredgers accounted for 63% of the total landed value of all gear, pelagic longline 12%, otter trawls 12%, and pots and traps for fish (black sea bass) 5%.

The total landed value of fish and shellfish in Ocean City and surrounding areas in 1992 was approximately $8 million. The top 10 species by percent landed value in 1992 were: surfclam (34%), ocean quahog (28%), summer flounder (5%), black sea bass (5%), sea scallop (4%), bigeye tuna (4%), swordfish (4%), dogfish (4%), yellowfin tuna (4%), and lobster (2%). Scup ranked 19th in importance, accounting for less than half of a percent of the total landed value in this port in 1992.

Pelagic longline gear is mainly use to catch tunas, swordfish, sharks, and dolphin fish. Inshore handlining for black sea bass and weakfish is also practiced in the Ocean City area. The top 4 species by percent landed value for handlining and pelagic longlining in 1992 were: black sea bass (53%), yellowfin tuna (20%), bluefin tuna (18%), and weakfish (4%).

The Ocean City otter trawlers take a large variety of finfishes, topped with summer flounder (40% of the total landed value), and spiny dogfish (28%). Black sea bass and scup ranked fifth and eighth with approximately 3% and 2%. Horseshoe crabs make up an unusually large component of this catch.

Black sea bass accounted for 0.08% of the total landed value for sink gill-nets, and 1.24% of the total landed value for drift gill-nets in 1992.

A significant black sea bass pot fishery exists in Ocean City. Sea bass pots are a traditional gear in this area. Black sea bass are caught with pots from April to September. Black sea bass accounted for approximately 92% of the total landed value of fish pots. Conch potting have increased in the area in recent years. Boats involved in conch potting have gill-netted in the past.

Even though the number of vessels operating in the surfclam and ocean quahog fishery has decrease substantially in recent years, they still contribute a large percentage of the port total landed value by species.

Loligo squid is caught by trawlers year round. During May and June there is a spring run in Ocean City, and during the rest of the year fishermen go offshore for squid. Trawling for butterfish mainly occurs in the fall. Butterfish is also a bycatch with weakfish. Bluefish are caught with trawl and gill-net in the spring and fall.

Several boats use gill-nets for weakfish and dogfish. Boats from Maine and New Hampshire have come to the Ocean City area to gill-net for dogfish. The dogfish season lasts from around the first of November until April.

The number of boats targeting summer flounder in Ocean City is small, mainly because Maryland's quota is small. Atlantic mackerel is targeted for about one week between March and April.

According to an informant, there have been no unusual changes in fishing in the Ocean City area. When a fishery is doing better, fishermen drift towards it in order to relieve pressure on another fishery.

Most of the vessels in Ocean City are owner operated, but a few hire captains. The transient longliners are generally not owner operated. Most owners pay their crew by the share system. In general the crew are younger men. Captains range in age from 23 years on up. A few of the captains have Masters or Bachelors degrees and some are high school graduates. A few African-Americans are part of the crews, and at least one boat had an African-American captain. Some of the boats from North Carolina also have African-American captains and crews.

No women are currently participating in fishing activities. However, in the past there have been a couple of women involved in fishing. In fact, there was a woman captain on a transient gill-net boat from New England.

"Businesses that serviced the surfclam and ocean quahog fishery such as trucking, fuel and ice have declined tremendously. There are unloading areas in Ocean City as well as local buyers. Fluke [summer founder] and black sea bass are taken to New York or Norfolk to bigger fish houses. During the summer, more summer flounder is sold locally and in Baltimore. Big-eye tuna and the best yellowfins go to Japan and bring a lot of money per pound."

"Ocean City is a well known recreational fishing port with many offshore charter boats." Headboats will hook for sea bass. However, the big money is in large pelagics. Pelagic boats target white marlin, as also tuna, bluefins and big eyes. Atlantic mackerel are also popular targets. According to McCay *et al.* (1993), there is no direct competition for docking space between commercial and recreational boats in Ocean City. However there are more marinas for recreational boats than for commercial boats.

Belford/Pleasant Point/Barnegat Light/Long Beach, New Jersey

Belford has 32 core boats in its port. The fleet is pretty much in the 40-60 foot range and made up of older boats. Draggers, poundnetters, and lobsterpotters make up the majority of the Belford fishing boats. Belford remains a family based fishing port. The Belford Seafood Co-op is the fish house for Belford. Most of the fish are handled by this local cooperative, with other firms handling lobster and shellfish. There is little or no tourism.

The total landed value for Belford in 1992 was about $9.2 million. In recent years ocean quahog vessels have moved to the port of Belford, with the result that the landed value for the port is now dominated by ocean quahogs (32% in 1992). The top species by value (excluding ocean quahog in 1992) landed in Belford was lobster (46%). Excluding ocean quahogs from the data, summer flounder, scup, and black sea bass accounted for 8%, 3%, and 1% of the total landed value by all species, respectively. The otter trawl accounts for 19% of the total landed value (much higher if ocean quahog dredges were not included). The species composition of otter trawl catches varies seasonally and over the years. In 1992 it was dominated by summer flounder (26%), silver hake (22.5%), and *Loligo* squid (14%), winter flounder (11%), and scup (9.3%).

The town of Point Pleasant is located at the mouth of the Manasquan inlet in Ocean County. The town's economy is geared towards the summer tourist and recreational economy. Point Pleasant is more diverse and larger. It is less dominated by family businesses. There are half a dozen fish houses, including a cooperative. There are also a lot of marine-related industries and a strong tourist sector. There are 51 core boats at Point Pleasant. They run the gamut from inshore gillnetters to scallop boats, draggers, longliners and lobster potters. The commercial, party/charter boat, and recreational fishing industries are very important to the local economy, employing many of the local residents and supporting many related industries such as seafood markets, restaurants, marine supply houses, welders and salvage, and many of the tourist oriented industries.

For the ocean and bay fisheries of Point Pleasant, the entire landed value was about $16 million. The top species by value (1992) landed in Point Pleasant was ocean quahog (38%). Summer flounder, scup, and black sea bass accounted for 1%, <1%, and <0.5% of the total landed value by all species, respectively.

Loligo squid is caught in the winter, often mixed with whiting. In 1992, *Loligo* usurped silver hake's position as the most valuable species caught by the trawlers, and it now accounts for about 49% of the landed value of the trawlers from Point Pleasant. At first, it was caught as a bycatch by those seeking silver hake in the Gully. Now it is targeted by a few of the trawler captains. As one trawler captain stated "You can't help but target squid sometimes, there is so much out there". Thus, the change to *Loligo* was initial de facto, now it is by choice.

In 1992 bottom fish otter trawl accounted for 15.73% of the total landed value for the Point Pleasant area. Major species caught include *Loligo* squid (50%), silver hake (21%), summer flounder (8%), and scup (4%).

The community of Barnegat Light is located on Long Beach Island, a barrier island along the New Jersey shore. The island up to and including Barnegat Light is intensely developed with summer and beach/boarding houses, and much of the community is heavily geared toward the summer beach economy. During the winter, Barnegat Light's economy slows significantly, and one of the major forms of employment becomes commercial fishing. It hires 150 people working on docks and is one of the biggest income generating businesses on the island during the winter.

Long Beach Island has a core of 30 steady boats that either longline, bottom trawl line, scallop, or gillnet. The gillnet boats are small, in the 30-45 foot range, but the vessel size in the fleet goes up to 100 foot scallop boats. The fleet remains a family based fleet, and the number of boats has remained constant over the years. Two docks pack fish in Long Beach, and there is an office for a swordfish and tuna dealer which purchases fish from the boats and has an offloading facility in Point Pleasant.

The larger region, including Barnegat Bay ports, had landings worth about $32 million in 1992. Major species, by percent of the landed value (excluding surfclams and ocean quahogs) were: sea scallops (28%), hard clams (17%), swordfish (13%), tuna (17%), and tilefish (8%). Black sea bass, scup, summer flounder accounted for 1.19%, 0.11%, and less than 0.01% of the total landed value by all species, respectively.

For the most all boats in these three ports are owner operated. And there are no freezer boats in any of these ports. Whiting is an important species at all the ports. It was the mainstay of the fisheries in the 1970s and 1980s but has declined. Some Jersey fishermen are suggesting that Rhode Island boats are catching much of the whiting before they migrate to their winter grounds off of New Jersey.

Most boats in these ports are owner-operated, and there are no freezer boats. Whiting is an important species, as are surfclams and ocean quahogs. "Summer flounder is big business for Belford and Pleasant Point." Scup and black sea bass are bycatch for these ports. Most summer flounder is caught in trawls, but some comes from gill nets. Captains tend to be aged 40-60. "Belford is a place where fishers have little other skilled work experience and thus are particularly dependent on fishing."

"Traditionally, summer flounder was pursued in the Mudhole in September and October. However, new quota laws have restricted fishing to just September. In the past a few captains specialized in summer flounder, but today it is only sought during quota time in a derby like fashion, It is marketed in the fresh fish markets of New York and Philadelphia, in local restaurants and fish stores, and in [the Point Pleasant Coop's] retail store."

"At one time there were a handful of trawlers that specifically targeted scup, partially because it took pressure off a supply burdened whiting market." Today scup is primarily a winter bycatch for trawls. Black sea bass are another occasional bycatch, but not a common one. Barnegat Light has a pot fishery which is heavily dependent on black sea bass and also lands some scup.

There is a charter boat fleet in Barnegat Light which targets mostly bluefish, summer flounder and tuna.

Cape May/Wildwood, New Jersey

There are about 33 local draggers operating from Cape May docks, most of which are wet boats. There are some equipped with refrigerated sea water (RSW) capacity and seven boats are wet boats. The draggers are generally 50-75 feet long, steel hulled. Many transit boats (57 in 1992) land in the Cape May/Wildwood area from places like Point Pleasant, and Point Judith, mainly to take advantage of winter stocks of *Loligo* squid and to find safe harbor during storms. "In addition to local boats, a large number of transient boats from North Carolina, Virginia and some northern states land here." The number of boats has been fairly stable recently, however, perhaps due to the great diversity of species landed here.

The total landed value of all species for the Cape May/Wildwood area was approximately $37 million in 1992. Cape May alone landed about $30.4 million, Wildwood landed $4.5 million, and other ports in the Cape May area landed $2.3 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 surfclams (8%). Summer flounder, scup, and black sea bass contributed 7%, 3%, and 2% of the total landed value of all species, respectively. Other ports in the 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.

"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." With the new quotas, some summer flounder fishers have moved into weakfish, though this has limited profitability. Scup fishers rely on summer flounder as a bycatch, so are increasingly pressed. The pot fishers are highly dependent on black sea bass.

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%). Scup ranked fourth with 8%, and 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. While there are marinas in town there is little conflict for space with commercial fishers. The commercial docks are located along one stretch of the road separated from the rest of the community.

Brooklyn/Freeport, New York

Vessels originating from these ports are primarily draggers fishing for whiting, summer flounder, winter flounder, *Loligo* squid, and scup. There are also lobster boats in these ports. Most are day boats who take an occasional 48 hour trip for squid.

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 Freeport/Brooklyn area in 1992 was about $4 million. Surf calms represented the most important fisheries in terms of landed value (45%), followed by *Loligo* (13%), summer flounder (11%), scup (10%), and lobster (6%). Black sea bass accounted for less than 1% of the total landed value. In 1992, the majority of the landed value by gear type corresponded to bottom otter trawls with 48%, and surfclam 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.

Stonington, Connecticut

The Long Island sound and its estuaries and rivers are the major foci of Connecticut fisheries. There is a small traditional haul seine fishery for alewives and other fishes (unspecified, for "industrial" uses). Dip-nets are used for blue crabs (and a few alewives). Drift gillnets are used for menhaden, bluefish, weakfish, black sea bass, alewife, Atlantic mackerel, and other species. There is a specialized drift gillnet fishery for American shad. Quahogs (hard clams) are very important, and over 70% of Connecticut's landed value comes from oysters cultivated in Long Island Sound. Second to oysters are lobsters, most of which are caught inshore, in the sound. Third in value is a mixed species otter trawl fishery, most of which is based in the port of Stonington.

Stonington is the primary port in Connecticut. The main fishing fleet is out of Stonington. Stonington is the only off-shore port with a fleet consisting of trawlers, lobster boats, ocean scallopers. People are mostly going for groundfish such as cod, haddock, and flounder.

Species of importance in the area include lobster, quahog, summer flounder, winter flounder, and squid. The major species of fish caught in Stonington are flounder, summer flounder, squid, whiting and some codfish during the winter months. Over the past five years (1988-1993) the fishermen have caught an increasing number of monkfish. The three large scallop boats have landed the majority of the monkfish.

There is a small drift gillnet fishery which takes a minimal amount of black sea bass, and a mixed species trawl fishery whose landings include large amounts of summer flounder and a small amount of scup and sea bass. "As soon as the summer flounder fishery is open, fishers will go for it exclusively until the quota is filled." In the past, summer flounder was the most important species caught by fishermen in Stonington. However, squid is increasing in importance as a result of the summer flounder quotas. During the summer of 1993, one boat attempted to specialize in dogfish but he discontinued this.

Although local otter trawlers may catch incidental tilefish in the winter, no boats specialize in catching tilefish in Stonington. Scup accounted for 0.9% of the landed value of all species in Other New London in 1992, and is caught in the spring fall and winter primarily by otter trawlers in Stonington. Black sea bass contributed with less than 0.1% (1992) of the total landed value Other New London. Before the quota system was implemented, summer flounder was the major species caught by Stonington fishermen. Summer flounder accounted for 6.53% of the landed value of all species in Other New London in 1992. Summer flounder was the most important species for draggers in terms of landed value in Other New London in 1992. Contributing with over 36% of the total landed value of all species. Squid is becoming increasingly important as a result of the summer flounder quotas.

The number of boats in Stonington is stable. Most fishers are of Portuguese descent, and family status is of moderate importance in crewing a vessel. The share system is typically used. There are several fish dealers, who sell to markets in Baltimore, Philadelphia, Boston and New York, or directly to local fish markets.

Newport/Other Washington County, Rhode Island

"Three ports make up the bulk of the landings in Rhode Island: Point Judith, Quonset Point, and Newport. Point Judith is generally a "wetfish" port, where the fish is most often landed on ice and packaged at port. Newport is similar. Quonset Point is strictly a large factory freezer vessel port."

Newport traditionally landed groundfish and lobster, but in the early 1990s began targeting squid, mackerel, butterfish, scup and dogfish. "Groundfishing boats, a few scallopers, gill-netters, and draggers make up the range of boats in Newport. While Newport's fish potters rely almost entirely on scup, they also catch a little tautog, small amounts of black sea bass, bluefish, and summer flounder, among other species." The dragger fishery mainly targets northeastern groundfish, as well as *Loligo* squid. Scup is a minor component of this fishery. In the summer time there is a scup pot fishery in Newport. The future of this fishery is in question given declines in scup landings. Sea bass are an incidental catch for these draggers. Scup is one of the half dozen or so species targeted by the floating trap fishery. Scup is also important to the small handline fishery in the area. The total landed value for all species in Newport in 1992 was $14.5 million. Lobster ranked first accounting for 44% of the total landed value. Summer flounder ranked fourth and scup fifth. In 1992, lobster pots accounted for about 50% of the landings in Newport. About 33% of the landings were associated with otter trawls.

The value of the landings at Other Washington County communities including Quonset Point in 1992 was around $20 million. Other Washington County including Quonset Point includes both traditional and innovative fisheries. Processing facilities for squid in the region have resulted in the dominance of both *Loligo* and *Illex* squid in terms of landed value, but lobster and bay quahogging and oystering remain important, as well as other inshore activities such as eel potting, trapping striped bass, and an unusual spearfishery for tautog (blackfish). There is some handlining for bluefin tuna and trolling for inshore species such as striped bass and summer flounder as well as yellowfin tuna. Atlantic mackerel, butterfish, scup, summer flounder, and angler are among the top ten species landed by value, and they figure importantly in the catch of the otter trawl vessels. The gillnet fishery for cod and tautog includes a small amount of angler and Atlantic mackerel. The fish pots are predominantly for scup, but some black sea bass, summer flounder, bluefish, and *Loligo* squid are caught in them too. Virtually all of the angler, butterfish, weakfish, Atlantic mackerel, and squid landed here are brought in by draggers. A major fishing location in Washington County is located at Quonset Point, an abandoned Navy Base which houses several isolated industrial developments, including a major offloading facility for car imports.

Point Judith has a large fishing fleet of trawlers, gillnetters and lobster boats. Estimates on the number of boats in the area vary. However, about 200 commercial boats dock in Point Judith, including 80 trawlers, 30 gillnetters, and approximately 100 lobster boats.

The total value of fish landed in Point Judith in 1992 was $37 million. The top 10 species by percent landed value in 1992 were: lobster (28%), *Loligo* squid (15%), silver hake (10%), angler (10%), summer flounder (8%), scup (5%), butterfish (4%), winter flounder (4%), yellowtail flounder (2%), and cod (2%). Black sea bass ranked 19th with less than 0.5%. Point Judith boats mainly target whiting, fluke, and monkfish. The commercial importance of monkfish is increasing. It is the second most available finfish after fluke. In 1992, six million dollars worth of monkfish was caught. Squid is also increasing in economic importance in the area.

Otter trawls accounted for 67% of the total landed value of all gear, while lobster pot fishing accounted for 28% of the total landed value in 1992. Of the total landed value by species caught with otter trawlers, *Loligo* squid was first with 23% of the total. Summer flounder ranked fourth with 12% of the total, and scup ranked fifth with 7% of the total. Black sea bass contributed less than 1% of the total.

Point Judith's boats are described by an informant as being diverse in their approach to the fisheries. The diverse approach to fisheries combined with full-time experienced fishermen means the fishermen are fishing year round even if they may switch fisheries and boats during the year.

Overall, the role of other types of gear in Point Judith is minor in all cases. Among these the highest levels are: fish pots which caught approximately 8% of the value of scup and 3.5% of the value of black sea bass. Gill-nets contributed with 7% of the value of anglers and 3% of the value of bluefish.

Point Judith draggers target whiting, summer flounder, and monkfish. There is also an established pot fishery in Newport and Point Judith which targets sea bass, scup, and squid, primarily during the summer. Pot fisheries, besides lobster, accounted for 0.48% of the total landed value for all gear in 1992. Pot fisheries are heavily dependent on scup. In 1992, scup contributed about 89-96% of the total landed value. Some summer flounder, scup, and black sea bass are taken in floating traps. A small amount are also taken by gillnets. The handline fishery relies heavily on black sea bass. Incidental takes of sea bass occur in lobster pots. Fishers from these ports tend to target a broad diversity of species and so are able to fish year round. "Scup, fluke, and sea bass are inside during the summer, offshore during the winter. There is no directed offshore fishery for sea bass in Rhode Island, but they are a bycatch during the summer *Loligo* fishery. The majority of scup landings are in the spring and summer." Point Judith harbors some minor fisheries. Pot fisheries, besides lobster, are heavily reliant on scup, and pots catch a small percentage of black sea bass, as well as tautog, conger eel, and small amounts of bluefish. Point Judith's small gill net fishery depends heavily on angler, as well as cod, dogfish, tautog, and other species. Bluefish, Atlantic mackerel, summer flounder, black sea bass, weakfish, and butterfish in small quantities are landed in the gill-net fishery. Angler are caught predominantly by draggers, accounting for the bulk of the total landed value for the dragger fishery in 1992. Bluefish, butterfish, summer flounder, scup, black sea bass, squids, weakfish, are also landed by draggers.

The people who make up the crews in Newport are not necessarily fishermen from the area. Some crew members come from Point Judith, New Jersey, New York, and New Bedford. The owners of the boats do not typically work the boats. In Point Judith, most boats, are not family run. Most of the inshore boats dock in Point Judith. Newport has several commercial fish packing and distributing firms, but is also heavily oriented to yachting and tourism. Few non-fishing jobs are available, however. Newport is a reasonably large coastal community. The town is known for its colonial history. The town's water front is mainly occupied by various marinas, hotels, shops, and condominiums. "Point Judith, which is part of the Narragansett, is almost exclusively a fishing community, having a core group of fishermen who fish full-time. During the summers the streets are filled with tourists coming or going on the Block Island ferry. Yet there is little for tourists to do in Point Judith. The town does not have the condominiums, shops, and hotels that other ports such as Chatham, Newport, and Montauk have. Only one hotel stands out in Point Judith, the Dutch Inn, which is circa 1960. The few restaurants, shops, and tourist venues, such as fudge shops, are enough to take care of the summer onslaught of ferry passengers and the year round working population centered around commercial fishing." The Point Judith coop employed some local labor as well, but is now closed.

<u>New Bedford, Massachusetts</u>

In 1992 the total landed value in New Bedford was over $150 million, with sea scallops contributing 60% of the total. Summer flounder contributed 1.2% and 2.97% of the total with and without scallops, respectively. Scup contributed 0.01% and 0.02% of the total with and without scallops, respectively. "The dominant gear types in new Bedford are scallop dredges and otter trawls." Angler, summer flounder, spiny dogfish, *Loligo* squid, and scup are among the most important species landed in New Bedford. "Summer flounder (fluke) is mostly a summer fishery, but some fishers are now targeting summer flounder during the latter part of the year. Fluke are mostly caught in Nantucket Sound, especially by smaller boats with 1 or 2 man crews. New Bedford's *Loligo* fleet are those that summer flounder during the summer. They target squid during the spring and fall when they are not going for summer flounder. Scup is targeted during summer months by a few boats. Black sea bass is a bycatch of scup or squid fishing, and it is caught in Vineyard and Nantucket Sounds by inshore boats. Black sea bass is also caught with pots."

Chatham, Massachusetts

"Chatham is a seasonal resort community. It is a wealthy community and property values are very high. Sportfishing and commercial fishing are important to the community. However they do not seem to be the mainstays of the community's economy. Chatham's fishing community is divided between two ports, Chatham Harbor on the east coast of town, and Stage Harbor on the south side of town. Scup, fluke, sea bass, mackerel, butterfish, weakfish and bluefish are caught as miscellaneous fish by Chatham Harbor boats. Squid, butterfish, mackerel, and scup landings in Chatham come almost exclusively from Stage Harbor." Summer flounder, scup, and black sea bass are caught primarily with pots. There is also some traditional handlining for sea bass and scup. The sea bass fishers are really not concentrated in any one port, however.

The total landed value of fish in Chatham in 1992 was around $11 million. Groundfish and shellfish --bay scallops, quahogs, and mussels-- comprise the majority of the landed value for Chatham, accounting for over 80% of the landed value. Scup, black sea bass and summer flounder contributed 1.15% (harvested by fish pots, 73.5%; draggers, 5%; and bottom long-line, 4%), 0.28% (harvested by fish pots, 98%), and 0.10% (harvested by fish pots, 65%; and draggers, 27%) of the total landed value for all species in Chatmam in 1992, respectively.

By gear type, scup, black sea bass contributed with 10.74%, 0.01% of the total landed value of all species landed with pound nets in 1992. Scup, black sea bass and summer flounder contributed with 29.73%, 9.75% and 2.37% of the total landed value of all species landed with fish pots in 1992, respectively.

Chatham boats are all under 50 feet and are owner-operated. Most crew are paid by the share system and others are paid by the day or are wage workers.

Other North Carolina locations

In the work conducted by McCay *et al.* (1993), the only port described in North Carolina was Wanchese. This section further describes the general characteristics of fishing activities in North Carolina. The descriptive information that follows is excerpted and paraphrased from a report prepared by Griffith (1996), and is based on visits to fishing centers around the state, surveys, and in depth-interviews.

The information presented in this section is based on the following visited locations: Swan Quarter, Englehard, Rose Bay, Germantown, and Ocracoke in Hyde County; Belhaven, and Aurora in Beaufort County; Hatteras, Wanchese, and Alligator River in Dare County; Atlantic, Stacey, Beaufort and Salter Path in Carteret County; Vandamere and Paradise in Pamlico County; Sneads

Ferry, and Hampstead in Oslow County; and Varnumtown in Brunswich County.

"First, most obviously, the busiest fishing season for almost all sites visited begins in the spring and lasts through summer, with December through February being relatively quiet in most locations. Exceptions to this are the fisheries of the Outer Banks, which tend to be net-based and to target winter species. Second, despite the fact that we find a number of extremely large vessels in the state, crews on most vessels tend to be small (<45'). Most crews consist of between one and three fishermen and many interviewed fishermen fish alone. The menhaden fishery, of course, is an exception to this (Garrite-Blake 1995). Third, relatively few sites we visited specialize in only one species, one type of gear, or one type of vessel. Crab pots and shrimp or otter trawls rank high among the principal gears used in the state, but others tend to be found in use alongside these either by the same fishermen or by others using the same docking and other facilities. Fourth, few full-time, owner-operator North Carolina fishermen rely on a single species or single gear for their livelihood, and many operate from more than one vessel; indeed, this diversity and flexibility constitutes one of the central defining characteristics of a full-time fishermen in North Carolina. Small crew sizes, especially those based on family and community relations, are adaptive under these conditions, where shifting among fishing gears and locations does not depend on mobilizing large numbers of crewmen. Fifth, this diversity and flexibility has some implications for managing the fisheries of the state. Although fishermen tend to be defined by the *primary* species they target and gear they use to capture those species, such as shrimpers using otter trawls or crabbers using crab pots, North Carolina fishermen become more alike one another, often, in the *secondary* species they target and, in particular, the gears they use for those species. Sixth, North Carolina fisheries are highly localized. Those sites with access to both inland and off-shore waters, such as fishermen based in Wanchese or the Outer Banks or Carteret County, have more options available to them to switch among fisheries and even between recreational and commercial sectors (such as operating as charter boat fishermen) than fishermen based along the Pamlico River or Albemarle Sound. Some fishermen, recognizing the advantages to these different locations, dock boats at more than one location or utilize more than one launching facility. However, several fishermen we interviewed had little or no idea about the character of fisheries fewer than fifty to sixty miles away. Seventh, regional differences occur among the fisheries as we move from North to South, yet are more pronounced as we move from East to West. For example, those fishermen who fish in the Albemarle Sound are more like fishermen of the Pamlico River than they are like those who operate out of Wanchese. Urban and rural distinctions also figure into these differences, fishing strategies of around the Nags Head/Manteo are more similar to Morehead City and Wilmington fishing strategies than they are toward those of Eastern Dare further down the Outer Banks. Finally, with the exception of crab processing plants, most shore sites are staffed by relatively few people on land; most of the work of off-loading, icing, and other handling of the catch is done by fishermen."

Regarding the present aspects of the fishery in the area, it was found that "North Carolina's principal fisheries have change considerably through time, yet certain historical continuities thread through the fishing lifestyles we find on the coast from prehistoric and colonial times to the present." Some families in the Tidewater area (Hyde County) still depend on combining commercial crabbing, eeling, gill net fishing, trapping, hunting, and hiring out as guides to hunters and sportfishermen. Individuals around the upper reaches of the Albemarle Sound still string together seasonal work in the herring fishery, hunting, logging, and from time to time, farming. "Two of the earliest fisheries in North Carolina provided an organizational template for fisheries that continue, in altered form, today. The early herring fisheries on the Chowan River and the Albemarle Sound were highly capitalized fisheries in which harvesting and processing were as tightly integrated as today's menhaden fishery."

Due to the lack of a license for sampling purposes, saltwater recreational fishing in North Carolina are hard to track and monitor. In order to assess recreational and other non-commercial (e.g. subsistence) fishermen, a structured interview with 178 individuals in these fisheries was conducted in order to address this lack of information. Interviewed fishermen were overwhelmingly white males (95%) between 21 to 79 years of age (average of 48 years). Twenty-five percent were between 20 to 41 years of age, 25% were between 40 to 48 years of age, 25% were between 47 to 59 years of age, and the remaining 25% were over 59 years of age. The majority (89%) were North Carolina residents, only 7% had not finished high school, and over 60% had some training or education after high school. About 77% were married at the time of the interview, with 11% never having married and the remainder either divorced/separated (7%) or widowed (4%). About forty two percent lived in households with more than two children, and only 13% were retired. Influenced by the sampling methodology, 41% of the interviewed fishermen fish most frequently from manmade structure, 34% from private boats, 19% from the beach or bank, and the remainder from other places such as charter boats or a combination of the previous fishing modes. About 79% of those interviewed primarily fish in state waters (rivers, sounds, or less than 3 miles from shore), with 13% fishing more than 3 miles from shore, and the majority (83%) rarely fishing in freshwater. "Anglers interviewed fish from one to 330 days per year. Average fishing effort is around 42 days/year, which would be 80% of the weekend, yet this varies widely within the sample. When they do fish, although slightly more than a third of the population has no target species (35%), the most commonly sought species include: King mackerel, flounder, trout, spot, bluefish, and Spanish mackerel. They catch these species, of course, primarily with hook and line...around one third eat 100% of their catch and 3% eat none of their catch. Around three-fourths give their catch away (usually half what they catch), and under 10% sell their catch. Boat ownership is relatively common among those interviewed, with 58.4% reporting that they owned boats."

Regarding fishermen carrying passengers for hire, "charter boat captains occupy a position between recreational and commercial fishermen and, in fact, often move between winter commercial fishing and running charter during the summer. A few we interviewed for this study come from long family traditions of fishing, both commercially and as recreational boat captains, and maintain strong social links with commercial fishing centers in the state. Of course, nearly all of their business as charter boat operators occurs during the summer months and most of their clients are tourists, but charter boat captains reported fishing heavily into the fall and beginning in the late spring."

2.3.2 Analysis of Permit Data

Summer flounder, black sea bass and scup are important components of the Mid-Atlantic commercial fishery. Some fishermen target only one of these species, others some combination. Data on the vessels in these fisheries, taken from NMFS permit files, are described below. Analysis of permit data is intended to further describe the characteristics of the vessels participating in the summer flounder, scup, and black sea bass fisheries.

A total of 1,970 vessels have Federal fisheries permits for summer flounder, scup, or black sea bass. (Table 30). However, at any one time approximately two thirds of permits for a particular fishery are not being actively fished. Only 1,022 vessels, for instance, actually landed one or more of these species in 1996. Further, summer flounder, scup, and black sea bass are rarely if ever found north of Massachusetts, yet there are vessels with home and/or primary port states of Maine and New Hampshire with permits for these fisheries. This may be a case of hedging their bets against, perhaps, retiring further south and wanting to keep fishing at least part-time. Or, it may be that owners of vessels eligible for limited access permits apply for and maintain these permits to increase the resale value of their vessels. Or, it may be that these species are such a small portion of those vessels landings that the primary port for those species is not the vessel's primary port overall. It is that overall primary port which is reported on the permit.

In addition, vessel characteristics differ across states (Table 31). Virginia, Pennsylvania and North Carolina seem to have the largest vessels, while New Hampshire, Delaware, and New York have the smallest.

3.0 ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

3.1 PREFERRED MEASURES TO ATTAIN MANAGEMENT OBJECTIVES

3.1.1 Framework Adjustment Procedure

Framework Adjustment Process

The annual specification process is the primary mechanism for adjusting management measures to meet the goals of the FMP. In addition to the annual review and modifications to management measures detailed in section 3.1.1.6, the Council could add or modify management measures through a framework adjustment procedure. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process. As such, management measures that have been identified in the plan could be implemented or adjusted at any time during the year. The following management measures could be implemented or modified through framework adjustment procedures:

1. Minimum fish size.
2. Maximum fish size.
3. Gear restrictions.
4. Gear requirements or prohibitions.
5. Permitting restrictions.
6. Recreational possession limit.
7. Recreational seasons.
8. Closed areas.
9. Commercial seasons.
10 Commercial trip limits.
11. Commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch.
12. Recreational harvest limit.
13. Annual specification quota setting process.
14. FMP Monitoring Committee composition and process.
15. Description and identification of essential fish habitat (EFH) and fishing gear management measures that impact EFH.
16. Description and identification of habitat areas of particular concern.
17. Overfishing definition and related thresholds and targets.
18. Regional gear restrictions.
19. Regional season restrictions (including option to split seasons).
20. Restrictions on vessel size (LOA and GRT) or shaft horsepower.
21. Operator permits.
22. Any other commercial or recreational management measures.
23. Any other management measures currently included in the FMP.
24. Set aside quotas for scientific research.

The adjustment procedure would involve the following steps. If the Council determines that an addition or adjustment to management measures is necessary to meet the goals and objectives of the Summer Flounder, Scup, and Black Sea Bass FMP, it will recommend, develop and analyze appropriate management actions over the span of at least two Council meetings. The Council will provide the public with advance notice of the availability of the recommendation, the appropriate justifications and economic and biological analyses, and opportunity to comment on the proposed adjustments at the first Council meeting and prior to and at the second Council meeting. After developing management actions and receiving public testimony, the Council will then submit the recommendation to the Regional Administrator. The Council's recommendation to the Regional Administrator must include supporting rationale, an analysis of impacts, and a recommendation to the Regional Administrator on whether to publish the management measures as a final rule.

If the Council recommends that the management measures should be published as a final rule, the Council must consider at least the following factors and provide support and analysis for each factor considered:

1. Whether the availability of data on which the recommended management measures are based allows for adequate time to publish a proposed rule.

2. Whether regulations have to be in place for an entire harvest/fishing season.

3. Whether there has been adequate notice and opportunity for participation by the public and members of the affected industry in the development of the Council's recommended management measures.

4. Whether there is an immediate need to protect the resource.

5. Whether there will be a continuing evaluation of management measures adopted following their promulgation as a final rule.

If, after reviewing the Council's recommendation and supporting information:

1. The Regional Administrator concurs with the Council's recommended management measures and determines that the recommended management measures may be published as a final rule then the action will be published in the Federal Register as a final rule; or

2. The Regional Administrator concurs with the Council's recommendation and determines that the recommended measures should be published first as a proposed rule, the action will be published as a proposed rule in the Federal Register. After additional public comment, if the Regional Administrator concurs with the Council recommendation, the action will be published as a final rule in the Federal Register; or

3. The Regional Administrator does not concur, the Council will be notified, in writing, of the reason for non-concurrence.

3.2 Revised Definitions of Overfishing

Summer Flounder

Overfishing for summer flounder is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Since F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. When an estimate of F_{MSY} is available, it will replace the proxy. F_{max} is 0.24 under current stock conditions. The target fishing mortality rate is also equal to 0.24. The summer flounder stock is overfished when the biomass falls below the minimum biomass threshold of ½ B_{MSY}. The biomass target is specified to equal B_{MSY}. Since B_{MSY} cannot be reliably estimated, the maximum biomass based on yield per recruit analysis and average recruitment is used a proxy. As such, the threshold and target biomass would be 169 million lbs (76,650 mt) and 338 million lbs (153,300 mt), respectively.

Scup

Overfishing for scup is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Since F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. When an estimate of F_{MSY} is available, it will replace the proxy. F_{max} is 0.26 under current stock conditions. The maximum value of the spring survey index based on a three year moving average (2.77 kg/tow), would serve as a biomass threshold. B_{MSY} cannot be reliably estimated for scup.

Black Sea Bass

Overfishing for black sea bass is defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Since F_{MSY} cannot be reliably estimated, F_{max} is used as a proxy for F_{MSY}. When an estimate of F_{MSY} is available, it will replace the proxy. F_{max} is 0.32 under current stock conditions. The maximum value of the spring survey index based on a three year moving average (0.9 kg/tow), would serve as a biomass threshold. B_{MSY} cannot be reliably estimated for black sea bass.

3.3 ALTERNATIVE TO THE AMENDMENT

3.3.1 Take no action

Under this alternative, the definitions of overfishing for each species managed under this FMP would remain unchanged. In addition, the framework process described in section 3.1.1 would not be implemented to address interannual changes in the fishery.

3.4 THE AMENDMENT RELATIVE TO THE NATIONAL STANDARDS

Section 301(a) of the MSFCMA 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 amendment meets them:

3.4.1 Conservation and management measures shall prevent overfishing while achieving, on a continuous basis, the optimum yield from each fishery for the United States fishing industry.

The Sustainable Fisheries Act (SFA), which reauthorized and amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) made a number of changes to the existing National Standards. With respect to National Standard 1, the SFA imposed new requirements concerning definitions of overfishing in US fishery management plans. In order to comply with National Standard 1, the SFA requires that each Council FMP define overfishing as a rate or level of fishing mortality that jeopardizes a fisheries capacity to produce maximum sustainable yield (MSY) on a continuing basis and defines an overfished stock as a stock size that is less than a minimum biomass threshold.

The SFA also requires that each FMP specify objective and measurable status determination criteria for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the requirements of the SFA, status determination criteria are comprised of two components: 1) a maximum fishing mortality threshold and 2) a minimum stock size threshold.

Summer Flounder

An Overfishing Definition Review Panel was formed by the New England Council to evaluate existing overfishing definitions for species managed by both New England and Mid-Atlantic Councils (Applegate *et al.* 1998). This panel developed recommendations for new definitions to meet the requirements of the Sustainable Fisheries Act.

The panel reviewed the results of a surplus production model for summer flounder. The model produced maximum sustainable yield (MSY) estimates (48.5 million lbs or 22,000 mt) that were nearly identical to the medium term projection results of SAW-25 (NEFSC 1997) and the modeling results of Chang and Pacheco (1976). However, estimates of B_{msy} and F_{msy} were considered unreliable. The panel indicated that the short time series of landings data coupled with the lack of range in the data accounted for this uncertainty.

The panel recommended that the Council base MSY proxy reference points and a control law for summer flounder on yield per recruit (YPR) analysis. These model results indicate that F_{max} is 0.24, YPR at F_{max} is 0.6031 kg/recruit and biomass per recruit (BPR) at F_{max} is 3.7754 kg/recruit (NEFSC 1997). The mean number of recruits estimated for the period 1982-1996 is 40.6 million (NEFSC 1997). Based on this recruitment level, maximum yield at F_{max} would be 54 million lbs (24,500 mt) at a biomass level of 338 million lbs (153,300 mt).

The panel recommended that F_{max} be used as a proxy for F_{msy} until further data and analyses are available. Although the estimates of F_{MSY} are uncertain, the panel agreed that F_{MSY} is greater than F_{max} for summer flounder. As such, F_{max} (0.24) for this particular species should be both the threshold and target fishing mortality rate under current stock conditions. The threshold and target biomass would be 169 million lbs (76,650 mt) and 338 million lbs (153,300 mt), respectively.

Based on the most recent assessment, summer flounder are overfished and overfishing is occurring (NEFSC 1997). In 1996, the fishing mortality rate was estimated to be 1.0. The total biomass estimated for 1996 was 81 m lbs (36,600 mt). This assessment was updated with new landings and survey information from 1997 to develop stock projections and quota recommendations for the 1999 fisheries. This preliminary information indicated that the fishing mortality rate in 1997 was 0.61. The biomass projected for 1999 is about 127 million lbs.

The Council and Commission implemented a rate reduction schedule to reduce fishing mortality on the summer flounder stock in Amendment 2 to the Summer Flounder FMP. The schedule reduced fishing mortality to the F_{max} level in 1998 and set the target at F_{max} for 1999 and beyond. Given the most recent biomass estimates and these target fishing mortality rates, medium term projections indicate that the stock can rebuild to the B_{MSY} level (338 million lbs or 153,300 mt) in less than 10 years (NEFSC 1997). As such, the Council and Commission are not proposing any changes to the current fishing mortality rate reduction schedule to rebuild the stock in this amendment.

Scup

A stock assessment for scup was recently completed by the NEFSC Southern Demersal Working Group and reviewed by the SARC-27. The NEFSC Southern Demersal Working Group tabled a stock assessment for scup that included the results of a surplus production model, ASPIC. Model results provided estimates of biological reference points such as MSY, B_{MSY}, and F_{MSY} as well as current estimates of biomass and fishing mortality. However, the SARC was concerned about estimates of catch and rejected the ASPIC results as a basis for current status, projections, or reference points.

The Overfishing Definition Review Panel did not propose a new overfishing definition for scup because they assumed that SARC-27 would meet their term of reference for scup and recommend a new overfishing definition to meet the SFA guidelines. Although SARC-27 rejected the recommendations of the working group, they did make some recommendations regarding overfishing definitions. However, they were incomplete. The SARC did not provide estimates of B_{MSY} or F_{MSY} for scup or current estimates of fishing mortality and stock biomass.

MSY has not been calculated for scup. In Amendment 8, Council staff indicated that long term potential catch (LTPC) can be used as a surrogate for MSY. The NEFSC has indicated that the LTPC for scup ranges from 22 to 33 million pounds. Results of yield per recruit analysis coupled with the results of the 1995 scup assessment (NEFSC 1995), indicate that maximum yield would be 31 million pounds based on an average recruitment level of 95 million fish and a maximum yield per recruit of 0.3303 pounds.

The SARC did provide some guidance to the Council and Commission regarding a biomass threshold. Specifically, SARC-27 recommended that a minimum biomass threshold be defined as the maximum value of a 3-year moving average of the NEFSC spring survey catch per tow of spawning stock biomass (1977-1979 average = 2.77 kg/tow). The SARC indicated that current indices of spawning stock biomass (the 1996-1998 average was 0.06 kg/tow), are at record low levels and less than one-tenth the 1977-1979 maximum. The Council and Commission propose that the spring index be used to identify a biomass threshold. However, no estimate of a biomass target (i.e., B_{MSY}) is available for scup.

Amendment 8 implemented a 7 year rate reduction schedule to reduce fishing mortality rates on scup and rebuild the stock. The amendment established target exploitation rates of 47% for 1997-1999, 33% for 2000-2001, and 19% (F_{max}) for 2002 and beyond. Relative to stock rebuilding, the SARC indicated that "if fishing mortality rates are obtained which are at or below the current management schedule for reductions in F, there is a minimal probability that the stock would rebuild to the minimum biomass index within 10 years, conditional on incoming recruitment."

In fact, the current assessment indicates that the 1997 year class is very strong. Management measures that the Council and Commission currently have in place (minimum fish size, mesh, and threshold) can be used to protect this year class, increasing the probability that the stock will rebuild in 10 years. In addition, the exploratory ASPIC analysis that was rejected by the SARC did evaluate the current rate reduction schedule relative to biomass targets. The results indicated that the stock could rebuild to B_{MSY} levels within ten years.

The current overfishing definition for scup is based on F_{max}, the fishing mortality rate that maximizes yield per recruit. Current yield per recruit analysis, conducted for SARC-27, indicates that F_{max} has increased slightly since Amendment 8 was approved and is now estimated to be 0.261.

As indicated above, the SARC did not estimate F_{MSY}. Instead, the SARC suggested that $F_{0.1}$ (the current estimate of $F_{0.1}$ is 0.15) be used as a proxy for F_{MSY}. The SARC argued that "greater caution is necessary in setting a fishing mortality threshold to accommodate the greater uncertainty in the assessment of scup."

However, the Council and Commission believe that F_{MSY} is greater than F_{max} for scup and as such F_{max} can be used as a proxy for the threshold mortality rate. In fact, results of an exploratory ASPIC Surplus Production Model, which was rejected by the SARC because of data concerns, indicated that the biomass weighted F_{MSY} was greater than F_{max}. In addition, F_{max} has been used as a proxy for F_{MSY} for a number of species including summer flounder, scallops, and *Loligo* squid.

Although the SARC proposed a rate-based overfishing definition for scup, they did not develop an estimate of current fishing mortality to assess stock status. The SARC stated that "reliable quantitative estimates of fishing mortality for scup are currently not available."

Council staff used a relative exploitation index based on landings and the NEFSC Spring Survey (SSB 3 year average) to assess current levels of mortality. The last SARC assessment to estimate fishing mortality (SARC-19), estimated fishing mortality in 1993 was 1.32 (an exploitation rate of 68%). Based on this level of mortality and the relative exploitation index, F in 1997 was 1.8 (an exploitation rate of 78%).

Thus, based on the spring survey index, scup are overfished and overfishing is occurring. The Council and Commission propose to revise the overfishing definition for scup such that the threshold fishing mortality is F_{MSY}. Since an estimate of F_{MSY} is lacking, the Council and Commission propose to use F_{max} ($F = 0.26$) as a proxy until further data are collected and analyses are completed. The target fishing mortality rate would vary according to the rate reductions schedule specified in Amendment 8.

The maximum value of the spring survey index based on a three year moving average (2.77 kg/tow), would serve as a biomass threshold. If the target fishing mortality rates are achieved, the best available data indicate that the stock could rebuild to the target biomass within a ten year period. As such, the Council and Commission are not proposing any changes to the rate reduction schedule in this amendment.

<u>Black Sea Bass</u>

A stock assessment for black sea bass was recently completed by the NEFSC Coastal/ Pelagic Working Group and reviewed by the SARC-27. The working group produced a stock assessment for black sea bass that included the results of a surplus production model, ASPIC. Model results provided estimates of biological reference points such as MSY, B_{MSY}, and F_{MSY} as well as current estimates of biomass and fishing mortality. However, the SARC was concerned about estimates of catch and rejected the ASPIC results as a basis for current status, projections, or reference points.

The Overfishing Definition Review Panel did not propose a new overfishing definition for black sea bass because they assumed that SARC-27 would meet their term of reference for black sea bass and recommend a new overfishing definition to meet the SFA guidelines. Although SARC 27 rejected the recommendations of the working group, they did make some recommendations regarding overfishing definitions. However, they were incomplete. The SARC did not provide estimates of B_{MSY} or F_{MSY} for black sea bass or current estimates of stock biomass.

Council staff developed an MSY estimate for black sea bass in Amendment 9 based on yield-per-recruit analysis. In the absence of direct estimates of MSY, results from yield per recruit analysis can be used to estimate a maximum yield for a given level of recruitment. The yield per recruit corresponding to F_{max} is 0.5882 pounds (NEFSC 1995). This weight can be multiplied by an average recruitment estimate to obtain the average sustained yield from the stock. The average value of recruitment for 1984 to 1992 was 20.4 million fish (NEFSC 1995). Multiplying the maximum yield per recruit by the average value of recruitment results in a yield of 12 million pounds for black sea bass.

SARC-27 did provide some guidance to the Council and Commission regarding a biomass threshold. Specifically, SARC-27 recommended that a minimum biomass threshold be defined as the maximum value of a 3-year moving average of the NEFSC spring survey catch per tow of exploitable stock biomass (1977-1979 average = 0.9 kg/tow). The SARC indicated that current indices of spawning stock biomass (the 1995-1997 average was 0.09 kg/tow), are one-tenth of the 1977-1979 maximum. The Council and Commission propose that the spring index be used to identify a biomass threshold. However, no estimate of a biomass target (i.e., B_{MSY}) is available for black sea bass.

Amendment 9 implemented an 8 year rate reduction schedule to reduce fishing mortality rates on scup and rebuild the stock. The amendment established target exploitation rates of 48% for 1999-2000, 37% for 2001-2002, and 23% (F_{max}) for 2003 and beyond. Relative to stock rebuilding, the SARC concluded that "based on historic trends in survey data, the stock has the capability of rebuilding to the minimum stock biomass within ten years." In addition, the exploratory ASPIC analysis that was rejected by the SARC did evaluate the current rate reduction schedule relative to biomass targets. The results indicated that the stock could rebuild to B_{MSY} levels within ten years.

The current overfishing definition for black sea bass is based on F_{max}, the fishing mortality rate that maximizes yield per recruit. Current yield per recruit analysis indicates that F_{max} is 0.32 (25% exploitation).

As indicated above, the SARC did not estimate F_{MSY}. Instead, the SARC suggested that $F_{0.1}$ (the current estimate of $F_{0.1}$ is 0.15) be used as a proxy for F_{MSY}. The SARC argued that "greater caution is necessary in setting a fishing mortality threshold to accommodate the greater uncertainty in the assessment of black sea bass."

However, the Council and Commission believe that F_{MSY} is greater than F_{max} for black sea bass and, as such, F_{max} can be used as a proxy for threshold mortality rate and the target mortality rate when the stock is rebuilt. In fact, results of an exploratory ASPIC Surplus Production Model, which was rejected by the SARC because of data concerns, indicated that F_{MSY} was nearly identical to F_{max}. In addition, F_{max} has been used as a proxy for F_{MSY} for a number of species including summer flounder, scallops, and *Loligo* squid.

Fishing mortality was estimated for 1997 using length based methods and NEFSC spring survey data. The results of that analyses indicated that the current fishing mortality rate was 0.73 (exploitation rate of 48%).

Thus, based on the spring survey index, black sea bass are overfished and overfishing is occurring. The Council and Commission propose to revise the overfishing definition for black sea bass such that the threshold fishing mortality is F_{MSY}. Since an estimate of F_{MSY} is lacking, the Council and Commission propose to use F_{max} ($F=0.32$) as a proxy until further data are collected and analyses are completed. The target fishing mortality rate would vary according to the rate reductions schedule specified in Amendment 9.

A biomass threshold would be based on the spring survey index. Specifically, the maximum value based on a three year moving average (0.9 kg/tow) would serve as a biomass threshold. If the target fishing mortality rates are achieved, the best available data indicate that the stock could rebuild to the target biomass within a ten year period. As such, the Council and Commission are not proposing any changes to the rate reduction schedule in this amendment.

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

The description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

3.4.3 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 description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

3.4.4 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 description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

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

The description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

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

The description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

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

The description of how this National Standard is met by the FMP was described in Amendments 2, 8, 9, and 10.

3.4.8 Conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to

(A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The overall port and community description and the importance of the summer flounder, scup, black sea bass and other fisheries to the fishing communities was described in section 2.3.4. In this section the probable impacts on communities of management measures implemented by the FMP for Summer Flounder, Scup and Black Sea Bass are assessed. The purpose of this FMP has been to provide a framework for the recovery of the summer flounder, scup, and black sea bass fisheries. Therefore, most if not all of the fishing communities along the US east coast will be positively impacted by the FMP in the long-term.

Since the implementation of Amendment 2 to the Summer Flounder FMP, a suite of management measures for the commercial and recreational fisheries has been used to manage the fisheries. The management of the scup and black sea bass fisheries began with the implementation of Amendments 8 and 9, respectively. Some of these measures have been modified by subsequent amendments to take into consideration changes in the fisheries.

In the summer flounder, scup, and black sea bass fisheries, the following management measures have been implemented: a commercial quota system, trip limits, commercial moratorium, recreational harvest limits, commercial and recreational fish size limits, minimum mesh requirements in the commercial fishery, minimum codend mesh for specific threshold levels of fish onboard, seasonal closures in the recreational fishery, and party/charter vessel permits, as well as several framework measures. A possession limit has been implemented in the summer flounder fishery, and escape vents on pots or traps, degradable hinges and fasteners in pots or traps, and maximum size of rollers in roller rig trawl gear are required in the scup and black sea bass fisheries. Vessel, dealer and operator permit requirements have been implemented in the summer flounder, scup and black sea bass fisheries. Reporting requirements have been established for all three fisheries (e.g., commercial and party/charter vessel logbooks and dealers).

The implementation of commercial quota systems for these fisheries may have had some short-term adverse social impacts in some of the communities and ports that were very dependent upon summer flounder, scup, and/or black sea bass. However, these impacts were minimized by the implementation of specific quota systems for each fishery (e.g., a state-by-state system in the summer flounder fishery, trimester coastwide in the winter period in conjunction with a state-by-state in the summer in the scup fishery, and coastwide quarterly quotas in the black sea bass fishery), in addition to specific trip limits that preserved historical fishing patterns as well as extended landings throughout the fishing seasons. The implementation of moratoriums in these fisheries eliminated the possibility that additional capitalization would occur, thus benefitting the ports and communities that have historically participated in these fisheries. In addition, the reporting requirements that have been established have allowed for timely management and monitoring of the fisheries.

The implementation of a minimum mesh requirement for owners and operators of otter trawl vessels possessing specific thresholds of summer flounder, scup, and black sea bass allows fishermen who traditionally target multi-species on a trip to fish and retain other species with small mesh until the specific threshold has been met. The minimum mesh provision in conjunction with the minimum fish size ensures that discards of sub-legal fish are minimized. As such, gains are accrued to fishermen through protecting these species until they reach legal size. By preventing overfishing, the FMP provides benefits to the fishing communities through increased summer flounder, scup, and black sea bass abundance and subsequent harvests at sustainable levels, thus providing positive benefits to ports and communities.

In addition, the implementation of a minimum mesh throughout the entire net in the summer flounder fishery likely reduced potential circumventions of mesh regulations. This measure had positive impacts on the fishermen who were abiding by the regulations and were placed at a competitive disadvantage to those who were not.

Gear restrictions in the scup and black sea bass fisheries (e.g., escape vents, degradable hinges and fasteners in pots and traps, and maximum size for rollers in used in roller rig trawl gear) are likely to provide positive benefits to ports and communities by protecting the stock from unnecessary waste and destruction of fish habitats.

At the present time, there are no behavioral or demand data available to estimate how sensitive party/charter boat anglers might be to changes in proposed fishing regulations. While it is possible that the recreational regulations implemented through this FMP have caused some decrease in recreational satisfaction, there is no indication that it has lead to a decline in the demand for party/charter boat trips for summer flounder scup, or black sea bass.

The number of recreational fishing trips taken in the summer flounder, scup, and black sea bass fisheries from 1992 to 1996 are shown in Table 32. The number of recreational summer flounder fishing trips have varied from year to year. However, there does not appear to be a downward trend in the party/charter boat sector market demand for summer flounder trips as s result of recreational measures implemented through this FMP. Amendment 8, which implemented new management measures for the scup fishery, was approved in 1996. The decreases in the number of scup fishing trips in recent years cannot be attributed to the recreational management measures implemented in this fishery, since the decrease in the number of scup recreational fishing trips occurred in the absence of any recreational measures. The reduction in recreational effort directed at scup in recent years is likely due to reduced abundance and availability of scup. In addition, party/charter boats may be targeting other species that are relatively more abundant in recent years (e.g., striped bass), thus accounting for the decrease in the number of fishing trips targeted at scup.

Amendment 9 which implemented new management measures for the black sea bass fishery was approved in 1996. As such, variations in the number of black sea bass fishing trips cannot be attributed to the recreational management measures implemented in this fishery. Since the variations in the number of black sea bass recreational fishing trips occurred in the absence of any recreational measures, it may be due to party/charter boats targeting other species that are relatively more abundant in recent years (e.g., striped bass), thus accounting for the variations in the number of fishing trips targeted at black sea bass. As such, port and communities with a strong party/charter business presence were likely not affected negatively by the recreational measures implemented in these fisheries. However, recreational management measures may positively benefit fishing communities in the long-term by increasing summer flounder, scup, and black sea bass biomass levels.

Clearly the ports that are very dependent upon summer flounder, scup, or black sea bass commercial landings may have been disproportionately affected by the proposed regulatory actions. The extent to which local communities will be affected "materially" is unknown and it will depend on the overall structure of the community. That is, communities with a diverse business structure (e.g., tourism, construction, manufacturing, etc.) would likely be affected to a lesser extent than communities that are highly dependent on the fishing industry and/or these species. Furthermore, fishing fleets for specific ports that are versatile in their fishing operations would have been affected to a lesser extent. However, in either case it is possible that some local businesses which support the commercial fishing industry had been adversely impacted by this FMP in the short-term.

The proper management of the summer flounder, scup, and black sea bass stocks through the implementation of the current management measures will be beneficial to the commercial and recreational fishing communities of the Atlantic coast in the long-term. By preventing overfishing and allowing stock rebuilding, benefits to the fishing communities will be realized through increased abundance of these species and subsequent harvests at sustainable levels. However, to meet the conservation objectives mandated by the Magnuson-Stevens Act, short-term reductions in catch and revenue from the summer flounder, scup, and/or black sea bass fisheries in some ports have been and will be unavoidable.

3.4.9 Conservation and management measures shall, to the extend practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

This National Standard requires Councils to consider the bycatch effects of existing and planned conservation and management measures. Bycatch can, in two ways, impede efforts to protect marine ecosystems and achieve sustainable fisheries and the full benefits they can provide to the Nation. First, bycatch can increase substantially the uncertainty concerning total fishing-related mortality, which makes it more difficult to assess the status of stocks, to set the appropriate optimal yield (OY) and define overfishing levels, and to ensure that OYs are attained and overfishing levels are not exceeded. Second, bycatch may also preclude other more productive uses of fishery resources.

The term "bycatch" means fish that are harvested in a fishery, but that are not sold or kept for personal use. Bycatch includes the discard of whole fish at sea or elsewhere, including economic discards and regulatory discards, and fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality). Bycatch does not include fish released alive under a recreational catch-and-release fishery management program. A catch-and-release fishery management program is one in which the retention of a particular species is prohibited. In such a program, those fish released alive would not be considered bycatch.

Recent stock assessments for summer flounder, scup and black sea bass indicate that the stocks are over exploited. As a result, the summer flounder, scup and black sea bass FMP and subsequent amendments have focused on reducing fishing mortality and rebuilding these stocks. The regulations are necessary to meet the conservation objectives of the FMP. Many of these management measures have associated discards. However, these regulations are necessary to achieve the principal goal of the Magnuson-Stevens Act - to halt overfishing and to rebuild overfished stocks.

The commercial fishery for summer flounder, scup, and black sea bass is primarily prosecuted with otter trawls, otter trawls and floating traps, and otter trawls and pots/traps, respectively. These fisheries are managed principally through the specification of annual quotas. In addition, there are other management measures in place which would affect discard rates in the summer flounder, scup, and black sea bass fisheries (e.g., minimum size regulation, mesh size/mesh thresholds, and trip limits).

An analysis of NMFS weighout data indicate that otter trawl vessels which land summer flounder, scup, and black sea bass also harvest other species throughout the year. These fisheries are mixed fisheries, where squid, Atlantic mackerel, silver hake, and other species are harvested with summer flounder, scup, and/or black sea bass. The contribution to total landings and value made by summer flounder, scup, and black sea bass (in addition to all other species landed) on trips targeting summer flounder, scup, or black sea bass are shown in Tables 33 through 35, respectively. For otter trawl trips that landed 100 or more lbs pounds of summer flounder, summer flounder contributed 22% of the total landings (weight) and 43% of the total value (Table 33). For otter trawl trips that landed 100 or more pounds of scup, scup contributed 21% of the total landings (weight) and 37% of the total value (Table 34). For otter trawl trips that landed 100 or more pounds of black sea bass, black sea bass contributed 6% of the total landings (weight) and 12% of the total value (Table 35).

Given the mixed fishery nature of the summer flounder, scup, and black sea bass fisheries, discards of targeted species and/or incidental species will occur. Catch disposition from NMFS sea sampling data for these species for 1996 are shown on Tables 36 through 38. This sea sampling data is the most recent and complete at-sea observation data available to characterize commercial catch and discards in the summer flounder, scup, and black sea bass fisheries. Many area/quarter strata were not covered by sea sampling trips in 1997; other area/quarter strata were only represented by single trip. As such, sea sampling data for 1996 was used to evaluate summer flounder, scup, and black sea bass discard rates and catch disposition of associated species in these fisheries.

Using this sea sampling data, the Council identified trips landing more than 100 lbs of summer flounder as a directed trip for purposes of this analysis. Table 36 indicates that a total of 11 species were harvested in addition to summer flounder in trips which caught and landed 100 or more lbs of summer flounder. A total of 99% of the summer flounder caught from these trips was landed i.e., the discard rate was 1%. In fact, most species with total catches of 10 or more pounds had landings of 97% or higher, with the exception of angler (82%), scup (73%), and weakfish (59%). Some species with less than 10 lbs of total catch (e.g., bluefish, cod, and winter flounder) had 100% discard rate. The total quantity discarded by weight for these species was small and approximately 2% of the total weight caught in these trips was discarded. The ratio of individual species discards to total catch of all species were the highest for summer flounder (1%) and angler (0.2%), with less than 0.05% for the rest of the species.

The degree to which the analyzed trips sampled in NMFS sea sampling program accurately describe the catch composition and disposition in the directed fisheries for summer flounder, scup, and black sea bass is unknown. However, sampling is not comprehensive and limited to a few areas and times. VTR data was used to further described catch disposition for summer flounder, scup, and black sea bass, and other species associated with directed trips for summer flounder, scup, and black sea bass for 1997. This VTR data is the most recent and complete data submitted by fishermen. Vessel trip report data has been collected by NMFS since 1994 for the recreational and commercial fisheries. In the commercial fishery, this data is collected from commercial vessels that have permits to operate in federal waters as required by the FMPs or amendments for Summer Flounder, Scup, Black Sea Bass, Northeast Multispecies, and Atlantic Mackerel, Butterfish and Squids. Commercial vessels with a federal permit are required to report their activities when they engage in a fishery for one or more of the species mentioned above. Further characterization of catch composition and disposition in the directed summer flounder, scup, and black sea bass fisheries is presented in Table 39, Table 40, and Table 41, respectively.

Based on an analysis of VTR data, 99% of the summer flounder on trips keeping 100 or more lbs of summer flounder were landed (Table 39). A total of 96 species were harvested in addition to summer flounder in 9,232 trips. The top ten species landed (by weight) had discard rates of approximately 1% or less with the exception of skates (7%) and butterfish (4%). Discard rates of over 15% were evident for several species, e.g., horseshoe crab (23%), spiny dogfish (36%), *Illex* squid (15%), Atlantic herring (76%), crab-unknown (44%), sea robins (52%), striped bass (21%), blue back herring (40%), fourspot flounder (18%), conger eel (60%), other shellfish (57%), starfish (64%), jonah crab (33%), and shark-unknown (80%). However, total catch for some of these species ranged from a few hundred pounds to a few thousand pounds. As such, the total quantity discarded by weight for some of these species was small. Overall, 4% of the total weight harvested on these trips was reported as discarded. The ratio of individual species discards to total catch of all species were the highest for skates (1.32%), Atlantic herring (0.5%), horseshoe crab (0.45%), and spiny dogfish (0.45%), with the rest of the species ranging from 0% to 0.2%.

These discard rates for summer flounder differ from previous analyses conducted by NEFSC personnel which indicated discard rates based on sea sample data were 17% and 28% in 1996 and 1997, respectively (Table 42). These differ from the Council analysis in that they are based on all trips landing summer flounder, i.e. trips landing more than 0 lbs of summer flounder. In addition, previous analysis of VTR data conducted for the Summer Flounder Monitoring Committee (M. Terceiro pers. com.) indicated summer flounder discard rates were 15% for 1996 and 1997 (Table 43). However, this analysis was based on VTR data for trips reporting discards of any species and catching summer flounder in 1997. As such, the data set represents a subsample of the larger data set analyzed by Council staff.

Based on the NEFSC analysis, overall discard rates in 1997 were the highest in the sea sampling (1989-1997) and VTR (1994-1997) time series. In 1997, the minimum fish size increased from 13" TL to 14" TL. According to Terceiro (pers. comm.) "The 1997 sea sampling data indicate that the major reason for discarding summer flounder in the otter trawl fishery was the minimum size regulation (57.9% of the 1996 observed tows with a discard reason recorded). Quota/trip limits was the next most recorded reason for discarding (27.6%), followed by high grading for price (9.7%), poor quality (2.6%), and "other" (0.5%). In general, compliance with the minimum size was the predominant reason for discarding during the first two quarters of 1997, while discarding due to quota/trip limits became much more important during the third and four quarters. In 1997, both the sea sampling and VTR data sets indicate that discarding of summer flounder by scallop dredge vessels was highest in all areas and quarters. Quota and/or trip limits were the principal reason given by scallopers for discarding (58.4% of the 806 observed tows with discard reason recorded), followed by minimum fish size (35.6%), high grading for price (5.6%), and "other" (0.4%)."

NEFSC staff used sea sampling data to estimate discards for the entire commercial summer flounder fishery. Based on these extrapolated estimates, discard estimates for summer flounder in the commercial fishery ranged from 4% in 1995 to 22% in 1992 (Table 44). In 1997, the discard rate in the commercial summer flounder fishery was 7%. Discard rates are higher in years of good recruitment, that is, years when more small fish were available.

Council staff also analyzed sea sampling data for scup based on a definition of a directed trip at 100 lbs. About 36% of the scup from trips keeping 100 or more lbs of scup were landed (Table 37). A total of 10 species were harvested in addition to scup in these trips. However, discard rates of over 50% were evident for Atlantic herring (100%), scup (64%), black sea bass (73%), silver hake (100%), and *Illex* squid (100%). However, total catch for some of these species was a few thousand pounds and, as such, the total quantity discarded by weight for some of these species was small. Approximately 22% of the total weight of all fish caught in these trips was discarded. The ratio of individual species discards to total catch of all species were the highest for Atlantic mackerel (14%), scup (4%), and black sea bass (2%), with less than 1% for the rest of the species.

Council staff analysis of VTR data indicates that 98% of the scup from trips keeping 100 or more lbs of scup were landed (Table 40). A total of 71 species were harvested in addition to scup in 1,848 trips. The top ten species landed (by weight) had discard rates of approximately 2% or less with the exception of skates (6%), summer flounder (3%), and butterfish (3%). Discard rates of over 10% were evident for several species, e.g., Atlantic herring (19%), spiny dogfish (60%), striped bass (28%), sea robins (74%), sand-dab flounder (13%), crab-unknown (61%), blue back herring (96%), and horseshoe crab (100%). However, total catch for some of these species ranged from a few pounds to a few thousand pounds. As such, the total quantity discarded by weight for some of these species was small. Overall, 2% of the total weight harvested on these trips was reported as discarded. The ratio of individual species discards to total catch of all species were the highest for Atlantic mackerel (0.51%), spiny dogfish (0.42%), and scup (0.33%), with the rest of the species ranging from 0% to 0.2%.

NEFSC staff used sea sampling data to estimate discards for the entire commercial scup fishery. Discard estimates for scup in the commercial fishery ranged from 16% in 1994 to 49% in 1992 based on this extrapolated data (Table 45). The average discard rate for the 1984 to 1997 period is approximately 33% with a discard rate in the commercial scup fishery in 1997 of approximately 45%. Sea sampling data indicate that the weight of the discarded fish may be equivalent to the weight of the landings in some years (Amendment 8). Discard rates are higher in years of good recruitment, that is, years when more small fish were available.

Council staff also analyzed sea sampling data for black sea bass based on a definition of a directed trip at 100 lbs. About 68% of the black sea bass from trips keeping 100 or more lbs of black sea bass were landed (Table 38). A total of 13 species were harvested in addition to black sea bass in these trips. Approximately 24% of the total weight caught in these trips was discarded. Discard rates of over 25% were evident for several species, e.g., alewife (26%), blue back herring (100%), summer flounder (28%), scup (66%), black sea bass (32%), silver hake (62%), and *Illex* squid (69%). However, total catch for these species ranged from a few pounds to a few thousand pounds and, as such, the total quantity discarded by weight for some of these species was small. The ratio of individual species discards to total catch of all species were the highest for Atlantic mackerel (10%), blue back herring (10%), scup (2%), and black sea bass (1%), with approximately 1% or less for the rest of the species.

Council staff analysis of VTR data indicates that 98% of the black sea bass from trips keeping 100 or more lbs of black sea bass were landed (Table 41). A total of 87 species were harvested in addition to black sea bass in 2,420 trips. The top ten species landed (by weight) had discard rates of approximately 1% or less with the exception of butterfish (7%), summer flounder (3%), and black sea bass (2%). Discard rates of over 10% were evident for several species, e.g., skates (16%), lobster (20%), spiny dogfish (74%), *Illex* squid (11%), Atlantic herring (18%), striped bass (23%), king whiting (11%), sea robins (91%), menhaden (42%), crab-unknown (73%), Atlantic sturgeon (100%), and hammerhead shark (100%). However, total catch for some of these species ranged from a few pounds to a few thousand pounds. As such, the total quantity discarded by weight for some of these species was small. Overall, 3% of the total weight harvested on these trips was reported as discarded. The ratio of individual species discards to total catch of all species were the highest for spiny dogfish (10.99%), butterfish (0.44%), and black sea bass (0.39%), with the rest of the species ranging from 0% to 0.20%.

Discard estimates for black sea bass in the commercial fishery ranged from 1% in 1996 to 10% in 1992 based on extrapolations of sea sample estimates conducted by NEFSC staff. The average discard rate for the 1984 to 1997 period is approximately 6% with a discard rate in the commercial black sea bass fishery in 1997 of approximately 10% (Table 46). Discard rates are higher in years of good recruitment, that is, years when more small fish were available.

In a April 17, 1998 letter to the Council, the Regional Administrator requested that the Council reconsider the use of threshold levels in association with mesh requirements for summer flounder, scup, and black sea bass. He argued that these measures "may reduce the conservation benefits associated with minimum mesh requirements by creating an opportunity to target these species with small mesh." He also argued that the Council should amend the Summer Flounder, Scup, and Black Sea Bass FMP to restrict harvesters to the use of only one mesh size per trip.

However, current regulations would allow the Council to respond to these concerns without an amendment to the FMP. Specifically, the Council and Commission can recommend low threshold levels that modify fishermen's behavior such that they use a single mesh to catch one specific target species per trip while implementing a small bycatch allowance for other species they may encounter. For example, the current regulations for summer flounder allow fishermen to use small mesh until they possess 100 lbs (summer) or 200 lbs (winter) of summer flounder. If they continue to fish for summer flounder, then they have to use a 5.5" mesh net. If they chose to continue fishing for other species with small mesh, then they are limited to these threshold levels for summer flounder.

Other regulations can be modified to reduce discards. For example, in June, 1998 mesh regulations changed such that the minimum mesh size for summer flounder applies to the body, extensions, and codend of the net. Previous mesh regulations applied to only the codend portion of the net. The implementation of this management measure should reduce summer flounder discards in 1998 and beyond.

The discard data for summer flounder, scup, and black sea bass are limited and/or contradictory. Extrapolated estimates of discards from sea sample data indicate that 10% or less of the summer flounder and black sea bass catch was discarded in 1996 and 1997. Estimates of scup discards were 36% and 45% for 1996 and 1997, respectively. However, these estimates are based on samples that are limited in their temporal or geographical scope. In addition, these estimates differ significantly from estimates derived from VTR data which indicate discard estimates are minimal for all three species, i.e., less than 3%.

The nature of the data make it difficult to develop any definitive or reliable conclusions about discards for these fisheries especially during the periods or in areas where sea sampling has not occurred. As such, it is difficult for the Council and Commission to modify or add management measures to further minimize discards if the data are not available to define the nature and scope of the discard problem or the data indicate that a discard problem does not exist.

The Council recognizes the need for improved estimates of discards for all of the fisheries managed under this FMP. This will require increased at-sea sampling intensity over a broader temporal and geographical scope than is currently available. The Council's Comprehensive Management Committee has begun to address this issue and has appointed a member to participate on the Atlantic Comprehensive Coastal Statistics Programs (ACCSP) Discard Prioritization Committee. This committee has been formed to address the need for collection of discard data. The Discard Prioritization Committee will provide guidance to the At-Sea Observer Program by initiating development of priorities and target sampling levels for collection of discard/releases information on recreational, for-hire and commercial fisheries. The Committee will develop a plan to implement sampling through existing or new data collection programs. The data collected through the ACCSP qualitative release, discard and protected species interactions monitoring program will be used to prioritize and modify the quantitative release, discard and protected species interactions data collection programs.

The lack of discard data, for summer flounder, scup and black sea bass has hampered the ability of the Council and Commission to respond to potential discard problems in the commercial fisheries.

In fact, the lack of this data has been the primary reason cited by the SARC as to why an age based assessment cannot be developed for either scup or black sea bass. The collection of additional data by NMFS will allow the Council and Commission to respond to discard problems by changes in mesh, threshold and minimum size regulations or by implementing season and area closures in response to changes in fishermen behavior or an increased level of discards. In addition, the framework adjustment procedure proposed in this amendment will allow for additional flexibility so that the Council and Commission can respond more quickly to changes in the fishery through the implementation of new management measures or the modification of existing measures.

There are also a significant recreational fisheries for summer flounder, scup, and black sea bass. A high portion of the summer flounder, scup, and black sea bass that are caught are released after capture (Tables 44-46). It is estimated that 25%, 15%, and 25% of the summer flounder, scup, and black sea bass that are caught and released by anglers die after release, i.e, the majority of the fish are released alive and are expected to survive after release. The fish that survive are not defined as bycatch under the SFA. The Council and Commission believe that information and education programs relative to proper catch and release techniques for summer flounder, scup, black sea bass and other species caught by recreational fishermen should help to maximize the number of these species released alive.

Current recreational management measures could effect the discards of summer flounder, scup, and black sea bass. These measures a possession limit, size limit, and season. The effects of the possession limit would be greatest at small limits and be progressively less at higher limits. The size limit would have similar effects but the level of discarding will be dependent upon the levels of incoming recruitment and subsequent abundance of small fish. Seasonal effects would differ depending on the length of the season and the amount of summer flounder, scup, and black sea bass caught while targeting other species.

The Council and Commission can currently implement annual changes in recreational management measures in response to changes in fishermen behavior or an increased level of discards. In addition, the framework adjustment procedure proposed in this amendment would allow for additional flexibility so that the Council and Commission can respond more quickly to changes in the fishery through the implementation of new management measures or the modification of existing measures.

Minimum size limits, bag limits and seasons have proven to be effective management tools in controlling fishing mortality in the recreational fishery. A notable example is the recent success in the management of the Atlantic coast striped bass fishery. The recreational striped bass fishery is managed principally through the use of minimum size limits, bag limits and seasons. When these measures were first implemented, release rates in the recreational striped bass fishery exceeded 90%. However, the quick and sustained recovery of the striped bass stock after implementation of these measures provides evidence of their effectiveness in controlling fishing mortality in recreational fisheries.

The commercial and recreational management measures in this FMP represent the most effective tools for managing the commercial and recreational summer flounder, scup, and black sea bass fisheries. The use of these measures are necessary to satisfy National Standard 1, and are intended to end overfishing and rebuild the stock to levels which produce MSY. By maximizing the number of fish released alive, the Council has also satisfied National Standard 9 by minimizing bycatch mortality to the extent practicable.

3.4.10 Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The Sustainable Fisheries Act (SFA), which reauthorized and amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), made a number of changes to the existing National Standards, as well as to definitions and other provisions an the Magnuson-Stevens Act. In regard to National Standard 10, the SFA requires that the safety of human life at sea must be promoted when implementing conservation and management measures.

National Standard 10 recognizes that fishery regulations by definition place constraints on fishing that would not otherwise exist. It's purpose is to ensure that fishery regulations do not create pressures on fishermen to fish under conditions they would otherwise avoid. None of the management measures in the current FMP promote or result in increased levels of unsafe behavior at sea.

Relative to section 303 (a) (6) of the Magnuson Act, the Council has not identified any problems related to access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery. If a problem is identified, the Council could use the framework adjustment process to modify or add management measures that would solve the problem through permanent or temporary adjustments.

This national standard was addressed in Amendment 10 to the Summer Flounder FMP. Specifically, Amendment 10 presented an extensive discussion on the current quota system for summer flounder. In particular, the amendment discussed the claim by some individuals that the state by state quota system has forced fishermen to travel hundreds of miles to land summer flounder in other states with open fisheries and higher landing limits. As a result, these claimants argue that vessels are put at unnecessary risks due to the adverse conditions they might encounter. However, Amendment 10 argues that summer flounder vessels have traditionally traveled long distances to fish for and land summer flounder. For example, a significant portion of the landings of summer flounder in the New England states can be attributed to vessels from North Carolina. In addition, many of the New England vessels are permitted to land in several, neighboring states.

None of the measures (recreational or commercial) should affect the vessel operating environment, gear loading requirements or create derby style fisheries (e.g., the use of trip limits minimize this) for summer flounder, scup, or black sea bass. The Council developed this FMP and subsequent amendments with the consultation of industry advisors to help ensure that this was the case. In summary, the Council has concluded that the proposed amendment will not impact or affect the safety of human life at sea. Therefore, National Standard 10 is met.

3.5 OTHER MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT REQUIREMENTS

Section 303(a)(12) of the MSFCMA requires the Councils to assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish. This requirement has been addressed under section 3.4.9 of this amendment.

Section 303(a)(13) of the MSFCMA requires the Councils to include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extend practicable, quantify trends in landings of the managed fishery resources by the commercial, recreational, and charter fishing sectors. The description of fishing activities for the summer flounder, scup, and black sea bass fisheries are presented in section 7 (Description of Fishing Activities) of Amendments 2, 8, 9, and 10. However, additional information pertaining the recreational and charter fishing sectors is presented below in section 3.5.1 (Additional Characterization of the Recreational and Party/Charter Fisheries).

Section 303(a)(14) of the MSFCMA requires that to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among commercial, recreational, and charter fishing sectors in the fishery. This requirement has been addressed under the section 3.4 (The Amendment Relative to the National Standards) in Amendments 2, 8, 9, and 10.

3.5.1 Additional Characterization of the Recreational and Party/Charter Fisheries

National Marine Fisheries Service permit data files indicate that approximately 1,084 party/charter vessels have federal permit to participate in the summer flounder, scup, and black sea bass fisheries (combined).

MRFSS catch data by mode indicates that for the 1986-1997 period (Table 47), most summer flounder (in numbers) were caught by private and rental boats in the North Atlantic (92.1%) and Mid-Atlantic (80.7%) regions. In North Carolina, the number of summer flounder caught by shore and private and rental modes were approximately similar, at 48.6% and 51%, respectively. The percentage of summer flounder caught by party/charter boats were 1.6, 11.7, and 0.4 in the North Atlantic region, the Mid-Atlantic region, and North Carolina, respectively. For the same time period, most summer flounder (weight) were landed by private and rental boats in the North Atlantic (94.6%) and Mid-Atlantic (80.1%) regions. In North Carolina, most summer flounder were landed (weight) by private and rental (57.1%) and shore (42.4%) fishing modes. The percentage of summer flounder (by weight) landed by party/charter vessels were 1.8, 15.7, and 0.5 in the North Atlantic region, the Mid-Atlantic region, and North Carolina, respectively.

MRFSS catch data by mode indicates that for the 1986-1997 period (Table 48), most scup (in numbers) were caught by private and rental boats in the North Atlantic (79.5%) and Mid-Atlantic (73.5%) regions. In North Carolina, the number of scup caught by shore and private and rental modes were approximately similar, at 47.6% and 47.8%, respectively. The percentage of scup caught by party/charter vessels were 11.9, 18.6, and 4.5 in the North Atlantic region, the Mid-Atlantic region, and North Carolina, respectively. For the same time period, most scup (weight) were landed by private and rental boats in the North Atlantic (81.4%) and Mid-Atlantic (77%) regions. In North Carolina, most scup were landed (weight) by private and rental (58.9%) and shore (30.2%) fishing modes. The percentage of scup (by weight) landed by party/charter vessels were 13.1, 18.3, and 10.9 in the North Atlantic region, the Mid-Atlantic region, and North Carolina, respectively.

MRFSS catch data by mode indicates that for the 1986-1997 period (Table 49), most black sea bass (in numbers) were caught by private and rental boats in the North Atlantic region (77.3%) and North Carolina (69.4%). In the Mid-Atlantic region, the number of black sea bass caught by party/charter and private and rental modes were approximately similar, at 47.8% and 42.4%, respectively. The percentage of black sea bass caught by party/charter vessels were 17.6 and 18.4 in the North Atlantic region and North Carolina, respectively. For the same time period, most black sea bass (weight) were landed by private and rental mode in the North Atlantic region (78.4%), by party/charter mode in the Mid-Atlantic region, and by private and rental mode (51.6%)

in North Carolina. The percentage of scup (by weight) landed by party/charter vessels were 19.6 and 46.5 in the North Atlantic region and North Carolina, respectively.

3.5.1.1 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 1986-1997 period, 11% of the summer flounder (in numbers), 15% of the scup (in numbers), and 35% of the black sea bass (in numbers) landed by anglers from Maine to North Carolina were caught from party or charter boats (MRFSS).

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.

However, it is important to note that since this survey was conducted, scup landings have generally declined, and summer flounder and black sea bass have generally increased, reflecting changes in availability, abundance and/or anglers interest. As such, some of the results obtained from this survey may not accurately describe current fishing trends (e.g., interest and demand for summer flounder, scup, or black sea bass, desirability of summer flounder, scup, or black sea bass, etc.).

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 50). Massachusetts, New Jersey, New York, and Virginia were most heavily represented, accounting for 80% of survey mailings.

A total of 172 of the 202 surveys returned to the Council 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 51). It was followed by bluefish (4.6), then summer flounder (3.6), Atlantic Mackerel (3.5), and striped bass (3.5). Black sea bass was ranked seventh (3.2) and scup was ranked next to last (2.2). 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).

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 51). Black sea bass and scup were ranked at the bottom of the list with mean interest of 2.1 and 1.4, respectively. The top six species were: spot (4.6), large pelagics (3.9), bluefish (3.9), striped bass (3.7), sharks (other than dogfish) (3.2), and summer flounder (3.2).

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 52). 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.

3.5.1.2 Marine recreational descriptive statistics

In 1994, sportfishing surveys were conducted by NMFS in the Northeast Region (Maine to Virginia) to obtain demographic and economic information on marine recreational fishing participants from Maine to Virginia. Data from the surveys were then used to access socio-economic characteristics of these participants, as well as to identify their marine recreational fishing preferences and their perceptions of current and prospective fishery management regulations. This information will be used in future stages of the research to estimate statistical models of the demand for marine recreational fishing for eight important recreational species. The information that follows is excepted and paraphrased from a preliminary report by Steinback and O'Neil (MS In prep.).

"Marine recreational fishing is one of the most popular outdoor recreational activities in America. In 1992, the lowest level of participation during the last ten years, approximately 2.57 million residents of coastal states in the Northeast Region participated in marine recreational fishing in their own state. Participation increased approximately 5% in 1993 (2.7 million) and increased another 14% in 1994 (3.1 million), exceeding the ten-year average of 2.9 million. Although the total number of finfish caught in the Northeast Region has declined over the past ten years effort (trips) has remained relatively stable. An estimated 22.4 million fishing trips were taken in 1994, up from 19.3 million in 1993."

The following discussion contains demographic and socio-economic characteristics of anglers, as well as their preferences, attitudes, and opinions, toward recreational fishing activities and regulations. There was little or no difference in mean age across subregions. "The largest proportion of anglers in both subregions were 36-45 years old (NE=28%, MA=25%). However, comparatively, New England anglers were younger than Mid-Atlantic anglers. Results show that participation in marine recreational fishing increased with age, peaked between ages of 36 to 45, and subsequently declined thereafter. The resultant age distribution is similar to the findings of other marine recreational studies. However, the distribution is not reflective of the general population in these subregions. Bureau of the Census estimates indicate population peaks between the ages of 25 to 34 in both subregions, declines until the age of 64 and then increases substantially." The complete distribution of recreational anglers by age for both subregions is as follows: between the ages of 16-25, 8% in NE and 7% in MA; between 26-35, 24% in NE and 20% in MA; between 36-45, 28% in NE and 25% in MA; between 56-65, 12% in NE and 15% in MA; and 65 and over, 8% in NE and 11% in MA. In this survey anglers under the age of 16 were not interviewed and are not included in the analysis.

In both subregions at least 88% of the anglers (age 25 and over) had obtained at least a high school degree (NE=91%, MA=88%). "While the educational background is similar across subregions, a greater portion of the anglers in New England earned college or post graduate/professional degrees (NE=29%, MA=23%). The shape of the educational distribution essentially mirrored the general population in both subregions. However, the average number of anglers without a high school degree was considerably lower than Bureau of the Census estimates (age 25 and over) for the general population. On the other hand, it appears that anglers in new England and the Mid-Atlantic earned less post graduate/professional degrees than Bureau of Census estimates."

When anglers were asked to describe their racial or ethnic origin, almost all of the anglers interviewed in both subregions considered themselves to be white (NE=95%, MA=90%). "In the Mid-Atlantic, most of the remaining individuals were black (7%), leaving 3% to be of other ethnic origins. In New England, the remaining anglers were evenly distributed across other ethnic origins. The high occurrence of white fishermen is representative of the general population of the coastal states in New England, Approximately 94% of the population in 1993 was estimated to be white. However, in the Mid-Atlantic, the percentage of white anglers was considerable higher than Bureau of Census populations estimates, and the percentage of black fishermen was 12 percent lower."

When anglers were asked to indicate from a range of categories what their total annual household income was, only minor differences between subregions were found. "The largest percentage of household incomes fell between $30,001 and $45,000 for both subregions (NE=27%, MA=26%). In comparison to the general population, anglers' annual household incomes are relatively higher in both subregions. Results are consistent with previous studies which showed that angler household incomes are generally higher than the population estimates."

If it is assumed that "years fished" is a proxy for "experience," the survey data shows that anglers in New England are relatively less experienced than anglers in the Mid-Atlantic. The distribution of recreational anglers years of experience is as follows: 0-5 years of experience, 22% in NE and 16% in MA; 6-10 years of experience, 10% in NE and 10% in MA; 11-15 years of experience, 13% in NE and 14% in MA; 16-20 years of experience, 9% in NE and 9% in MA; 21-25 years of experience, 12% in NE and 12% in MA; 26-30 years of experience, 13% in NE and 12% in MA; and 30 or more years of experience, 21% NE and 26% in MA.

On average, it was found that New England anglers spent more on boat fees, lodging, and travel expenses than Mid-Atlantic anglers (due to budget and interview time constraints, expenditure information pertaining to bait, tackle, ice, or meals was not collected). "During the follow-up telephone portion of the survey, anglers that fished from a party/charter boat or a private/rental boat were asked how much they <u>personally</u> spent on boat fees for the trip in which they were interviewed. Boat fees averaged $61.00 per trip in New England and $51.00 in the Mid-Atlantic. Two categories of lodging expenses were obtained. The first category (Lodging (>0)) is an estimate of the mean lodging expense per night for those anglers who indicated they spent at least one night away from their residence and personally incurred lodging costs. Subsequently, the second category (Lodging (all)) is an estimate of mean lodging expenses across all overnight anglers, regardless of whether an angler incurred a lodging expense. Per night costs were estimated by dividing total lodging costs for the trip by the number of days the angler was away from his/her residence on the trip. Anglers that personally incurred lodging expenses spent $58.00 on average per night in New England and $47.00 per night in the Mid-Atlantic. Across all overnight anglers, per night lodging expenses in New England averaged $29.00 and in the Mid-Atlantic, $21.00. Anglers expenditures also included money spent on gas, travel fares, tolls, and ferry and parking fees. One-way travel expenditures averaged $11.00 in new England and $8.00 in the Mid-Atlantic per trip. Therefore, if arrival costs are tantamount to departure costs, average round-trip travel expenses would approximate $22.00 in New England and $16.00 in the Mid-Atlantic." Since certain expenditures such as parking, tolls, and other travel fares may be incurred only once, the estimated round-trip travel expense should be considered an upper bound estimate.

Survey results show that over 50% of the anglers in both subregions indicated boat ownership (NE=51%, MA=53%). These results were obtained when anglers were asked if anyone living in their household owns a boat that is used for recreational saltwater fishing.

Regarding the duration of the interviewed trip length, "at least 80 percent of the anglers in both subregions indicated they were on a one-day fishing trip (NE=80%, MA=84%). One-day fishing trips were defined to be trips in which an angler departs and returns on the same day. Less than one fourth of the respondents indicated the day fishing was part of a longer trip which they spent at least one night away from their residence (NE=20%, MA=16%)."

"Respondents were asked why they chose to fish at the site they were interviewed. "Convenience" and "better catch rates" were the main reasons why anglers chose fishing sites in both subregions. Forty-nine percent of the anglers in New England and 57 percent of the anglers in the Mid-Atlantic indicated "convenience" as either first or second reason for site choice. "Better catch rates" was the first or second stated reason for site choice by 51 percent of the anglers in New England and 50 percent of the anglers in the Mid-Atlantic. Other notable responses were "always go there," "boat ramp," "access to pier," and "scenic beauty." Results indicate that although anglers chose fishing sites for many different reasons, sites that offered good catch rates and were convenient attracted the most anglers."

Recreational anglers were asked to rate recreational fishing against their other outdoor activities during the last two months. Specifically, they were asked if fishing was their most important outdoor activity, their second most important outdoor activity, or only one of many outdoor activities? "Over 60% of the respondents in both subregions (NE=61%, MA=68%) reported marine recreational fishing was their most important outdoor activity during the past two months. Less than 30 percent in both subregions (NE=27%, MA=20%) said recreational fishing was only one of many outdoor activities. These results were consistent with national outdoor recreation surveys carried over the past three decades indicating that fishing is consistently one of the top outdoor recreational activities in terms of number of people who participate.

Recreational anglers ratings of reasons (7 preestablished reasons for fishing) for marine fishing are presented in Table 53. More than 66% of the anglers in both subregions said that it was very important to go marine fishing because it allowed them to: spend quality time with friends and family (NE=81%, MA=85%); enjoy nature and the outdoors (NE=89%, MA=87%); experience or challenge of sport fishing (NE=69%, MA=66%); and relax and escape from my daily routine (NE=83%, MA=86%). "The reasons that were rated as not important by the largest proportion of anglers consisted of: fish to eat (NE=42%), to be alone (NE=55%, MA=58%), and to fish in a tournament or when citations were available (NE=79%, MA=73%). In the Mid-Atlantic, although to catch fish to eat was rated as being somewhat important by the largest proportion of anglers (40%), approximately 31 percent felt that catching fish to eat was very important. Whereas, in New England, only 20 percent concurred. It is clear from these responses that marine recreational fishing offers much more than just catching fish to anglers. Over 80 percent of the respondents in both subregions perceived recreational fishing as a time to spend with friends and family, a time to escape from their daily routine, and time to enjoy nature and outdoors. While catching fish to eat is somewhat important to anglers, findings of this survey generally concur with previous studies that found non-catch reasons are rated highly by almost all respondents while catch is very important for about a third and catching to eat fish is moderately important for about another third."

"The economic survey sought to solicit anglers opinions regarding four widely applied regulatory methods used to restrict total recreational catch of the species of fish for which they typically fish: (1) limits on the minimum size of the fish they can keep; (2) limits on the number of fish they can keep; (3) limits on the times of the year when they can keep the fish they catch; and (4) limits on the areas they fish. Anglers were asked whether or not they support or opposed the regulations." As indicated in Table 54, strong support existed for all regulatory methods in both subregions. Limits on the minimum size of fish anglers could keep generated the highest support in both regions (NE=93%, MA=93%), while limits on the area anglers can fish, although still high, generated relatively lower support (NE=68%, MA=66%).

Regulations which limit the number of fish anglers can keep ranked second (NE=91%, MA=88%). The results from this solicitation indicate that recreational anglers in the Northeast Region appear to be conservation oriented and generally support regulations employed to restrict total catch. Not surprisingly, when analyzing anglers opinions regarding the four widely applied regulatory methods, it was found that anglers in all modes indicated strong support for the regulatory measures. With minimum size limits generating the strongest support, followed by catch limits, seasonal closures, and lastly, area closures. "Although party/charter, private/rental, and shore respondents did offer varying degrees of support for each of a selection of regulatory measures, similar support existed across all modes. Support was highest for common regulatory methods currently being implemented in New England and the Mid-Atlantic (e.g., size and bag limits), than for area and seasonal closures."

3.6 EFFECTS ON THE ENVIRONMENT

No changes to the existing management measures are being proposed in this amendment.

3.6.1 Management Costs

There will be no new management costs associated with this amendment.

3.6.2 Effect on Endangered Species and on the Coastal Zone

No changes to the existing management measures are being proposed in this amendment.

3.6.3 Effects on Flood Plains or Wetlands

The adopted management measures or their alternatives will not adversely affect flood plains or wetlands, and trails and rivers listed or eligible for listing on the National Trails and Nationwide Inventory of Rivers.

3.6.4 Findings of no Significant Environmental Impact

For the reasons discussed above, it is hereby determined that neither approval and implementation of the proposed action nor the alternatives would affect significantly the quality of the human environment, and that the preparation of an environmental impact statement on the Amendment is not required by Section 102(2)(c) of the National Environmental Policy Act nor its implementing regulations.

Assistant Administrator for Fisheries, NOAA ____ Date

4.0 REGULATORY IMPACT REVIEW AND REGULATORY FLEXIBILITY ANALYSIS

4.1 INTRODUCTION

The National Marine Fisheries Service (NMFS) requires the preparation of a Regulatory Impact Review (RIR) for all regulatory actions that either implement a new Fishery Management Plan (FMP) or significantly amend an existing plan. The RIR is prepared by the Regional Fishery Management Councils with assistance from the National Marine Fisheries Service (NMFS), as necessary. The RIR is part of the process of preparing and reviewing FMPs and provides a comprehensive review of the level and incidence of economic impact associated with proposed regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems. The purpose of the analysis is to ensure that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way.

The National Marine Fisheries Service requires a RIR for all regulatory actions that are part of public interest. The RIR does three things: 1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; 2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to the problem; and 3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so public welfare can be enhanced in the most efficient and cost effective way.

The RIR addresses many items in the regulatory philosophy and principles of Executive Order (E.O.) 12866. The RIR also serves as the basis for determining whether any proposed regulation is a "significant regulatory action" under certain criteria provided in E.O. 12866 and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with Regulatory Flexibility Act of 1980 (RFA) as amended by Public Law 104-121. The purpose of the RFA is to relieve small businesses, small organizations, and small government entities from burdensome regulations and record keeping requirements, to the extent possible.

4.2 PROBLEMS AND OBJECTIVES

The description of the summer flounder, scup and black sea bass fisheries can be found in section 7.0 of Amendment 2, Amendment 8 and Amendment 9 to the FMP, respectively. The problems for resolution and management objectives are outlined in sections 1.1.2 and 1.1.3 of this amendment, respectively.

4.3 METHODOLOGY AND FRAMEWORK FOR ANALYSIS

The basic approach adopted in this RIR is an assessment of management measures from the standpoint of determining the resulting changes in costs and benefits to society. The net effects should be stated in terms of producer and consumer surpluses for the harvesting, processing/dealer sectors, and for consumers. Ideally, the expected present values of net yield streams over time associated with different alternatives should be compared in evaluating the impacts. The approach taken in analyzing the alternative management actions is to describe and/or quantify to the extent possible the changes in net benefits.

4.4 IMPACTS OF THE PREFERRED ACTIONS AND ALTERNATIVES TO THE AMENDMENT

The proposed management actions and the alternative management actions in this amendment were discussed in the integrated portion of this document (section 3.1) and are summarized below.

4.4.1 Summary of Impacts of Preferred Actions

Amendment 12 would establish a framework mechanism to allow timely adjustments to management measures as necessary in the future. The purpose of this summary is to briefly describe the expected economic impacts of the preferred actions considered in this Amendment.

4.4.1.1 Establish Framework Adjustment Procedure

In an effort to make the management process more efficient and reduce costs, the Council is requesting that a framework adjustment procedure be introduced into the FMP. This adjustment procedure would allow the Council to add or modify management measures through a streamlined public review precess. As such, management measures that have been identified in the plan could be implemented or adjusted at any time during the year. Full details of the process are described in section 3.1.1.

While expediting the management process, the Council must still provide appropriate justifications, as well as the necessary biological, and economic analysis to accompany the framework action when they are submitted. This measure simply enables the Council to engage in such an action at a future date. Therefore, no economic impact is anticipated from adoption of framework management authority in this amendment.

4.4.2 Summary of Impacts of the Alternatives to the Amendment

Alternative 1 (Take no action) will mean that the FMP is not in compliance with the SFA. As such, the problems identified in section 1.1.3 of this amendment would not be solved.

4.5 DETERMINATIONS OF A SIGNIFICANT REGULATORY ACTION

The proposed action does not constitute a significant regulatory action under Executive Order 12866 for the following reasons. (1) It will not have an annual effect on the economy of more than $100 million. Based on unpublished NMFS preliminary data (Maine-North Carolina) the total commercial value in 1997 was estimated at $15.5 million for summer flounder, $6.4 million for scup, and $3.9 million for black sea bass. The measures considered in this Amendment are not expected to affect total revenues generated by the commercial and recreational sector to the extent that a $100 million annual economic impact will occur. The proposed actions are necessary to protect summer flounder, scup and black sea bass from overfishing, to maintain the harvest of these species at sustainable levels, and to allow for changes in measures that account for variations in the fishery. The proposed action benefits in a material way the economy, productivity, competition and jobs. The proposed action will not adversely affect, in the long-term, competition, jobs, the environment, public health or safety, or sate, local, or tribal government communities. (2) The proposed actions will not create a serious inconsistency or otherwise interfere with an action taken or planned by another agency. No other agency has indicated that it plans an action that will affect the summer flounder, scup, and black sea bass fisheries in the EEZ. (3) The proposed actions will not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of their participants. (4) The proposed actions do not raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

4.6 REVIEW OF IMPACTS RELATIVE TO THE REGULATORY FLEXIBILITY ANALYSIS

4.6.1 Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to minimize the adverse impacts from burdensome regulations and record keeping requirements on small businesses, small organizations, and small government entities. The category of small entities likely to be affected by the proposed plan is that of commercial and recreational entities harvesting summer flounder, scup, and black sea bass. The impacts of the proposed action on the fishing industry as a whole were discussed above. The following discussion of impacts centers specifically on the effects of the proposed actions on the mentioned small business entities.

4.6.2 Determination of Significant Economic Impact on a Substantial Number of Small Entities

The Small Business Administration (SBA) defines a small business in the commercial fishing and recreational fishing activity, a firm with receipts (gross revenues) of up to $3.0 million. It is estimated that approximately 1022 commercial vessels landed summer flounder, scup, and/or black sea bass in 1996. In addition to this, it is estimated that approximately 1042 party/charter vessels have Federal permit to participate in these fisheries (combined). All these vessels readily fall within the definition of small business.

According to the guidelines on regulatory analysis of fishery management actions, a "substantial number" of small entities is more than 20 percent of those small entities engaged in the fishery. Since the proposed action will directly and indirectly affect most of these vessels, the "substantial number" criterion will be met.

Economic impacts on small business entities are considered to be "significant" if the proposed action would result in any of the following: a) a reduction in annual gross revenues by more than 5 percent; b) an increase in total costs of production by more than 5 percent as a result of an increase in compliance costs; c) an increase in compliance costs as a percent of sales for small entities at least 10 percent higher than compliance costs as a percent of sales for large entities; d) capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities; or, e) as a "rule of thumb," 2 percent of small businesses entities being forced to cease business operations.

4.6.3 Analysis of Economic Impacts

<u>(a) Does this action result in revenue loss of >5 percent for >20 percent or more of the participants?:</u> It is not anticipated that the management measures in this amendment will have any impacts on the revenues of summer flounder, scup, and black sea bass fishermen. The allowance for framework management mechanism is not expected to have a direct impact on the industry.

(b) Does the action result in an increase in compliance costs (annualized capital, operating, reporting, etc.) of >5 percent for 20 percent or more of the participants: There are no new compliance costs for participants as a result of this amendment. Therefore, this threshold is not met.

(c) Does this action result in 2 percent of the entities ceasing operations: It is not anticipated that this amendment will have any impacts on industry revenues, or force any entities to cease operations.

The preceding analysis of impacts relative to the regulatory Flexibility Act indicates that, while a substantial number of small entities may be impacted by this action, the proposed management actions in this amendment will not result in significant economic impacts upon a substantial number of such entities. These measures are proposed in order to conserve the summer flounder, scup, and black sea bass resources along the Atlantic coast.

5.0 OTHER APPLICABLE LAWS

5.1 RELATION OF RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

5.1.1 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. U.S. fishermen usually 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.

5.1.2 Treaties or International Agreements

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

5.1.3 Federal Law and Policies

5.1.3.1 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 1,000 fathom isobath.

Four hundred and seventy one large whale sightings, 1547 small whale sightings and 1172 sea turtles were encountered in the surveys. 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 (University of Rhode Island 1982).

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 northward migration of both species in the Gulf Stream with a southward return in continental shelf waters nearer to shore. Both species usually were found over the shoreward half of the slope and in depths less than 200 feet. The northwest Atlantic may be important for sea turtle feeding or migrations, but the nesting areas for these species generally are in the South Atlantic and Gulf of Mexico.

This problem may become acute when climatic conditions result in concentration of turtles and fish in the same area at the same time. These conditions apparently are met when temperatures are cool in October but then remain moderate into mid-December and result in a concentration of turtles between Oregon Inlet and Cape Hatteras, North Carolina. In most years sea turtles leave Chesapeake Bay and filter through the area a few weeks before the fall fisheries become concentrated. Efforts are currently under way (by VIMS and the U.S. Fish and Wildlife Service refuges at Back Bay, Virginia, and Pea Island, North Carolina) to more closely monitor these mortalities due to trawls. Fishermen are encouraged to carefully release turtles captured incidentally and to attempt resuscitation of unconscious turtles as recommended in the 1981 *Federal Register* (pages 43976 and 43977).

The only other endangered species occurring in the northwest Atlantic is the shortnose sturgeon (*Acipenser brevirostrum*). The Councils urge fishermen to report any incidental catches of this species to the Regional Administrator, NMFS, One Blackburn Drive, Gloucester, Massachusetts 01930, who will forward the information to persons responsible for the active sturgeon database.

The range of the species managed under this FMP and the above mentioned marine mammals and endangered species overlap and there always exists a potential for an incidental kill. Except in unique situations, such accidental catches should have a negligible impact on marine mammal or abundances of endangered species, and the Councils do not believe that implementation of this FMP will have any adverse impact upon these populations.

Commercial and recreational fisheries lose thousands of pounds of fishing gear annually. Incidences of entanglement in and ingestion of this gear is common among sea turtles and marine mammals, and may result directly or indirectly in some deaths.

5.1.3.2 Marine sanctuaries

National marine sanctuaries are allowed to be established under the National Marine Sanctuaries Act of 1973. Currently there are 12 designated marine sanctuaries that creates a system that protects over 14,000 square miles (National Marine Sanctuary Program 1993).

There are four designated national marine sanctuaries in the area covered by the FMP: the *Monitor* National Marine Sanctuary off North Carolina, and the Stellwagen Bank National Marine Sanctuary off Massachusetts, Gray's Reef off Georgia and the Florida Keys National Marine Sanctuary . There is currently one additional proposed sanctuary on the east coast, the Norfolk Canyon.

The *Monitor* National Marine Sanctuary was designated on 30 January 1975, under Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). Implementing regulations (15 CFR 924) prohibit deploying any equipment in the Sanctuary, fishing activities which involve "anchoring in any manner, stopping, remaining, or drifting without power at any time" (924.3 (a)), and "trawling" (924.3 (h)). The Sanctuary is clearly designated on all National Ocean Service (NOS) charts by the caption "protected area." This minimizes the potential for damage to the Sanctuary by fishing operations. Correspondence for this sanctuary should be addressed to: *Monitor* NMS, NOAA, Building 1519, Fort Ousts, Virginia 23604.

Gray's Reef was designated a National Marine Sanctuary in January 1981. Located 17 miles off the coast of Georgia, Gray's Reef is one of the largest nearshore sandstone reefs in the southeastern United States. The sanctuary encompasses 17 nm^2 of live-bottom habitat. Implementing regulations (15 CFR 922.90) permit recreational fishing and commercial fishing is restricted. Specifically, wire fish traps and bottom tending fishing gears (dredges, trawls etc.) are prohibited. Correspondence for this sanctuary should be addressed to: Gray's Reef Sanctuary Manager, 10 Ocean Science Circle, Savannah, Georgia 31411.

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) 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, Massachusetts 02360.

The United States Congress passed the Florida Keys National Marine Sanctuary and Protection Act of 1990 designating the Florida Keys a National Marine Sanctuary. The act required NOAA to develop a comprehensive management plan with implementing regulations to govern the overall management of the Sanctuary and to protect and conserve it's resources. The Sanctuary consists of 2,800 nm^2 of coastal and oceanic waters, and the associated submerged lands surrounding the Florida Keys, extending westward to include the Dry Tortugas, but excluding the Dry Tortugas National Park. The sanctuary prohibits the taking of coral or live rock, except as permitted by the NMFS or the state of Florida. The sanctuary contains designated Sanctuary Preservation Areas and Replenishment Reserves where the taking or disturbance of sanctuary resources is prohibited. Fishing is prohibited in these non-consumptive areas. Correspondence for this sanctuary should be addressed to Superintendent, NOAA/Florida Keys National Marine Sanctuary, P.O. Box 500368, Marathon, Florida 33050.

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, Maryland 20910.

5.1.3.3 Indian treaty fishing rights

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

5.1.3.4 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.

5.1.3.5 Paper work reduction act of 1995

The Paperwork Reduction Act concerns the collection of information. The intent of the Act is to minimize the federal paperwork burden for individuals, small business, state and local governments, and other persons as well as to maximize the usefulness of information collected by the federal government.

The Council proposes, through this amendment, to establish the implementation of a party/charter, dealer, and operator permits. The total public reporting burdens for the time for reviewing instructions, searching existing data, collection of information and maintaining the data needed, reviewing the collection of information, and reporting requirements are estimated to be about 1088 hours.

5.1.3.6 Impacts of the plan relative to federalism

The Amendment does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under Executive Order 12612.

5.1.4 State, Local, and Other Applicable Law and Policies

5.1.4.1 State management activities

Summer Flounder

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

Scup

This amendment will apply to all states from North Carolina to Maine. This Includes North Carolina, Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine.

Black Sea Bass

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

Compliance

The Commission has established compliance Criteria as a part of the interstate management process. The Commission requires that states adopt the following measures in regard to summer flounder, scup, and black sea bass:

-Commercial size limits and mesh requirements
-Commercial quota provisions
-Commercial fishery closure ability
-Recreational size, possession limits, seasonal limits, and seasonal closure ability
-Recreational harvest limit
-Permit and reporting requirements
-Area closures
-Gear restrictions

Compliance with Commission management plans is reviewed annually by the Management Board and Plan Review Team through a process outlined in the Interstate Fisheries Management Program (ISFMP) Charter. Each year, the Plan Review Team prepares an FMP status report that documents landings and compliance for each state. If a state is out of compliance with the required management measures the Team forwards a recommendation of non-compliance to the Management Board. The Board then reviews the recommendations of the Plan Review Team and , if it determines a state is out of compliance, forwards a recommendation of non-compliance to the ISFMP Policy Board. The Policy Board considers the recommendation and makes a final compliance determination.

States often voluntarily adopt management measures that are more restrictive than the federal management program.

5.1.4.2 Compliance reporting contents and schedules

Each state must submit an annual report concerning it's summer flounder, scup, and black sea bass fisheries and management program on or before June 1 of each year. The report shall cover:

A) the previous 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 changes from the previous year.

5.1.4.3 Procedures for determining compliance

Procedures for determining a state's compliance with the provisions of a fishery management plan are contained in section 7 of the Interstate Fisheries Management Program Charter (ASMFC 1998).

The following compliance determination will be done in addition to the Summer Flounder, Scup, and Black Sea Bass FMP Monitoring Committee activities. The following represents compliance determination procedures as applied to this plan:

The Plan Review Team (PRT) will continually review the status of state implementation, and advise the Management Board at any time that a question arises concerning state compliance. The Plan Review Team will review state reports submitted under annually 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 PRT, 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 in 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 and the Commission shall deal with the Management Board's recommendation according to the Commission's Charter for the Interstate Fisheries Management Program.

5.1.4.4 Adaptive management process

The Commission will participate in the framework process to adjust management measures. The Commission's Summer Flounder, Scup, and Black Sea Bass Management Board will attend all Council framework meetings. During the framework process the Management Board will solicit public participation by submitting all proposed changes to each interested state for public comment.

In accordance with the Commission's Interstate Fisheries Management Program Charter each fishery management plan may provide for changes within the management program to adapt to changing circumstances. Changes made under adaptive management shall be documented in writing through addenda to the fishery management plan. The Management Board shall in coordination with each relevant state, utilizing that states established public review process, ensure that the public has an opportunity to review and comment upon proposed adaptive management changes. The states shall adopt adaptive management changes through established legislative and regulatory procedures. However, the states may have a large range of procedures and time frames involved with adjusting and implementing fishery regulations.

5.1.4.5 Impact of federal regulations on state management activities

No reason to change this section at this time.

5.1.4.6 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, North Carolina, South Carolina, Georgia, and Florida. Letters will be sent to all of the states listed along with a hearing draft of the FMP. The letters to all of the states will state that the Council concluded that the FMP would not 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.

6.0 COUNCIL REVIEW AND MONITORING OF THE FMP

No reason to change this section at this time.

7.0 LIST OF PREPARERS

This Amendment was prepared by the following members of the MAFMC staff - Dr. Christopher M. Moore, José L. Montañez, Dr. Thomas B. Hoff, Valerie M. Whalon, and Richard J. Seagraves. In addition Dr. Jeffrey Cross at NMFS Sandy Hook and Timothy Goodger of NMFS Oxford contributed greatly to the EFH information.

8.0 AGENCIES AND ORGANIZATIONS CONSULTED IN FORMULATING THE PROPOSED ACTION

In preparing the Amendment, the Council consulted with the NMFS, the New England Fishery Management Council, the South Atlantic Fishery Management Council, the Fish and Wildlife Service, the Department of State, and the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina through their membership on the Council and the following committees - Demersal Committee, MAFMC Summer Flounder, Scup, and Black Sea Bass Committee, ASMFC Board, MAFMC Statistical and Science Committee, Mid-Atlantic EFH Technical Committee, Northeast Region Steering Committee, MAFMC Habitat Committee, and MAFMC Habitat Advisory Panel. In addition to the states that are members of this Council, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, South Carolina, Georgia and Florida were also consulted through the Coastal Zone Management Program consistency process.

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Table 1. Summary of life history and habitat parameters for summer flounder, *Paralichthys dentatus:* inshore New Jersey, Delaware and North Carolina.

Life Stage	Size	Geographic Location	Habitat	Substrate	Temperature
TRANSFORMING LARVAE (No pertinent information for DE)	~>8 - <18 mm SL	**NJ**: Great Bay, Little Egg Harbor; **NC**: Pamlico Sound & Cape Fear estuaries.	Shallow tidal flats & marsh creeks.	Sand preference [1]	Time to completion of metamorphosis temperature dependent. Increased temperatures = shorter metamorphosis. Mortality from <2-4°C. No effect of starvation on mortality or time to completion of metamorphosis at temperatures <10°C.[1]
JUVENILES	~>20 mm - ~<28 cm TL	**NJ**: Great Bay, Little Egg Harbor; **DE**: Delaware, Indian R., Rehobeth Bays; **NC**: Pamlico Sound & Cape Fear estuaries.	Lower estuary: flats, channels, salt marsh creeks, eelgrass beds. Possible preference for creek mouths (**NJ**) and inlets (**NC**). Creeks are foraging habitat. **DE**: Attracted to macroalgae because of the presence of prey, but remain in nearby sand to avoid predation.	**NJ**: found on muddy bottoms. **NC**: greater abundance on sand or mixed substrates. Scarce on mud. **DE**: Sand preference.[1] Captured on sand and mud. Substrate preference possibly overrides salinity preference.	**DE**: >3°C, all fish survived. **NC**: Feeding rate, growth rate & efficiencies increase with increasing temperatures. <7-9°C = no positive growth rates (both **DE, NC** fish); 20-25°C = fastest growth rates. **NC** fish higher maximum growth rates/growth efficiencies at 6-18°C than **DE** fish.[1] **DE** juveniles show greater tolerances for low temperatures than **NC** juveniles. Mortality of juveniles depends more on rate of temperature decline than on final exposure temperatures.[1]
ADULTS (No pertinent information for NJ, NC)	~>28 cm TL	Delaware Bay	Captured from the shoreline to 25 m.		

[1] Laboratory study
Dissolved Oxygen: no pertinent information

References

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Delaware: Smith and Daiber (1977), Malloy and Targett (1991), Malloy and Targett (1994a,b), Timmons (1995)
North Carolina: Deubler and White (1962), Williams and Deubler (1968b), Peters and Angelovic (1971), Powell and Schwartz (1977, 1979), Weinstein *et al.* (1980a,b), Powell (1982), Ross and Epperly (1985), Burke (1991), Burke *et al.* (1991), Malloy and Targett (1994a,b), Burke (1995), Hettler *et al.* (1997)

Table 1 (continued). Summary of life history and habitat parameters for summer flounder, *Paralichthys dentatus:* inshore New Jersey, Delaware and North Carolina.

Life Stage	Salinity	Light	Currents	Prey	Predators
TRANSFORMING LARVAE (No pertinent information for DE)	Salinities found in lower estuaries optimal for growth: 10-30 ppt.; Increasing salinity = increased body weight [Weinstein *et al.* 80a: Distribution possibly influenced more by salinity than by substrate.]	Prefer burying during daylight.[1] Night active.	**NJ**: Increased burial at flood tide,[1] although **NC** (Weinstein *et al.* 80b) study indicates possible surface movement on flood, settlement on ebb.	Calanoid copepod *Temora longicornis* -- indicates pelagic feeding. Benthic feeding in late-stage metamorphs, prey includes polychaete tentacles, harpactacoid copepods, polychaetes.	Burying behavior determined by presence of particular predator.[1] **NJ:** 11-16 mm transforming larvae vulnerable to predation by large size range of shrimp *C. septemspinosa* (~ 11-50 mm TL)[1]
JUVENILES	More abundant in higher salinities of 18-35 ppt. Possible preference, but interactions with substrate preferences. **DE:** Experimental salinity variation (10-30 ppt) had no effect on feeding, growth or survival.[1]	Visual predators, feeding restricted to daylight, but **NJ** study (Rountree & Able 97) shows increased night-time catches in marsh creeks. **DE:** No pertinent information.	Selective tidal stream transport. Feeding, optimal environmental conditions cause movement. **DE:** No pertinent information.	Smaller juveniles: infauna (e.g. polychaetes). Larger juveniles (~ >100 mm TL): fish, shrimps, crabs; often tied to abundance in environment.	**DE:** In caging experiments, blue crabs were least able to prey on the flounder in cages with sand bottoms only, but had an advantage in capturing the flounder in cages containing macroalgae.[1] **NJ, NC:** No pertinent information.
ADULTS (No pertinent information for NJ, NC)				<45 cm fed on invertebrates, >45 cm TL ate more fish. In order of % frequency of occurrence: shrimp (*C. septemspinosa*), weakfish, mysids (*N. americana*), anchovies, squids, silversides, herrings, hermit crabs (*P. longicarpus*), isopods (*O. praegusta*).	

Source: Packer and Greisbach 1998.

[1] Laboratory study
Dissolved Oxygen: no pertinent information

Note: 1 mm = 0.04 in 1 cm = 0.39 in 1 m = 39.37 in 1 kg = 2.2046 lbs

References
New Jersey: Rountree and Able (1992a,b), Szedlmayer *et al.* (1992), Keefe and Able (1993,1994), Szedlmayer and Able (1993), Witting and Able (1993), Rountree and Able (1997), Grover (1998)
Delaware: Smith and Daiber (1977), Malloy and Targett (1991), Malloy and Targett (1994a,b), Timmons (1995)
North Carolina: Deubler and White (1962), Williams and Deubler (1968b), Peters and Angelovic (1971), Powell and Schwartz (1977, 1979), Weinstein *et al.* (1980a,b), Powell (1982), Ross and Epperly (1985), Burke (1991), Burke *et al.* (1991), Malloy and Targett (1994a,b), Burke (1995), Hettler *et al.* (1997)

Table 2. Presence of Summer Flounder inshore, by State, as documented by authors cited in the text and personal communications from each States' flounder experts.

Author	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes
	MA													
Howe personal communication	shoals s. of Cape Cod & Cape Cod Bay					A II ——	——	——	——	—— EE	EEEEEEE	EEEEEEE	EEEEEEE	
	CT													
Smith personal communication	Long Island Sound	A - - - -	- - - -		III	II ——	——	——	/ ——	A: peak ——	——	/ ——	- - - -	
	NY													
Poole 62	Great South Bay, Long Island									A EEEEE	EEEEEE			mean length 38cm
	NJ													
Szedlmayer *et al*. 92	Great Bay, Little Egg Harbor	TL IIIIIIIIIII	IIIIIIIIIII	IIIIIIIIIII	IIIIIIIIIII	IIIIIIIIIII	J ——	——	——	EE ——		TL IIIIIIIIIII	IIIIIIIIIII	TL: 11-17mm, J: YOY, 60-326mm
Allen *et al*. 78	Hereford Inlet, near Cape May		TL ——	——	—— /	J, A ——	——	——	——	——	——			TL: 12-15mm J/ A: 200-400m
Murawski 70	Sandy Hook & Cape May				A IIIIIIIIIII	IIIIIIIIIII	——	——	——	EEEEE				A: 230-700mm
Festa 74	NJ estuaries; Sandy Hook to Great Bay	L/TL ////////// /	IIIIIIIIIII	IIIIIIIIIII							L/TL ////////// /	////////// /	////////// /	L/TL 5-21mm; enter est. early Oct-late Jan most yrs, as late as March
Keefe & Able 93	NJ estuaries	TL IIIIIIIIIII	IIIIIIIIIII	IIIIIIIIIII	IIIIIIIIIII						TL ////////// /	////////// /	////////// /	TL: 10-15mm, most abundant Oct-Dec
Able *et al*. 90	NJ estuaries					——	——	/ J: peak ——	EEEEEEE ——	EEEEEEE ——	EEEEEEE ——	EEEEEEE	EEEEEEE	J: YOY, 160-320mm TL

——	presence	L	larvae
——	peak abundance	TL	transforming larvae
- - - -	limited numbers	J	juveniles
//////////	peak ingress	A	adults
IIIIIIIIIII	ingress		
EEEEEE	egress		

Table 2 (continued). Presence of Summer Flounder inshore, by State, as documented by authors cited in the text and personal cummunications from each States' flounder experts.

Author	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes
	DE													
Smith personal communication	Delaware Bay	A - - - -	- - - -	- - - -	A: peak ━━━	━━━	━━━	━━━	━━━	━━━	━━━	━━━	- - - -	some adults present all year
Smith & Daiber 77	Delaware Bay	- - - -	- - - -	- - -		J/A: peak ━━━	━━━	━━━	━━━	━━━			- - -	some juveniles present in deep parts of bay every winter month
	VA													
Musick personal communication	Eastern Shore & lower Chesapeake Bay	J - - - -	- - - -	IIIIIIIIIIII	IIIIIIIIIIII	———	———	———	———	———	EEEEEEE	EEEEEEE	- - - -	In milder winters some age 1+ fish remain in bay
	Eastern Shore, seaside inlets/lagoons				A IIIIIIIIIIII	———	———	———	EEEEEEE					
	lower Chesapeake Bay				A IIIIIII	———	———	———	———	——— EEE	EEE			
Wyanski 90	both sides of Eastern Shore	J IIIIIIIIIIII	IIIIIIIIIIII	IIIIIIIIIIII	IIIIIIIIIIII							////////////	////////////	peak recruitment Nov-Dec
	western Chesapeake Bay		J IIIIIIIIIIII	////////////	////////////									peak recruitment March-April

———	presence	L	larvae
━━━	peak abundance	TL	transforming larvae
- - - -	limited numbers	J	juveniles
//////////	peak ingress	A	adults
IIIIIIIIII	ingress		
EEEEEE	egress		

Table 2 (continued). Presence of Summer Flounder inshore, by State, as documented by authors cited in the text and personal communications from each States' flounder experts.

Author	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Notes
	NC													
Hettler & Barker 93	Oregon Inlet, Ocracoke Inlet		TL ////////////// /		////////////// /TL									TL: peak ingress
Powell & Schwartz 77	Pamlico sound	——— J II	IIIIIIII ———	———	———	———	———	———	*E ——/——	———	———	———	———	J=YOY, present ~18-20 mos. from mid winter recruitment to ~Aug. of 2nd yr. *
Burke *et al*. 91	Newport River, North River estuaries	TL IIIIIIIIIIII	////////////// /	////////////// /	IIIIIIIIIIII									TL = 11-17mm SL
Monaghan personal communication	Beaufort Inlet		TL ///	////////////// /										TL: peak ingress
Tagatz & Dudley 61	Beaufort Inlet			TL/J ———	———	———	———	———	———	———	———	———		TL/J = 11-180mm
Weinstein 79	Cape Fear River			TL IIIIIIIIIIII	IIIIIIIIIIII									TL = 9-16mm SL
	SC													
Wenner *et al*. 90a	Charleston Harbor & vicinity	TL/J IIIIIIIIIIII	IIIIII/////// /	//////IIIIII I	IIIIIIIIIIII									TL/J = 10-20mm TL

———	presence	L	larvae
━━━	peak abundance	TL	transforming larvae
– – – –	limited numbers	J	juveniles
//////////	peak ingress	A	adults
IIIIIIIIIII	ingress		
EEEEEE	egress		

Table 3. Summary of life history and habitat parameters for scup. Information is presented for each life stage.

Life Stage	Time of Year	Location	Temp.	Substrate	Salinity	Wetland Type	Depth (m)	Dissolved Oxygen	Notes
ADULTS - SPAWNING	May - August, peak in June; often in the morning	Coastal areas & larger estuaries from VA north, but mostly in s. New England	> 9°C	Weedy to sandy sediments	Coastal-marine > 15ppt	Use unreported	< 30m	Appears to avoid hypoxic areas	Scup mature at age 2+ (~15-16 cm FL); feeding reduced during spawning.
EGGS	May - August	Coastal VA to s. New England, Cape Cod Bay	13-23°C	Eggs are buoyant in water column	Coastal-marine > 15ppt	Use unreported	< 30m		Eggs hatch in about 70-75 hrs at 18°C & in 40-54 hrs at 21-22°C; predators include most planktivores.
LARVAE	Fall / winter of age 2+	Continental shelf s. of Long Island	> 7°C	Various sands	Coastal-marine	Use unreported	< 20m		Newly hatched larvae are ~2mm, use yolk for ~3 days to grow to ~2.8mm when feeding on plankton must begin; predators include most larger planktivores.
LARVAE - JUVENILE TRANSITION	April - November, minimum temperature (7°C) sensitive	Coastal areas DE to Cape Cod, variably into Gulf of Maine following the ~7-8°C bottom isotherm, formerly into Chesapeake Bay	~7-25°C, can acclimate to 35.6°C	Fine to silty sands, mud, mussel beds, artificial & rocky reefs, wrecks & other man-made structures	Coastal-marine > 15ppt	Not relevant	< 30m		Benthic settlement occurs at ~15-30mm FL, prey is mix of plankton & small benthic invertebrates; predators are many larger fish & crustacea.
YOY JUVENILE	November - April	Usually offshore, s. of NY to NC	> 7°C	Mixed sand	Marine	Use unreported	Intertidal to subtidal < 38m		Diurnal schooling feeders, prey consists of small benthic invertebrates; yr. 1+ grow to ~10cm by Nov; predators include most larger fish such as bluefish, cod, summer flounder, etc.

Table 3 (continued). Summary of life history and habitat parameters for scup. Information is presented for each life stage.

Life Stage	Time of Year	Location	Temp.	Substrate	Salinity	Wetland Type	Depth (m)	Dissolved Oxygen	Notes
NON-ESTUARINE (WINTERING) JUVENILES	November - April / May	Offshore, s. of Long Island except in warm years when they persist in deeper Long Island Sound	> 7°C	Various sands	Coastal-marine > 15ppt	Use unreported	> 38m	Probably not a problem during this season	Prey-predator relationships probably as for estuarine juveniles, above; cod are specifically mentioned as predators on southerly migrating juveniles; winter growth is much reduced.
JUVENILE - ADULT TRANSITION	Fall / winter of age 2+	Continental shelf s. of Long Island	> 7°C	Various sands	Coastal-marine	Not relevant	> 38m		Habitat use characteristic of this life stage not well defined or known.
COASTAL ADULTS	April - November, min. temp. (7°C) sensitive	Coastal areas DE to Cape Cod, variably into Gulf of Maine following the ~7-8°C bottom isotherm, formerly into Chesapeake Bay	~7-25°C, can acclimate to 35.6°C	Fine to silty sands, mud, mussel beds, artificial & rocky reefs, wrecks & other man-made structures	Coastal-marine > 15ppt	Use unreported	~2-38m	Possibly tolerant or avoids problem areas	Usually found in schools; prey on small benthic/near bottom pelagic invertebrates, occasional small fish.
WINTERING ADULTS	November - April	Usually offshore, s. of NY to NC	> 7°C	Mixed sand	Marine	Not relevant	38-185 m, depending on > 7°C isothermal conditions	Normally not a problem during this season	Larger fish lead offshore migration, prey are still small benthic invertebrates; feeding & growth reduced during coldest period - spring fecundity may be based on previous summer feeding.

Source: Steimle *et al.* 1998a.

Note: 1 mm = 0.04 in
1 cm = 0.39 in
1 m = 39.37 in
1 kg = 2.2046 lbs

Table 4. Summary of life history and habitat parameters for black sea bass. Information is presented for each life stage.

Life Stage	Time of Year	Location	Temp.	Substrate / Structure	Salinity	Wetland Type	Depth (m)	Dissolved Oxygen	Prey - Predator Relationship	Notes
SPAWNING (Age > 1)	May through Oct, peak in June.	Inner continental shelf, off Chesapeake Bay to s. New England; may progress south to north.	> 10 °C, peaked at ~18 - 20 °C	Over sand & sand mixed with rock, artificial & natural reefs.	Coastal-marine	Not relevant	~ 20 - 50 m	Adult mortalities reported at levels < 2.0ppm in coastal NY Bight in June.	Feeding reduced during spawning; predators undefined.	Spawning not known in true estuaries but can occur in semi-enclosed coastal bays; some sub-populations may home annually to same spawning grounds in s. New England; larval cestodes inhibit gonad development.
EGGS	May through Oct; incubation probably within a week & temp. dependent.	Continental shelf off NC-VA in May & gradually extending northwesterly into coastal NJ-NY & Buzzards Bay MA.	Sensitive to extremes in lab experiments	Upper water column	Coastal-marine; sensitive to high salinity in lab experiments	Not relevant	Upper water column, shore zone to ~200+ m (off VA)	Unknown	Many planktivores consume fish eggs.	Lab studies found eggs to be sensitive to low pH, high nitrate-nitrite concentrations.
LARVAE: Early Yolk-Sac & Feeding (< 6 mm)	June-Nov	NC to s. New England, seasonal progression northward; inner shelf (4-82 km) & mouths of some but not all estuaries.	14.3 - 28.0 °C	Upper water column	30.3 - 34.6 pp	Not relevant	Upper to mid-water column, to ~33 m.	Unknown	Must feed normally within a few days of hatching; prey is small planktonic crustacea & other zooplankters; many planktivores consume fish larvae, including medusae.	Length at hatching is ~1.5-2.0mm; lab studies found larvae with water quality sensitivities similar to that of eggs.
LARVAE: Late to benthic transition (~6 - 24 mm)	June-Nov; settlement July-Oct	Sub-surface water column VA to NY; when demersal - near coastal zone & into marine parts of estuaries.	14.3 - 28.0 °C	When larvae become demersal, they are found on structured inshore habitat such as sponge beds	30.3 - 34.6 ppt	Some larvae in benthic transition may use salt marsh	< 50 m (?)	Unknown	Prey is small zooplankters including mysid shrimp & small benthic epifauna after demersal settlement; many planktivores consume fish larvae.	Most larvae may become demersal outside mouths of estuaries.

Table 4 (continued). Summary of life history and habitat parameters for black sea bass. Information is presented for each life stage.

Life Stage	Time of Year	Location	Temp.	Substrate	Salinity	Wetland Type	Depth (m)	Dissolved Oxygen	Predator - Prey Relationship	Notes
YOUNG JUVENILES (25 -~ 180 mm, age 0+)	April-Dec, most post-larval juveniles begin to appear inshore in mid/late summer.	Summer - coastal/estuarine areas with shelter (bottom structure), VA to MA; winter - offshore NJ & south.	~6 - 30 °C	Rough bottom, shellfish & eelgrass beds, man-made structures in sandy-shelly areas; offshore clam beds & shell patches may be used during winter.	8-38ppt; prefers > 18ppt	Adjacent salt marsh	"Shallow" < 37 m	Unknown	Prey is small epi- & supra-benthic invertebrates (especially crustacea & molluscs) & fish; predators undefined.	Loss of oyster & eelgrass beds in Chesapeake Bay & elsewhere may reduce good nursery habitat; man-made structures & debris adds "structured" habitat.
OLDER JUVENILES, sub-adults (immature ages 1+ - 3)	Inshore, April-Dec; offshore Dec-April.	Some return to estuaries, but more use of marine coastal waters in summer & warmer offshore waters in winter.	>6 - 30 °C	As for younger juveniles, but more use of deeper habitat	12 - 38 ppt, prefers > 18 ppt	Salt marshes adjacent	2 - 37 m	Unknown	Prey is small epi- & supra-benthic invertebrates (especially crustacea & molluscs) & fish; predators undefined.	Prefers shelter at base of larger submerged structures.
ADULTS: winter and spring migration	Late Nov-April	Winters offshore & south of NY; distribution temp. dependent.	> 6 °C	Silty sand with shell; use of structure unknown.	Marine	Not used	Inshore range limit associated with > 6°C isotherm.	Usually not a problem during winter	Prey includes squid, butterfish, epibenthic crustacea; predators undefined.	Fish caught unexpectedly in a cold water mass may hide within a structure or burrow slightly into sedi-ment surface; ex-tended exposures to temps. < 5°C may result in mortalities.
ADULTS: summer and fall migration	April-Dec, can be coastal residents along VA to NC coast.	Coastal area from NC to MA .	6 - 28 °C	Structured habitats (natural & man-made), sand & shell.	Marine	Normally not used	Trans-continental shelf	Mortalities & avoidance noted at levels < 2ppm.	Prey includes small endo-, epi- & supra-benthic crustacea, molluscs, other invertebrates & fish; predators undefined.	Spawning occurs during inshore migration to summering habitats.
Other Life History Notes: Black sea bass are proogynous hermaphrodites. Most juveniles start as females, change to males after maturity/ growth >20 cm (?), thus most large, fishery preferred fish are males.										

Source: Steimle *et al.* 1998b.

Note: 1 mm = 0.04 in 1 cm = 0.39 in 1 m = 39.37 in 1 kg = 2.2046 lbs

Table 5. Spatial distribution and relative abundance of summer flounder in Atlantic coast estuaries.

	Mid-Atlantic Estuaries																	
	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	✳	M	S	✳	M	S	T	M	S	T	M	S	T	M	✳	✳	M	S
A		▼	▼		●	●	▼	▼	●		▼	▼		●			●	●
S																		
J		▼	●		●	●	▼	▼	▼		▼	▼		●			●	●
L		▼	▼		▼	▼		▼	▼									
E						▼			▼									

	Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	✳	M	S	T	M	S	T	M	S	T	M	S	T	M	S	✳	M	S
A		●	●		●	●		●	●		●	●		●	●		●	▲
S																		
J		●	●		●	●		●	●		●	●		●	●		■	▲
L				▼	▼	▼		▼	▼		▼	▼					▼	■
E						▼												

	Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	✳	✳	S	T	M	S	T	M	✳	T	M	✳	T	M	✳	T	M	✳
A			▲		●	●		●			●			●			●	
S																		
J			▲		●	▼		●			●			●			●	
L					●	●												
E																		

	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	✳	M	✳	T	M	✳	T	M	✳	T	M	✳
A		●			●			●			●	
S												
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 - Egg

Source: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 5 (continued). Spatial distribution and relative abundance of summer flounder in Atlantic coast estuaries.

	Southeast Estuaries																				
	Albemarle Sound			Pamlico Sound			Pamlico/ Pungo Rivers			Neuse River			Bogue Sound			New River			Cape Fear River		
Life Stage	T	M	✳	T	M	S	T	M	✳	T	M	✳	T	M	S	T	M	S	T	M	S
A		●			●	■		●			●			●	■		●	●		●	●
S																					
J	▼	●			■	■	▼	●			●			●	●		●	●		●	●
L		●			●	■					●			▼	●		▼	●		●	●
E																					

	Winyah Bay			N & S Santee Rivers			Charleston Harbor			St. Helena Sound			Broad River			Savannah River			Ossabaw Sound		
Life Stage	T	M	S	T	M	✳	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
A		▼	●		●			●	●		●	●		●	●		▼	▼		▼	▼
S																					
J		●	■		●			●	●		●	●		●	●		■	■		■	■
L		●	●		●			●	●		●	●		●	●		●	●		●	●
E																					

	St. Cathe/ Sapelo Sound			Altamaha River			St. Andrew /St. Simon Sound			St. Johns River			Indian River			Biscayne Bay		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	✳	M	S	✳	M	S
A		▼	▼		▼	▼		▼	▼	●	●	●		●	●			
S																		
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: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 6. Temporal distribution and relative abundance of summer flounder in Atlantic coast estuaries.

Mid-Atlantic Estuaries

Waquoit Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					R	R	R	R	R	R		
S												
J					R	C	C	C	C	C		
L									R	R	R	R
E												

Buzzards Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					C	C	C	C	C	C		
S												
J					C	C	C	C	C	C		
L	R	R	R	R			R	R	R	R	R	R
E									R	R	R	R

Narragansett Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					C	C	C	C	C	C		
S												
J					R	R	R	R	R	R		
L	R	R					R	R	R	R	R	R
E	R	R	R									

Long Island Sound

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			R	R	R	R	R	R	R	R	R	
S												
J			R	R	R	R	R	R	R	R	R	
L												
E												

Connecticut River

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			R	C	C	C	C	C	C	C	R	
S												
J			R	C	C	C	C	C	C	C	R	
L												
E												

Gardiners Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			R	C	C	C	C	C	C	C	R	
S												
J			R	C	C	C	C	C	C	C	R	
L												
E												

Great South Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				C	C	C	C	C	C	R		
S												
J				C	C	C	C	C	C	R		
L												
E												

Hudson R./Raritan Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			R	R	C	C	C	C	C	C	R	R
S												
J			R	R	C	C	C	C	C	C	R	R
L				R	R	R			R	R	R	R
E									R	R	R	R

Barnegat Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				R	C	C	C	C	C	R		
S												
J	R	R	R	R	C	C	C	C	C	R	R	R
L	R	R	R	R	R					R	R	R
E												

New Jersey Inland Bays

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				R	C	C	C	C	C	R		
S												
J	R	R	R	R	C	C	C	C	C	R	R	R
L	R	R	R	R	R					R	R	R
E												

Delaware Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				R	C	C	C	C	C	R	R	R
S												
J	R	R	R	R	C	C	C	C	C	R	R	R
L												
E												

Delaware Inland Bays

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				R	A	H	H	H	A	R		
S												
J	R	R	R	C	H	H	H	H	H	C	R	R
L	A	C	C	R						C	C	A
E												

Relative Abundance

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 6 (continued). Temporal distribution and relative abundance of summer flounder in Atlantic coast estuaries.

	Mid-Atlantic Estuaries		
Estuary / Month	Chincoteague Bay	Chesapeake B. mainstem	Chester River
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*R R R C A H H H A A C R*	*C C C C C C C R*	*C C C C C C R*
S			
J	*R R R C A H H H A A C R*	*R R R R R C C C C C C R*	*R R R R R C C C C C R R*
L		*C C C C R*	
E			
Estuary / Month	Choptank River	Patuxent River	Potomac River
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*C C C C C C R*	*C C C C C C R*	*C C C C C C R*
S			
J	*R R R R R C C C C C R R*	*R R R R R C C C C C R R*	*R R R R R C C C C C R R*
L			
E			
Estuary / Month	Tangier/Pokomoke Sound	Rappahannock River	
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	
A	*C C C C C C R*	*R C C C C C R*	
S			
J	*R R R R R C C C C C R R*	*R R R R R R C C C C C R*	
L		*R C C R*	
E			
Estuary / Month	York River	James River	
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	
A	*R C C C C C R*	*R C C C C C R*	
S			
J	*R R R R R R C C C C C R*	*R R R R R R C C C C C R*	
L	*R C C R*	*R C C R*	
E			

Relative Abundance

H - Highly Abundant
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C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 6 (continued). Temporal distribution and relative abundance of summer flounder in Atlantic coast estuaries.

Southeast Estuaries

Estuary / Month	Albemarie Sound											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C									C
E												

Estuary / Month	Pamlico Sound											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A	C				C	C	C	C	A	A	A	C
S												
J	A	A	A	A	A	A	A	A	A	A	A	A
L	C	A	A	C								C
E												

Estuary / Month	Pamlico/Pungo Rivers											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L												
E												

Estuary / Month	Neuse River											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C									C
E												

Estuary / Month	Bogue Sound											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	A	A	A	A	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C								
E												

Estuary / Month	New River											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				C	C	C	C	C	C	C	C	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C	R							
E												

Estuary / Month	Cape Fear River											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C								C
E												

Estuary / Month	Winyah bay											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	R	R
S												
J	C	C	C	A	A	A	A	A	A	A	C	C
L	C	C	C	C	C							C
E												

Estuary / Month	N/S Santee Rivers											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	C
S												
J	R	R	R	R	C	C	C	C	C	R	R	R
L	C	C	C	C								
E												

Estuary / Month	Charleston Harbor											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C								C
E												

Estuary / Month	St. Helena Sound											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C								
E												

Estuary / Month	Broad River											
Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A			C	C	C	C	C	C	C	C	C	C
S												
J	C	C	C	C	C	C	C	C	C	C	C	C
L	C	C	C	C								
E												

<u>Relative Abundance</u>

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

<u>Life Stage</u>

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 6 (continued). Temporal distribution and relative abundance of summer flounder in Atlantic coast estuaries.

Southeast Estuaries

Savannah River	J	F	M	A	M	J	J	A	S	O	N	D
A	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
S												
J	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
L	*C*	*C*	*C*	*C*								
E												

Ossabaw Sound	J	F	M	A	M	J	J	A	S	O	N	D
A	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
S												
J	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
L	*C*	*C*	*C*	*C*								
E												

St. Cath/Sapelo Sound	J	F	M	A	M	J	J	A	S	O	N	D
A	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
S												
J	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
L	*C*	*C*	*C*	*C*								
E												

Altamaha River	J	F	M	A	M	J	J	A	S	O	N	D
A	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
S												
J	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
L	*C*	*C*	*C*	*C*								
E												

St. And./St. Sim. Sound	J	F	M	A	M	J	J	A	S	O	N	D
A	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
S												
J	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
L	*C*	*C*	*C*	*C*								
E												

St. Johns River	J	F	M	A	M	J	J	A	S	O	N	D
A			*C*	*C*	*C*	*C*	*C*	*C*	*C*			
S												
J	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*
L	*C*	*C*	*C*									*C*
E												

Indian River	J	F	M	A	M	J	J	A	S	O	N	D
A	*C*	*C*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*C*	*C*
S												
J	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*	*R*
L	*R*	*R*	*R*									
E												

Biscayne Bay	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Relative Abundance

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Nelson *et al.* 1991, Stone *et al.* 1994.

Table 7. Spatial distribution and relative abundance of scup in Atlantic coast estuaries.

North Atlantic Estuaries

	Passamaquoddy Bay			Englishman Machias Bays			Narraguagus Bay			Blue Hill Bay			Penobscot Bay			Muscongus Bay		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
A																		
S																		
J																		
L																		
E																		

	Damariscotta River			Sheepscot River			Kennebec/ Androscoggin Rivers			Casco Bay			Saco Bay			Wells Harbor		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	✳	M	S
A												▼			▼			
S																		
J												▼			▼			
L																		
E																		

	Great Bay			Merrimack River			Massachusetts Bay			Boston Harbor			Cape Cod Bay		
Life Stage	T	M	S	T	M	✳	✳	✳	S	✳	M	S	✳	M	S
A									▼			▼			●
S															
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 - Egg

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 7 (continued). Spatial distribution and relative abundance of scup in Atlantic coast estuaries.

	Mid-Atlantic Estuaries																	
	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A		▼	●		▼	▲		■	●		▼	▲		▼			▼	■
S			●			■			●			■						■
J		▼	●		▼	▲		▲	■		▼	▲		▼			▼	■
L		▼	■		▼	■		▼	●		▼	■		▼			▼	■
E		▼	■		●	■		▼	●		▼	■		▼			▼	■
	Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A			●		▼	●		▼	▼		▼	▼		▼	●			●
S						●												
J			●		▼	■		▼	●		▼	●		●	●			●
L					▼	●												
E					▼	●												
	Chincoteague Bay			Chesapeake Bay mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
A					●	●												
S																		
J			▼		●	■												
L																		
E																		
	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River								
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*						
A		▼									▼							
S																		
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 - Egg

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 8. Temporal distribution and relative abundance of scup in Atlantic coast estuaries.

	North Atlantic Estuaries		
Estuary / Month	Passamaquoddy Bay	Englishman/Machias Bays	Narraguagus Bay
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A			
S			
J			
L			
E			
Estuary / Month	Blue Hill Bay	Penobscot Bay	Muscongus Bay
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A			
S			
J			
L			
E			
Estuary / Month	Damariscotta River	Sheepscot River	Kennebec/ Androscoggin Rivers
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A			
S			
J			
L			
E			

Relative Abundance

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 8 (continued). Temporal distribution and relative abundance of scup in Atlantic coast estuaries.

North Atlantic Estuaries

Estuary / Month: Casco Bay Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					*R*	*R*	*R*	*R*	*R*	*R*		
S												
J					*R*	*R*	*R*	*R*	*R*	*R*		
L												
E												

Estuary / Month: Saco bay Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					*R*	*R*	*R*	*R*	*R*	*R*		
S												
J					*R*	*R*	*R*	*R*	*R*	*R*		
L												
E												

Estuary / Month: Wells Harbor Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Estuary / Month: Great Bay Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Estuary / Month: Merrimack River Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Estuary / Month: Massachusetts Bay Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					*R*	*R*	*R*	*R*	*R*	*R*		
S												
J						*R*	*C*	*C*	*C*	*R*		
L						*R*	*R*	*R*	*R*			
E												

Estuary / Month: Boston Harbor Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						*R*	*R*	*R*	*R*			
S												
J						*R*	*R*	*R*	*R*	*R*		
L							*R*	*R*	*R*			
E												

Estuary / Month: Cape Cod Bay Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					*R*	*C*	*C*	*C*	*C*	*R*		
S												
J						*R*	*C*	*C*	*C*	*R*		
L						*R*	*R*	*R*	*R*			
E												

Relative Abundance

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 8 (continued). Temporal distribution and relative abundance of scup in Atlantic coast estuaries.

	Mid-Atlantic Estuaries		
Estuary / Month	Waquoit Bay	Buzzards Bay	Narragansett Bay
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*C C C C C C*	*R H H C H H C*	*R C A C C C C*
S	*C C C R*	*A A C R*	*C C C R R*
J	*R C C C C C C*	*C C H H H H*	*A H H C A A*
L	*C A A C C R*	*C A A C C*	*R C C C C*
E	*A A C R R*	*R A A C C C C*	*C C C R R*
Estuary / Month	Long Island Sound	Connecticut River	Gardiners Bay
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*C A A A A H C*	*R R R R R R R*	*C A A A A A C*
S	*C A C R*		*C A A C*
J	*A H H H H A C*	*R R R R R R R*	*C A A A A A C*
L	*C A C C*	*R R R R*	*C A C R*
E	*C A C R*	*R R R R*	*C A C R*
Estuary / Month	Great South Bay	Hudson R./Raritan B.	Barnegat Bay
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*R C C C C C R*	*C C C C C*	*R R R R R*
S		*R C R R*	
J	*C C C C C C C*	*A A A A A*	*C C C C C*
L		*R C R R R*	
E		*R C R R R*	
Estuary / Month	New Jersey Inland Bays	Delaware Bay	Delaware Inland Bays
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*R R R R R*	*C C C C C C C C C*	*C C C C C R R R*
S			
J	*C C C C C*	*R R R C C R*	*C C C C C R R R*
L			
E			

<u>Relative Abundance</u>

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

<u>Life Stage</u>

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 8 (continued). Temporal distribution and relative abundance of scup in Atlantic coast estuaries.

Mid-Atlantic Estuaries

Estuary	Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
Chincoteague Bay	A												
	S												
	J						*R*	*R*	*R*	*R*			
	L												
	E												
Chesapeake B. mainstem	A				*C*	*C*	*C*	*C*	*C*	*C*			
	S												
	J					*C*	*C*	*A*	*C*	*C*	*C*	*R*	
	L												
	E												
Chester River	A												
	S												
	J												
	L												
	E												
Choptank River	A												
	S												
	J												
	L												
	E												
Patuxent River	A												
	S												
	J												
	L												
	E												
Potomac River	A												
	S												
	J												
	L												
	E												
Tangier/Pocomoke Sd.	A						*R*	*R*	*R*	*R*			
	S												
	J						*R*	*R*	*R*	*R*			
	L												
	E												
Rappahannock River	A												
	S												
	J												
	L												
	E												
York River	A												
	S												
	J						*R*	*R*	*R*	*R*			
	L												
	E												
James River	A				*R*	*R*	*R*	*R*	*R*	*R*			
	S												
	J					*R*	*R*	*R*	*R*	*R*	*R*		
	L												
	E												

Relative Abundance

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 9. Spatial distribution and relative abundance of black sea bass in Atlantic coast estuaries.

	Mid-Atlantic Estuaries																	
	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A			▼		▼	●		▼	●		▼	▼					▼	●
S						●												
J			▼		▼	●		▼	●		▼	●					▼	●
L						●			▼									
E						●												

	Great South Bay			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A			●		▼	▼		●	■		●	■		▼	●			▼
S																		
J					▼	▼		●	■		●	■		●	●		●	●
L									▼									
E																		

	Chincoteague Bay			Chesapeake Bay mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
A			●		●	●		▼			▼			▼			▼	
S																		
J			●		●	●		▼			▼			▼			▼	
L																		
E																		

	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*
A		●			▼			▼			●	
S												
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 - Egg

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 10. Temporal distribution and relative abundance of black sea bass in Atlantic coast estuaries.

Mid-Atlantic Estuaries

Waquoit Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					R	R	R	R	R	R	R	
S												
J					R	R	R	R	R	R	R	
L												
E												

Buzzards Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					C	C	C	C	C	C	R	
S				C	C	C	C					
J					C	C	C	C	C	C	R	
L					R	R	R	C	C			
E					R	C	C	C	R			

Narragansett Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					C	C	C	C	C	C		
S												
J					C	C	C	C	C	C		
L					R	R	R	R				
E												

Long Island Sound

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A	R	R	R	R	R	R	R	R	R	R	R	R
S												
J	R	R	R	C	C	C	C	C	C	C	C	R
L												
E												

Connecticut River

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Gardiners Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				C	C	C	C	C	C	C	C	
S												
J				C	C	C	C	C	C	C	C	
L												
E												

Great South Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					C	C	C	C	C	C	C	
S												
J												
L												
E												

Hudson R./Raritan B.

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A				R	R	R	R	R	R	R	R	
S												
J				R	R	R	R	R	R	R	R	
L												
E												

Barnegat Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					R	A	A	A	A	R	R	R
S												
J				R	A	A	A	A	A	C	R	R
L							R	R				
E												

New Jersey Inland Bays

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					R	A	A	A	A	R	R	R
S												
J				R	A	A	A	A	A	C	R	R
L												
E												

Delaware Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						C	C	C	C	C		
S												
J						R	C	C	C	R	R	
L												
E												

Delaware Inland Bays

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A					R	R	R	R	R	R	R	
S												
J					C	C	C	C	C	C	C	
L												
E												

<u>Relative Abundance</u>

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

<u>Life Stage</u>

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 10 (continued). Temporal distribution and relative abundance of black sea bass in Atlantic coast estuaries.

	Mid-Atlantic Estuaries		
Estuary / Month	Chincoteague Bay	Chesapeake B. mainstem	Chester River
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*C C C C C C C C*	*R C C C C C C R*	*R R R R R R R*
S			
J	*C C C C C C C C*	*R C C C C C C R*	*R R R R R R R*
L			
E			
Estuary / Month	Choptank River	Patuxent River	Potomac River
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
A	*R R R R R R R*	*R R R R R R R*	*R R R R R R R*
S			
J	*R R R R R R R*	*R R R R R R R*	*R R R R R R R*
L			
E			
Estuary / Month	Tangier/Pocomoke Sd.	Rappahannock River	
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	
A	*R C C C C C R*	*R R R R R R R*	
S			
J	*R C C C C C R*	*R R R R R*	
L			
E			
Estuary / Month	York River	James River	
Life Stage	J F M A M J J A S O N D	J F M A M J J A S O N D	
A	*R R R R R R R*	*R C C C C C C R*	
S			
J	*R R R R R*	*C C C C C*	
L			
E			

<u>Relative Abundance</u>

H - Highly Abundant
A - Abundant
C - Common
R - Rare
Blank - Not Present
na - No Data Available

<u>Life Stage</u>

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 11. Approximate area (percent and number of 10 minute squares) for the summer flounder catch and area EFH alternatives (adapted from Cross pers. comm.). The logged catch alternative was not presented because the percent area and number of squares consistently fall between the catch and area alternatives. The preferred alternative is 90% of the area.

Eggs

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
18	50	60
38	75	90
50	88	106
60	90	108
75	95	114
90	98	118
100	100	120

Larvae

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
20	50	31
45	75	70
50	90	78
75	95	116
90	97	140
100	100	155

Source: Adapted from Cross pers. comm.

Table 11(continued). Approximate area (percent and number of 10 minute squares) for the summer flounder catch and area EFH alternatives (adapted from Cross pers. comm.). The logged catch alternative was not presented because the percent area and number of squares consistently fall between the catch and area alternatives. The preferred alternative is 90% of the area.

Juvenile

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
10	50	27
25	75	68
44	90	119
50	91	135
75	95	203
90	98	243
100	100	270

Adults

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
18	50	99
32	75	177
50	90	276
75	95	414
90	98	497
100	100	552

Source: Adapted from Cross pers. comm.

Table 12. Approximate area (percent and number of 10 minute squares) for the scup catch and area EFH alternatives (adapted from Cross pers. comm.). The logged catch alternative was not presented because the percent area and number of squares consistently fall between the catch and area alternatives. The preferred alternative is 90% of the area.

Juveniles

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
5	50	20
17	75	68
30	90	120
50	93	200
75	95	300
90	98	360
100	100	400

Adults

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
2	50	9
11	75	48
28	90	125
50	93	225
75	96	338
90	99	405
100	100	450

Source: Adapted from Cross pers. comm.

Table 13. Approximate area (percent and number of 10 minute squares) for the black sea bass catch and area EFH alternatives (adapted from Cross pers. comm.). The logged catch alternative was not presented because the percent area and number of squares consistently fall between the catch and area alternatives. The preferred alternative is 90% of the area.

Larvae

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
15	50	20
34	75	45
50	88	66
58	90	76
75	95	98
90	98	118
100	100	131

Source: Adapted from Cross pers. comm.

Table 13(continued). Approximate area (percent and number of 10 minute squares) for the black sea bass and area EFH alternatives (adapted from Cross pers. comm.). The logged catch alternative was not presented because the percent area and number of squares consistently fall between the catch and area alternatives. The preferred alternative is 90% of the area.

Juvenile

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
5	50	16
15	75	47
30	90	94
	93	156
75	95	234
90	99	281
100	100	312

Adults

% Area	% Catch Index Index	Number of 10" Squares
0	0	0
15	50	47
36	75	112
50	90	156
92	90	193
75	96	234
90	99	281
100	100	312

Source: Adapted from Cross pers. comm.

Table 14. Atlantic coast estuaries which are designated as EFH (x) for summer flounder.

Mid-Atlantic Estuaries

	Waquiot Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A					x	x			x					x			x	
J		x	x		x	x	x	x	x		x	x		x			x	x
L		x	x		x	x		x	x									
E																		

	South Shore Bay Complex			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A		x	x		x	x		x	x		x	x		x	x		x	x
J		x	x		x	x		x	x		x	x		x	x		x	x
L				x	x	x		x	x		x	x					x	x
E																		

	Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
A			x		x	x		x			x			x			x	
J			x		x	x		x			x			x			x	
L					x	x												
E																		

	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*
A		x			x			x			x	
J		x			x			x			x	
L					x			x			x	
E												

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone not present

Life stage

A - Adults
J - Juveniles
L - Larvae
E - Egg

Table 14 (continued). Atlantic coast estuaries which are designated as EFH (x) for summer flounder.

	Southeast Estuaries																				
	Albemarie Sound			Pamlico Sound			Pamlico/ Pungo Rivers			Neuse River			Bougue Sound			New River			Cape Fear River		
Life Stage	T	M	✳	T	M	S	T	M	✳	T	M	✳	T	M	S	T	M	S	T	M	S
A		x			x	x		x			x			x	x		x	x		x	x
J	x	x			x	x	x	x			x			x	x		x	x		x	x
L		x			x	x					x			x	x		x	x		x	x
E																					

	Winyah Bay			N & S Santee Rivers			Charleston Harbor			St. Helena Sound			Broad River			Savannah River			Ossabaw Sound		
Life Stage	T	M	S	T	M	✳	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
A			x		x			x	x		x	x		x	x						
J		x	x		x			x	x		x	x		x	x		x	x		x	x
L		x	x		x			x	x		x	x		x	x		x	x		x	x
E																					

	St. Cathe/ Sapelo Sound			Altamaha River			St. Andrew /St. Simon Sound			St. Johns River			Indian River			Biscayne Bay		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	✳	M	S	✳	M	S
A										x	x	x		x	x			
J		x	x		x	x		x	x	x	x	x		x	x			
L		x	x		x	x		x	x		x	x		x	x			
E																		

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
✳ - Salinity Zone not present

Life stage

A - Adults
J - Juveniles
L - Larvae
E - Egg

Table 15. Atlantic coast estuaries which are designated as EFH (x) for scup.

	North Atlantic Estuaries																	
	Passama-quoddy Bay			Englishman Machias Bays			Narraguagus Bay			Blue Hill Bay			Penobscot Bay			Muscongus Bay		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
A																		
J																		
L																		
E																		

	Damariscotia River			Sheepscot River			Kennebec/ Androscoggin Rivers			Casco Bay			Saco Bay			Wells Harbor		
Life Stage	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	✳	M	S
A																		
J																		
L																		
E																		

	Great Bay			Merrimack River			Massachusetts Bay			Boston Harbor			Cape Cod Bay		
Life Stage	T	M	S	T	M	✳	✳	✳	S	✳	M	S	✳	M	S
A															x
J									x					x	x
L															
E															

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
✳ - Salinity Zone not present

Life stage

A - Adults
J - Juveniles
L - Larvae
E - Egg

Table 15 (continued). Atlantic coast estuaries which are designated as EFH (x) for scup.

Mid-Atlantic Estuaries

	Waquiot Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A			x			x		x	x			x						x
J			x			x		x	x			x						x
L			x			x			x			x						x
E			x		x	x			x			x						x

	South Shore Bay Complex			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A			x			x									x			x
J			x			x			x			x		x	x			x
L						x												
E						x												

	Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
A					x	x												
J					x	x												
L																		
E																		

	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*
A												
J												
L												
E												

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone not present

Life stage

A - Adults
J - Juveniles
L - Larvae
E - Egg

Table 16. Atlantic coast estuaries which are designated as EFH (x) for black sea bass.

	Mid-Atlantic Estuaries																	
	Waquiot Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A						x			x									x
J						x			x			x						x
L						x												
E						x												

	South Shore Bay Complex			Hudson R./ Raritan B.			Barnegat Bay			New Jersey Inland Bays			Delaware Bay			Delaware Inland Bays		
Life Stage	*	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A			x					x	x		x	x			x			
J								x	x		x	x		x	x		x	x
L																		
E																		

	Chincoteague Bay			Chesapeake Bay Mainstem			Chester River			Choptank River			Patuxent River			Potomac River		
Life Stage	*	*	S	T	M	S	T	M	*	T	M	*	T	M	*	T	M	*
A			x		x	x												
J			x		x	x												
L																		
E																		

	Tangier/ Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*
A		x									x	
J		x									x	
L												
E												

<u>Salinity Zone</u>

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone not present

<u>Life stage</u>

A - Adults
J - Juveniles
L - Larvae
E - Egg

Table 17. SAV mapping efforts occurring in Atlantic coastal states, including agency or organization implementing project, estimated percentage complete, and expected completion date.

State	Agency	Estimated % Completed	Comprehensive Survey Completion Date	Contact
ME	ME Dept of Marine Resources & Nature Conservancy	in progress	6/98	Seth Barker, ME Dept. of Marine Resources PO Box 8 West Booth Bay Harbor, ME 04575 PH: 207/633-9507 FAX: 207/633-9579
NH	University of New Hampshire	unknown	no comprehensive survey planned	Bill Ingham, New Hampshire Fish and Game 2 Hazen Drive Concord, NH 03301 PH: 603/271-2461 FAX: 603/271-2461
MA	MA Dept of Environmental Protection	90% - in progress	6/97	Paul Caruso, MA Division of Marine Fisheries 50 A Portside Drive Pocasset, MA 02559 PH: 508/563-1779 x107 FAX: 508/563-5482
RI	Naragansett Bay Program	3%	no comprehensive survey planned	Jim Boyd, RI Coastal Resources Mgmt Program Oliver Stedman Government Center Wakefield, RI 02873 PH: 401/277-2476 FAX: 401/277-3922
CT	University of Connecticut	100%	1996	Ron Rozsa & Sue Mickolyzck, CT Dept of Env Protection Office of Long Island Sound Programs 79 Elm Street Hartford, CT 06106 PH: 860/424-3034 FAX: 860/424-4054
NY	NY Bureau of Marine Resources*	0%*	no comprehensive survey planned	Art Newell, NY State Dept of Environment Protection Bureau of Marine Resources 205-No Belle Meade Road East Setauket NY 11733 PH: 516/444-0430 FAX: 516/444-0434
NJ	NJ Dept of Environmental Protection	100%	1980, 1988 update in areas	Bruce Halgren, NJ Dept of Environmental Protection Division of Fish, Game & Wildlife CN 400 Trenton NJ 08625-0400 PH: 609/292-2083 FAX: 609/984-1414

Source: Ernst and Stephan 1997.

Table 17 (continued). SAV mapping efforts occurring in Atlantic coastal states, including agency or organization implementing project, estimated percentage complete, and expected completion date.

State	Agency	Estimated % Completed	Comprehensive Survey Completion Date	Contact
DE	none	0%	no comprehensive survey planned	Bill Moyer, DE Dept of Nat Resources & Env Control 89 King Highway / PO Box 1401 Dover, DE 19903 PH: 302/739-4691 FAX: 302/739-3491
MD	VA Institute of Marine Sciences	100%	annual updates	Nancy Butowski, MD Dept of Natural Resources 580 Taylor Avenue Annapolis, MD 21401 PH: 401/974-2242 FAX: 401/974-2600
VA	VA Institute of Marine Sciences	100%	annual updates	Randy Owen, VA Marine Resources Commission PO Box 756 Newport News, VA 23607-0756 PH: 804/247-2200 FAX: 804/247-8062
NC	National Marine Fisheries Service, NC Division of Marine Fisheries	30%	no comprehensive survey planned	Mike Street, NC Division of Marine Fisheries PO Box 769 Morehead City, NC 28557 PH: 919/726-7021 FAX: 919/726-7222
FL	National Marine Fisheries Service, FL Dept of Environmental Protection	100%	continuous updates	Leonard Nero, Dept of Environmental Protection 3111 B13 Fortune Way Wellington, FL 33414 PH: 407/791-4042 FAX: 407/791-4722

Source: Ernst and Stephan 1997.

Table 18. Comparisons of intensity and severity of various sources of physical disturbance to the seafloor (based on Hall 1994, Watling and Norse MS1997). Intensity is a measure of the force of physical disturbance and severity is the impact on the benthic community.

Source	Intensity	Severity
ABIOTIC		
Waves	Low during long temporal periods but high during storm events (to 70-80 m depth)	Low over long temporal periods since taxa adapted to these events but high locally depending on storm behavior
Currents	Low since bed shear normally lower than critical velocities for large volume and rapid sediment movement	Low since benthic stages rarely lost due to currents
Iceberg Scour	High locally since scouring results in significant sediment movement but low regionally	High locally due to high mortality of animals but low regionally
BIOTIC		
Bioturbation	Low since sediment movement rates are small	Low since infauna have time to repair tubes and burrows
Predation	Low on a regional scale but high locally due to patchy foraging	Low on a regional scale but high locally due to small spatial scales of high mortality
HUMAN		
Dredging	Low on a regional scale but high locally due to large volumes of sediment removal	Low on a regional scale but high locally due to high mortality of animals
Land Alteration (Causing silt laden runoff)	Low since sediment laden runoff per se does not exert a strong physical force	Low on a regional scale but high locally where siltation over coarser sediments causes shifts in associated communities
Fishing	High due to region wide fishing effort	High due to region wide disturbance of most types of habitat

Source: Auster and Langton 1998.

Table 19. Studies of the impacts of fishing gear on the structural components of fish habitat.

Habitat	Gear Type	Location	Results	Reference(s)
Eelgrass	Scallop dredge	North Carolina	Comparison of reference quadrats with treatments of 15 and 30 dredgings in hard sand and soft mud substrates within eelgrass meadows. Eelgrass biomass was significantly greater in hard sand than soft mud sites. Increased dredging resulted in significant reductions in eelgrass biomass and number of shoots.	Fonesca et al. (1984)
Eelgrass and shoalgrass	Clam rake and "clam kicking"	North Carolina	Comparison of effect of two fishing methods. Raking and "light" clam kicking treatments, biomass of seagrass was reduced approximately 25% below reference sites but recovered within one year. In "intense" clam kicking treatments, biomass of seagrass declined approximately 65% below reference sites. Recovery did not begin until more than 2 years after impact and biomass was still 35% below the level predicted from controls to show no effect.	Peterson et al. (1987)
Eelgrass and shoalgrass	Clam rakes (pea digger and bull rake)	North Carolina	Compared impacts of two clam rake types on removal of seagrass biomass. The bull rake removed 89% of shoots and 83% of roots and rhizomes in a completely raked 1 m2 area. The pea digger removed 55% of shoots and 37% of roots and rhizomes.	Peterson et al. (1983)
Seagrass	Trawl	western Mediter-ranean	Noted loss of *Posidonia* meadows due to trawling; 45% of study area. Monitored recovery of the meadows after installing artificial reefs to stop trawling. After 3 years plant density has increased by a factor of 6.	Guillen et al. (1994)
Sponge-coral hard-bottom	Roller-rigged trawl	off Georgia coast	Assessed effect of single tow. Damage to all species of sponge and coral observed; 31.7% of sponges, 30.4% of stony corals, and 3.9% of octocorals. Only density of barrel sponges (*Cliona* spp.) significantly reduced. Percent of stony coral damage high because of low abundance. Damage to other sponges, octocorals, and hard corals varied but changes in density not significantly different. No significant differences between trawled and reference sites after 12 months.	Van Dolah et al. (1987)
Sponge-coral hard-bottom	roller-frame shrimp trawl	Biscayne Bay, Florida	Damage to approximately 50% of sponges, 80% of stony corals, and 38% of soft corals.	Tilmant (1979) (cited in Van Dolah et al. 1987)

Source: Auster and Langton 1998.

Table 19 (continued). Studies of the impacts of fishing gear on the structural components of fish habitat.

Habitat	Gear Type	Location	Results	Reference(s)
Various tropical emergent benthos	Trawl	North West Shelf, Australia	Catch rates of all fish and large and small benthos show that in closed areas fish and small benthos abundance increased over 5 years while large benthos (>25 cm) stayed the same or increased slightly. In trawled areas all groups of animals declined. Found that settlement rate and growth to 25 cm was on the order of 15 years for the benthos.	Sainsbury et al. (In press)
Gravel pavement	Scallop dredge	Georges Bank	Assessed cumulative impact of fishing. Undredged sites had significantly higher percent cover of the tube-dwelling polychaete *Filograna implexa* and other emergent epifauna than dredged sites. Undredged sites had higher numbers of organisms, biomass, species richness, and species diversity than dredged sites. Undredged sites were characterized by bushy epifauna (bryozoans, hydroids, worm tubes) while dredged sites were dominated by hard-shelled molluscs, crabs, and echinoderms.	Collie et al. (1996, 1997)
Gravel-boulder	Assumed roller-rigged trawl	Gulf of Maine	Comparison of site surveyed in 1987 and revisited in 1993. Initially mud draped boulders and high density patches of diverse sponge fauna. In 1993, evidence of moved boulders, reduced densities of epifauna and extreme truncation of high density patches.	Auster et al. (1996)
Cobble-shell	Assumed trawl and scallop dredge	Gulf of Maine	Comparison of fished site and adjacent closed area. Statistically significant reduction in cover provided by emergent epifauna (e.g., hydroids, bryozoans, sponges, serpulid worms) and sea cucumbers.	Auster et al. (1996)
Gravel	Beam trawl	Irish Sea	An experimental area was towed 10 times. Density of epifauna (e.g., hydroids; soft corals, *Alcyonium digitatum*) was decreased approximately 50%.	Kaiser and Spencer (1996a)
Boulder-Gravel	Roller-rigged trawl	Gulf of Alaska	Comparisons of single tow trawled lane with adjacent reference lane. Significant reductions in density of structural components of habitat (two types of large sponges and anthozoans). No significant differences in densities of a small sponge and mobile invertebrate fauna. 20.1% boulders moved or dragged. 25% of ophiuroids (*Amphiophiura ponderosa*) in trawled lanes were crushed or damaged compared to 2% in reference lanes.	Freese et al. (In prep.)
Gravel over sand	Scallop dredge	Gulf of St. Lawrence	Assessed effects of single tows. Suspended fine sediments and buried gravel below the sediment-water interface. Overturns boulders.	Caddy (1973)

Source: Auster and Langton 1998.

Table 19 (continued). Studies of the impacts of fishing gear on the structural components of fish habitat.

Habitat	Gear Type	Location	Results	Reference(s)
Bryozoan beds (on sand and cobble)	Otter trawl and roller-rigged trawl	New Zealand	Qualitative comparison of closed and open areas. Two bryozoans produce "coral-like" forms and provide shelter for fishes and their prey. Comparisons of fished site with reference sites and prior observations from fishers show reduced density and size of colonies.	Bradstock and Gordon (1983)
Mussel bed	Otter trawl	Strangford Lough, Northern Ireland	Comparison of characteristics of trawled and untrawled *Modiolus modiolus* beds as pre and post impacts of a trawl. Trawled areas, confirmed with sidescan sonar, showed mussel beds disconnected with reductions in attached epibenthos. The most impacted sites were characterized by few or no intact clumps, mostly shell debris, and sparse epifauna. Trawling resulted in a gradient of complexity with flattened regions at the extreme. Immigration of *Nephrops* into areas previously dominated by *Modiolus* may result in burial of new recruits due to burrowing activities; precluding a return to a functional mussel bed habitat.	Magorrian (1995)
Sand-mud	Trawl and scallop dredge	Hauraki Gulf, New Zealand	Comparisons of 18 sites along a gradient of fishing effort (i.e., heavily fished sites through unfished reference sites). A gradient of increasing large epifaunal cover correlated with decreasing fishing effort.	Thrush et al. (In press)
Soft sediment	Scallop dredge	Port Phillip Bay, Australia	Compared reference and experimentally towed sites in BACI designed experiment. Bedforms consisted of cone shaped callianasid mounds and depressions prior to impact. Depressions often contained detached seagrasses and macroalgae. Only dredged plot changed after dredging. Eight days after dredging the area was flattened; mounds were removed and depressions filled. Most callianasids survived and density did not change in 3 mo following dredging. One month post impact, seafloor remained flat and dredge tracks distinguishable. Six months post impact mounds and depressions were present but only at 11 months did the impacted plot return to control plot conditions.	Currie and Parry (1996)
Sand	Beam trawl	North Sea	Observations of effects of gear. As pertains to habitat, trawl removed high numbers of the hydroid *Tubularia*.	DeGroot (1984)

Source: Auster and Langton 1998.

Table 19 (continued). Studies of the impacts of fishing gear on the structural components of fish habitat.

Habitat	Gear Type	Location	Results	Reference(s)
Gravel-sand-mud	Trawl	Monterey Bay	Comparison of heavily trawled (HT) and lightly trawled (LT) sites. The seafloor in the HT area had significantly higher densities of trawl tracks while the LT area had significantly greater densities of rocks >5 cm and mounds. The HT area had shell debris on the surface while the LT area had a cover of flocculent material. Emergent epifauna density was significantly higher for all taxa (anenomes, sea pens, sea whips) in the LT area.	Engel and Kvitek (MS1997)
Sand	Otter trawl	North Sea	Observations of direct effects of gear. Well buried boulders removed and displaced from sediment. Trawl doors smoothed sand waves. Penetrated seabed 0-40 mm (sand and mud).	Bridger (1970, 1972)
Sand-shell	Assumed trawl and scallop dredge	Gulf of Maine	Comparison of fished site and adjacent closed area. Statically significant reduction of habitat complexity based on reduced cover provided by biogenic depressions and sea cucumbers. Observations at another site showed multiple scallop dredge paths resulting in smoothed bedforms. Scallop dredge paths removed cover provided by hydrozoans which reduced local densities of associated shrimp species. Evidence of shell aggregates dispersed by scallop dredge.	Auster et al. (1996)
Sand-silt to mud	Otter trawl with chain sweep and roller gear	Long Island Sound	Diver observations showed doors produced continuous furrows. Chain gear in wing areas disrupted amphipod tube mats and bounced on bottom around mouth of net, leaving small scoured depressions. In areas with drifting macroalgae, the algae draped over grounder of net during tows and buffered effects on the seafloor. Roller gear also created scoured depressions. Spacers between discs lessened impacts.	Smith et al. 1985

Source: Auster and Langton 1998.

Table 20. Studies of short-term impacts of fishing on benthic communities.

Taxa	Gear and Sediment Type	Region	Results	Reference(s)
Infauna	beam trawl; megaripples and flat substrate	Irish Sea, U.K.	Assessed at the immediate effects of beam trawling and found a reduction in diversity and abundance of some taxa in the more stable sediments of the northeast sector of their experimental site but could not find similar effects in the more mobile sediments. Out of the top 20 species 19 had lower abundance levels at the fished site and nine showed a statistically significant decrease. Coefficient of variation for numbers and abundance was higher in the fished area of the NW sector supporting the hypothesis that heterogeneity increases with physical disturbance. Measured a 58% decrease in mean abundance and a 50% reduction in the mean number of species per sample in the sector resulting from removal of the most common species. Less dramatic change in the sector where sediments are more mobile.	Kaiser and Spencer (1996a)
Starfish	beam trawl; coarse sand, gravel and shell, muddy sand, mud	Irish Sea, U.K.	Evaluated damage to starfish at three sites in the Irish sea that experienced different degrees of trawling intensity. Used ICES data to select sites and used side scan to confirm trawling intensity. Found a significant correlation between starfish damage (arm regeneration) and trawling intensity.	Kaiser (1996)
Horse mussels	otter trawl; horse mussel beds,	Strangford Lough; N. Ireland	Used video/rov, side scan and benthic grabs to characterize the effect of otter trawling and scallop dredging on the benthic community. There was special concern over the impact on *Modiolus* beds in the Lough. Plotted the known fishing areas and graded impacts based on a subjective 6 point scale; found significant trawl impacts. Side scan supported video observations and showed areas of greatest impact. Found that in otter trawl areas that the otter boards did the most damage. Side scan suggested that sediment characteristics had changed in heavily trawled areas.	Industrial Science Division. (1990)
Benthic fauna	beam trawl; mobile megaripples structure and stable uniform sediment	Irish Sea, U.K.	Sampled trawled areas 24 hours after trawling and 6 months later. On stable sediment found significant difference immediately after trawling. Reduction in polychaetes but increase in hermit crabs. After six months there was no detectable impact. On megaripples substrate no significant differences were observed immediately after trawling or 6 months later.	Kaiser et al MS 1997

Source: Auster and Langton 1998.

Table 20 (continued). Studies of short-term impacts of fishing on benthic communities.

Taxa	Gear and Sediment Type	Region	Results	Reference(s)
Bivalves, sea scallop, surf clams, ocean quahog	scallop dredge, hydraulic clam dredge; various substrate types	Mid-Atlantic Bight, USA	Submersible study of bivalve harvest operations. Scallops harvested on soft sediment (sand or mud) had low dredge induced mortality for uncaught animals (<5%). Culling mortality (discarded bycatch) was low, approx. 10%. Over 90% of the quahogs that were discarded reburrowed and survived whereas 50% of the surf clams died. Predators crabs, starfish, fish and skates, moved in on the quahogs and clams in the predator density 10 items control area levels within 8 hours post dredging. Noted numerous "minute" predators feeding in trawl tracks. Non-harvested animals, sand dollars, crustaceans and worms significantly disrupted but sand dollars suffered little apparent mortality.	Murawski and Serchuck (1989)
Ocean quahog	hydraulic clam dredge;	Long Island, N.Y., USA	Evaluated clam dredge efficiency over a transect and changed up to 24 hours later. After dredge fills it creates a "windrow of clams". Dredge penetrates up to 30 cm and pushes sediment into track shoulders. After 24 hours track looks like a shallow depression. Clams can be cut or crushed by dredge with mortality ranging from 7 to 92 %, being dependent on size and location along dredge path. Smaller clams survive better and are capable of reburrowing in a few minutes. Predators, crabs, starfish and snails, move in rapidly and depart within 24 hours.	Meyer et al. (1981)
Macro-benthos	scallop dredge; coarse sand	Mercury Bay, New Zealand	Benthic community composed of small short-lived animals at two experimental and adjacent control sites. Sampling before and after dredging and three months later. Dredging caused an immediate decrease in density of common macrofauna. Three months later some populations had not recovered. Immediate post-trawling snails, hermit crabs and starfish were feeding on damaged and exposed animals	Thrush et al. (1995)
Scallops and associated fauna	scallop dredge; "soft sediment"	Port Phillip Bay, Australia	Sampled twice before dredging and three times afterwards, up to 88 days later. The mean difference in species number increased from 3 to 18 after trawling. The total number of individuals increased over the sampling time on both experimental and control primarily as a result of amphipod recruitment, but the number of individuals at the dredged sites were always lower than the control. Dissimilarity increased significantly, as a result of dredging, because of a decrease in species numbers and abundance.	Currie and Parry (1994)

Source: Auster and Langton 1998.

Table 20 (continued). Studies of short-term impacts of fishing on benthic communities.

Taxa	Gear and Sediment Type	Region	Results	Reference(s)
Sea Scallops and associated fauna	otter trawl and scallop dredge; gravel and sand	Gulf of St. Lawrence, Canada	Observed physical change to sea floor from otter doors and scallop dredge and lethal and nonlethal damage to the scallops. Noted an increase in the most active predators within the trawl tracks compared to outside; winter flounder, sculpins and rock crabs. No increase in starfish or other sedentary forms within in an hour of dredging.	Caddy (1973)
Macrofauna	beam trawl; hard-sandy substrate	North Sea, coast of Holland	Sampling before and after beam trawling (*hrs, 16 hrs and 2 weeks) showed species specific changes in macrofaunal abundance. Decreasing density ranged from 10 to 65% for species of echinoderms (starfish and sea urchins but not brittle stars), tube dwelling polychaetes and molluscs at the two week sampling period. Density of some animals did not change others increased but these were not significant after 2 weeks.	Bergman and Hup (1992)
Benthic fauna	beam trawl and shrimp trawl; hard sandy bottom, shell debris and sandy-mud	North Sea, German coast	Preliminary report using video and photographs comparing trawled and untrawled areas. Presence and density of brittle stars, hermit crabs, other "large" crustaceans and flatfish was higher in the controls than the beam trawl site. Difference in sand ripple formation in trawled areas was also noted, looking disturbed not round and well developed. Found a positive correlation with damage to benthic animals and individual animal size. Found less impact with the shrimp trawl, diver observations confirmed low level of impact although the net was "festooned" with worms. Noted large megafauna, mainly crabs, in trawl tracks.	Rumhor et al. (1994)
Soft bottom macrofauna	beam trawl; very fine sand	North Sea, Dutch Sector	Compared animal densities before and after trawling and looked at fish stomach contents. Found that total mortality due to trawling varied between species and size class of fish, ranging from 4 to 139% of pretrawling values. (values> 100% indicate animals moving into the trawled area). Mortality for echinoderms was low, 3 to 19%, undetectable for some molluscs, esp. solid shells or small animals, while larger molluscs had a 12 to 85% mortality. Burrowing crustaceans had low mortality but epifaunal crustaceans approximated 30 % but ranged as high as 74%. Annelids were generally unaffected except for Pectinaria, a tube building animal. Generally mortality increased with number of times the area was trawled (once or twice). Dab were found to be the major savager, immigrating into the area and eating damaged animals.	Santbrink and Bergman (1994)

Source: Auster and Langton 1998.

Table 20 (continued). Studies of short-term impacts of fishing on benthic communities.

Taxa	Gear and Sediment Type	Region	Results	Reference(s)
Hermit Crabs	beam trawl	Irish Sea, U.K.	Compared the catch and diet of two species of hermit crab on trawled and control sites. Found significant increases in abundance on the trawl lines two to four days after trawling for both species but also no change for one species on one of two dates. Found a general size shift towards larger animals after trawling. Stomach contents weight was higher post-trawling for one species. Diets of the crabs were similar but proportions differed.	Ramsey et al. (1996)
Sand macrofauna and infauna	scallop dredge	Irish Sea	Compared experimental treatments based frequency of tows (i.e., 2,4,12,25). Bottom topography changes did not change grain size distribution, organic carbon, or chlorophyll content. Bivalve molluscs and peracarid crustaceans did not show significant changes in abundance or biomass. Polychaetes and urchins showed significant declines. Large molluscs, crustaceans and sand eels were also damaged. In general, there was selective elimination of fragile and sedentary components of the infauna as well as large epifaunal taxa.	Eleftheriou and Robertson (1992)

Source: Auster and Langton 1998.

Table 20 (continued). Studies of short-term impacts of fishing on benthic communities.

Taxa	Gear and Sediment Type	Region	Results	Reference(s)
Hermit Crabs	beam trawl	Irish Sea, U.K.	Compared the catch and diet of two species of hermit crab on trawled and control sites. Found significant increases in abundance on the trawl lines two to four days after trawling for both species but also no change for one species on one of two dates. Found a general size shift towards larger animals after trawling. Stomach contents weight was higher post-trawling for one species. Diets of the crabs were similar but proportions differed.	Ramsey et al. (1996)
Sand macrofauna and infauna	scallop dredge	Irish Sea	Compared experimental treatments based frequency of tows (i.e., 2,4,12,25). Bottom topography changes did not change grain size distribution, organic carbon, or chlorophyll content. Bivalve molluscs and peracarid crustaceans did not show significant changes in abundance or biomass. Polychaetes and urchins showed significant declines. Large molluscs, crustaceans and sand eels were also damaged. In general, there was selective elimination of fragile and sedentary components of the infauna as well as large epifaunal taxa.	Eleftheriou and Robertson (1992)

Source: Auster and Langton 1998.

Table 21. Studies of long-term impacts of fishing on benthic communities.

Habitat Type and Taxa Present	Time Period	Location	Effect	Reference
Sand; macrobenthos and meiofauna	2-7 months	Bay of Fundy	Experimental trawling in high energy area. Otter trawl doors dug up to 5 cm deep and marks were visible for 2 to 7 months. Initial significant effects on benthic diatoms and nematodes but no significant impact on macrofauna. No significant longterm effects.	Brylinsky et al. (1994)
Quartz sand; benthic infauna	5months	South Carolina Estuary	Compared benthic community in two areas, one open to trawling one closed, before and after shrimp season. Found variation with time but no relationship between variations and trawling per se.	Van Dolah et al. (1991)
Sandy; ocean quahogs	----	Western Baltic	Observed otter board damage to bivalves, especially ocean quahogs, and found an inverse relation between shell thickness and damage and a positive correlation between shell length and damage.	Rumhor and Krost (1991)
Subtidal shallows and channel; macrobenthos	100 years	Wadden Sea	Reviewed changes in benthic community documented over 100 years. Considered 101species. No long term trends in changing abundance for 42 common species, with 11 showing considerable variation. Sponges, coelenterates and bivalves suffered greatest losses while polychaetes showed the largest gains. Decrease subtidally for common species from 53 to 44 and increase intertidally from 24 to 38.	Reise (1982)
Intertidal sand; lug worms	4 years	Wadden Sea	Studied impact of lugworm harvesting versus control site. Machine digs 40 cm gullies. Immediate impact is a reduction in several benthic species and slow recovery for some the larger long-lived species like soft shelled clams. With one exception, a polychaete, the shorter-lived macrobenthic animals showed no decline. It took several years for the area to recover to prefishing conditions.	Beukema (1995)
Various habitat types; all species	---	North Sea	Review of fishing effects on the North Sea based primarily on ICES North Sea Task Force reports. Starfish, sea urchins and several polychaetes showed a 40 to 60 % reduction in density after beam trawling but some less abundant animals showed no change and one polychaete increased. At the scale of the North Sea the effect of trawling on the benthos is unclear.	Gislason (1994)

Source: Auster and Langton 1998.

Table 21 (continued). Studies of long-term impacts of fishing on benthic communities.

Habitat Type and Taxa Present	Time Period	Location	Effect	Reference
Sand; macrofauna	73 years	Kattegatt	Compared benthic surveys form 1911-1912 with 1984. Community composition has changed with only approximately 30% similarity between years at most stations. Primary change was a decrease in sea urchins and increase in brittle stars. Animals were also smaller in 1984. Deposit feeders have decreased while suspension feeders and carnivores have increased.	Pearson et al. (1985)
Subtidal shallows and channels; Macrofauna	55 years	Wadden Sea, Germany	Documented increase in mussel beds and associated species such as polychaetes and barnacles when comparing benthic survey data. Noted loss of oyster banks, *Sabellaria* reefs and subtidal sea grass beds. Oysters were overexploited and replaced by mussels; *Zostera* lost to disease. Conclude that major habitat shifts are the result of human influence.	Riesen and Reise (1982)
146 stations; Ocean Quahogs	---	Southern North Sea, Europe	Arctica valves were collected from 146 stations in 1991 and the scars on the valve surface were dated, using internal growth bands, as an indicator of the frequency of beam trawl damage between 1959 and 1991. Numbers of scars varied regionally and temporally and correlated with fishing.	Witbaard and Klein (1994)
Various habitats; Macrofauna	85 years	Western English Channel, UK	Discusses change and causes of change observed in benthic community based on historic records and collections. Discusses effects of fishing gear on dislodging hydroid and bryozoan colonies, and speculates that effects reduce settlement sites for queen scallops.	Holme (1983)
Gravel/sand; Macrofauna	3 years	Central California, USA	Compared heavily trawled area with lightly trawled (closed) area using Smith MacIntyre grab samples and video transect data collected over three years. Trawl tracks and shell debris were more numerous in heavily trawled area, as were amphinomid polychaetes and oligochaetes in most years. Rocks, mounds and flocculent material were more numerous at the lightly trawled station. Commercial fish were more common in the lightly trawled area as were epifaunal invertebrates. No significant differences were found between stations in term of biomass of most other invertebrates.	Engel and Kvitek (MS 1997)
Fine sand; razor clam	----	Barrinha, Southern Portugal	Evaluated disturbance lines in shell matrix of the razor clam and found an increase in number of disturbance lines with length and age of the clams. Sand grains were often incorporated into the shell suggestive of a major disturbance , such as trawling damage, and subsequent recovery and repair of the shell.	Gaspar et al. (1994)

Source: Auster and Langton 1998.

Table 21 (continued). Studies of long-term impacts of fishing on benthic communities.

Habitat Type and Taxa Present	Time Period	Location	Effect	Reference
Fine to medium sand; ocean quahogs	----	Southern New Jersey, USA	Compared areas unfished, recently fished and currently fished for ocean quahogs using hydraulic dredges. Sampled invertebrates with a Smith MacIntyre grab. Few significant differences in numbers of individuals or species were noted, no pattern suggesting any relationship to dredging.	MacKenzie (1982)
Gravel, shell debris and fine mud; Horse mussel community	8 years	Strangford Lough, Northern Ireland	Review paper of effects of queen scallop fishery on the horse mussel community. Compared benthic survey from the 1975-80 period with work in 1988. Scallop fishery began in 1980. *Modiolus* community has remained unchanged essentially from 1857 to 1980. The scallop fishery has a large benthic faunal bycatch, including horse mussels. Changes in the horse mussel community are directly related to the initiation of the scallop fishery and there is concern about the extended period it will take for this community to recover.	Brown (1989)
Shallow muddy sand; scallops	6 months	Maine, USA	Sampled site before, immediately after and up to 6 months after trawling. Loss of surficial sediments and lowered food quality of sediments, measured as microbial populations, enzyme hydrolyzable amino acids and chlorophyll *a*, was observed. Variable recovery by benthic community. Correlation with returning fauna and food quality of sediment.	Watling et al. (MS 1997)
Sand and seagrass; hard shelled clams and bay scallops	4 years	North Carolina, USA	Evaluated effects of clam raking and mechanical harvesting on hard clams, bay scallops, macroinvertebrates and seagrass biomass. In sand, harvesting adults showed no clear pattern of effect. With light harvesting seagrass biomass dropped 25% immediately but recovered in a year. In heavy harvesting seagrass biomass fell 65% and recovery did not start for >2 years and did not recover up to 4 years later. Clam harvesting showed no effect on macroinvertebrates. Scallop densities correlated with seagrass biomass.	Peterson et al. (1987)
Gravel pavement; benthic magafauna	Not known	Northern Georges Bank, USA	Used side scan, video and naturalist dredge sampling to characterize disturbed and undisturbed sites based on fishing activity records. Documented a gradient of community structure from deep, undisturbed to shallow disturbed sites. Undisturbed sites had more individual organisms, greater biomass, greater species richness and diversity and were characterized by an abundant bushy epifauna. Disturbed sites were dominated by hard-shelled molluscs, crabs and echinoderms.	Collie et al. (1997)

Source: Auster and Langton 1998.

Table 21 (continued). Studies of long-term impacts of fishing on benthic communities.

Habitat Type and Taxa Present	Time Period	Location	Effect	Reference
Sand; epifauna	3 year	Grand Banks, Canada	Experimentally trawled site 12 times each year within 31 to 34 hours for three years. Total invertebrate bycatch biomass declined over the three year study in trawls. Epibenthic sled samples showed lower biomass, averaging 25%, in trawled areas than reference sites. Scavenging crabs were observed in trawl tracks after first 6 hours and trawl damage to brittle stars and sea urchins was noted. No significant effects of trawling were found for four dominant species of mollusc.	Prena et al. (MS 1997)
Sand, shrimp and macrobenthos	7 months	New South Wales, Australia	Sampled macrofauna, pretrawling, after trawling and after commercial shrimp season using Smith McIntyre grab at experimental and control sites. Under water observation of trawl gear were also made. No detectable changes in macrobenthos was found or observed.	Gibbs et al. (1980)
Soft sediment; scallops and associated fauna	17 months	Port Phillip Bay, Australia	Sampled 3 months before trawling and 14 months after trawling. Most species showed a 20 to 30% decrease in abundance immediately after trawling. Dredging effects generally were not detectable following the next recruitment within 6 months but some animals had not returned to the trawling site 14 months post trawling.	Currie and Parry (1996)
Bryozoans; fish and associated fauna	----	Tasman Bay, New Zealand	Review of ecology of the coral-like bryozoan community and changes in fishing gear and practices since the 1950s. Points out the interdependence of fish with this benthic community and that the area was closed to fishing in 1980 because gear had developed which could fish in and destroy the benthic community thereby destroying the fishery.	Bradstock and Gordon (1983)
Various habitat types; diverse tropical fauna	5+years, ongoing	North West Shelf, Australia	Describes a habitat dependent fishery and an adaptive management approach to sustaining the fishery. Catch rates of all fish and large and small benthos show that in closed areas fish and small benthos abundance increased over 5 years while large benthos (>25 cm) stayed the same or increased slightly. In trawled areas all groups of animals declined. Found that settlement rate and growth to 25 cm was on the order of 15 years for the benthos.	Sainsbury et al. (In press)

Source: Auster and Langton 1998.

Table 21 (continued). Studies of long-term impacts of fishing on benthic communities.

Habitat Type and Taxa Present	Time Period	Location	Effect	Reference
Mudflat; commercial clam cultivation and benthos	7 months	South-east England	Sampled benthic community on a commercial clam culture site and control area at the end of a two year growing period, immediately after sampling, and again 7 months later. Infaunal abundance was greatest under the clam culture protective netting but species composition was similar to controls. Harvesting with a suction dredge changed the sediment characteristics and reduced the numbers of individual animals and species. Seven months later the site had essentially returned to the unharvested condition.	Kaiser et al. (1996a)
Sand; razor clam and benthos	40 days	Loch Gairloch, Scotland	Compared control and experimentally harvested areas using a hydraulic dredge at 1 day and 40 days after dredging. On day one a non-selective reduction in the total numbers of all infaunal species was apparent but no differences were observed after forty days.	Hall et al. (1990)
Sand and muddy areas; Macro-zoobenthos	3years; ongoing	German Bite, Germany	Investigated macro-zoobenthos communities around a sunken ship that had been "closed" to fishing for three years. Compared this site with a heavily fished area. Preliminary results show an increase in polychaetes and the bivalve Tellina in the fished, sandy, area. The data does not yet allow for a firm conclusion regarding the unfished area but there is some (nonsignificant) increase in species numbers and some delicate, sensitive species occurred within the protected zone.	Arntz et al. (1994)

Source: Auster and Langton 1998.

Table 22. Total commercial landings in millions of pounds by gear type from Maine to Virginia, in 1995.

GEAR TYPE	X 10^6 POUNDS	% OF TOTAL
PURSE SEINE, MENHADEN	739	44.90%
TRAWL, OTTER, BOTTOM	249	15.12%
UNKNOWN	142	8.60%
DREDGE, CLAM	118	7.17%
PURSE SEINE, HERRING	76	4.63%
POT/TRAP, LOBSTER	71	4.32%
TRAWL, OTTER, MIDWATER	69	4.25%
GILL NET, SINK, OTHER	58	3.55%
DIVING GEAR	28	1.70%
DREDGE, SCALLOP, SEA	22	1.32%
POTS + TRAPS, OTHER	21	1.28%
DREDGE, OTHER	17	1.02%
OTHER	14	0.82%
LONGLINE, BOTTOM	10	0.62%
LONGLINE, PELAGIC	6	0.36%
GILL NET, OTHER	3	0.19%
POUND NET	2	0.13%
PURSE SEINE, OTHER	1	0.04%
GRAND TOTAL	1650	100.00%

Source: USDC weighout file 1995.

Table 23. Fishing gear used to catch more than 1% of the total landings of the Mid-Atlantic Council-managed species, in 1995 weighout data.

Species \ Gear	Dredge, Scallop Sea	Dredge, SC/OQ	Floating Traps, Shallow	Gill Nets, Drift, Other	Gill Nets Sink, Other	Lines, Hand, Other	Lines, Long, Bottom	Otter Trawl, Bottom, Fish	Otter, Trawl, Bottom, Other	Pots and Traps, Fish	Pots and Traps, Lobster, Inshore	Pots and Traps, Lobster, Offshore	Pound Nets, Fish	Pound Nets, Other	Unknown
Atlantic Mackerel			X		X			X	X					X	
Black Sea Bass						X		X		X	X	X			X
Bluefish			X	X	X	X		X					X	X	X
Butterfish								X							X
Illex								X							
Loligo								X							
Ocean Quahog		X													
Scup			X					X		X	X	X			X
Spiny Dogfish					X		X	X							
Summer Flounder	X							X	X					X	X
Surfclam		X													

Table 24. Fishing gear managed by South Atlantic Fishery Management Council.

Gear Impacts and Council Action
Gear Used in Fisheries Under South Atlantic Council Fishery Management Plans

The following is a list of gear currently in use (or regulated) in fisheries managed under the South Atlantic Council fishery management plans. In general, if gear is not listed, it is prohibited or not commonly used in the fishery:

Snapper Grouper Fishery Management Plan

1. Vertical hook-and-line gear, including hand-held rod and manual or electric reel or "bandit gear" with manual, electric or hydraulic reel (recreational and commercial).

2. Spear fishing gear including powerheads (recreational and commercial).

3. Bottom longlines (commercial).
   - Prohibited south of a line running east of St. Lucie Inlet, Florida and in depths less than 50 fathoms north of that line.
   - May not be used to fish for wreckfish.

4. Sea bass pots (commercial).
   - May not be used or possessed in multiple configurations.
   - Pot size, wire mesh size and construction restrictions.
   - May not be used in the EEZ south of a line running due east of the NASA Vehicle Assembly Building, Cape Canaveral, Florida.

5. Special Management Zones (created under the Snapper Grouper FMP).
   - Sea bass pots are prohibited in all Special Management Zones.
   - Fishing may only be conducted with hand-held hook-and-line gear (including manual, electric, or hydraulic rod and reel) and spearfishing gear in specified Special Management Zones, however, and other specified Special Management Zones a hydraulic or electric real that is permanent affixed to a vessel ("bandit gear") and or spear fishing gear (or only powerheads) are prohibited.

Shrimp Fishery Management Plan

1. Shrimp trawls -- wide-ranging types including otter trawls, mongoose trawls, rock shrimp trawls, etc. (commercial).
   - Specified areas are closed to trawling for rock shrimp.

Red Drum Fishery Management Plan

1. No harvest or possession is allowed in or from the EEZ (no gear specified).

Golden Crab Fishery Management Plan

1. Crab traps (commercial).
   - May not be fished in water depths less than 900 feet in the northern zone and 700 feet in the middle and southern zones.
   - Trap size, wire mesh size, and construction restrictions.

Coral, Coral Reefs, and Live/Hard Bottom Habitat

1. Hand harvest only for allowable species (recreational and commercial).
2. Oculina Bank Habitat Area of particular concern.
   - Fishing with bottom longlines, bottom trawls, dredges, ports, or traps is prohibited.
   - Fishing vessels may not anchor, use and anchor and chain, or use a grapple and chain.

Coastal Migratory Pelagic Resource Fishery Management Plan

1. Hook-and-line gear, usually rod and reel or bandit gear, hand lines, flat lines, etc. (recreational and commercial).
2. Run-around gillnets or sink nets (commercial).
   - A gillnet must have a float line less than 1,000 yards in length to fish for coastal migratory pelagic species.
   - Gillnets must be at least 4-3/4 inch stretch mesh.
3. Purse seines for other coastal migratory species (commercial) with an incidental catch allowance for Spanish mackerel (10%) and king mackerel (1%).
4. Surface longlines primarily for dolphin.

Source: SAFMC 1998.

Table 25. Proposed impact of fishing gear on summer flounder, scup, and black sea bass.

GEAR TYPE	KNOWN	POTENTIAL	NO EXPECTED
PURSE SEINE, MENHADEN			X
TRAWL, OTTER, BOTTOM		X	
UNKNOWN			X
DREDGE, CLAM		X	
PURSE SEINE, HERRING			X
POT/TRAP, LOBSTER		X	
TRAWL, OTTER, MIDWATER			X
GILL NET, SINK, OTHER		X	
DIVING GEAR			X
DREDGE, SCALLOP, SEA		X	
POTS + TRAPS, OTHER		X	
DREDGE, OTHER		X	
OTHER			X
LONGLINE, BOTTOM			X
LONGLINE, PELAGIC			X
GILL NET, OTHER		X	
POUND NET			X
PURSE SEINE, OTHER			X

Table 26. Matrix of prioritized threats in regards to their potential impact to summer flounder, scup, and black sea bass EFH along the Atlantic coast.

	IMPACTS																								
Threat	A. Change in Topography	B. Fish Blockage	C. Wetland alteration	D. Loss of SAV	E. Loss of riparian habitat	F. Erosion	G. Change in nature of substratight	H. Suspended sediments, turbidity	I. Change in temperature regime	J. Change in salinity regime	K. Change in circulation pattern	L. Hypoxia / Anoxia	M. Nutrient loading, Eutrophication	N. Change in photosynthesis regime	O. Water contamination	P. Sediment contamination	Q. Litter	R. Atmospheric Deposition	S. Loss in benthic organisms	T. Physical damage to organism	U. Gene pool deterioration	V. Trophic alteration	W. Pathogens, disease	X. Displacement of Species	Y. Introduction of exotic species
1.0 Coastal Development	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					*	
2.0 Nonpoint Source Pollution	*			*			*	*	*	*	*	*	*	*	*	*	*	*	*				*	*	
3.0 Dredging and Dredge Spoil Placement	*		*	*			*	*			*	*		*	*	*			*	*			*	*	
4.0 Port Development, Utilization, and Shipping	*		*				*	*				*		*	*	*		*	*	*				*	*
5.0 Marinas and Recreational Boating			*	*		*	*	*	*	*		*			*	*	*	*	*	*			*	*	*
6.0 Energy Production and Transport		*	*				*	*	*	*	*				*	*		*		*				*	
7.0 Sewage Treatment and Disposal			*				*	*	*			*	*	*	*	*			*				*	*	
8.0 Industrial Wastewater and Solid Wastes		*	*				*		*	*			*	*	*	*				*				*	
9.0 Marine Mining	*		*	*		*	*	*				*		*					*					*	
10.0 Aquaculture	*	*	*	*		*	*						*								*		*	*	*
11.0 Ocean Disposal							*	*				*	*	*	*	*							*	*	
12.0 Introduced Species	*			*				*													*	*	*	*	

Table 27. Importance of wetlands to summer flounder as habitat.

Species Name:	*Paralichthys dentatus*	Summer Flounder
Relationship to salt marsh habitat	The summer flounder (*Paralichthys dentatus*) depends on subtidal salt march creeks for foraging and nursery habitat in southern New England (Roundtree 1992; Able and Kaiser, 1994). Able and Kaiser provide the following summary of the importance of salt marsh creeks for summer flounder: "It is clear that estuaries are critical nursery areas throughout its range. High salinity subtidal creeks are the most important estuarine habitats because they provide optimal conditions for growth of juveniles, especially during the spring and summer of the first year." Summer flounder are rarely found north of Cape Cod (Bigelow and Schroeder 1953).	
Habitat requirements	*P. dentatus* exhibits a strong preference for subtidal habitat and makes only limited use of the intertidal portion of salt marsh creeks for foraging (Roundtree 1992; Able and Kaiser 1994). summer flounder stocks are currently at very low levels of abundance. It is believed that declining habitat quality and quantity has contributed to these low levels of abundance (Able and Kaiser 1994).	
Food web relationship	Quantitative data about this species' rate of biomass production in salt marsh habitats are lacking. Szedlmayer et al. (1992) reports that juvenile summer flounder exhibit among the fastest growth rates for estuarine fishes in subtidal salt marsh creeks in southern New Jersey.	
Food habitats	Several marsh-dependent species of fish are important components of the summer flounder's diet. The Atlantic silverside (*M. menidia*) and the common mummichog (*Fundulus heteroclitus*) are the most abundant fishes in the diet of juvenile summer flounder (Roundtree 1992). The sand shrimp (*C. septemspinosa*) is one of the principal food items in the diet of juvenile summer flounder. This species was found to comprise 38% of the diet of the juvenile summer flounder in subtidal creeks in southern New Jersey (Roundtree 1992). Sand shrimp were found to comprise 29% of the total diet of summer flounder in Great South Bay, Long Island (Poole 1964). The sand shrimp utilizes salt marsh creeks as spawning, nursery, and foraging habitat in New England (Roundtree 1992).	
Value	In 1993, almost ten million pounds of summer flounder, valued at $15.5 million, were landed in the northeastern United States. Commercial and recreational catches of *P. dentatus* began to decline from the waters of Rhode Island northward (Able and Kaiser 1994).	

Source: Minton 1997.

Table 28. Physical characteristics and nutrient loadings for eight major Mid-Atlantic estuaries.

Location	Volume (cubic ft.)	Surface Area (sq. mi.)	Average Daily Inflow (cfs)	Total Drainage Area (sq. mi.)	Estimated Nitrogen Loadings (tons/yr.)	Estimated Phosphorus Loadings (tons/yr.)
Delaware Bay	4.48×10^{11}	768	19,800	13,450	50,199 (High)	13,109 (High)
Delaware Inland Bays	3.85×10^{9}	33.3	300	292	1,425 (Med-High)	82 (Med.)
Chincoteague Bay	2.25×10^{10}	137	400	300	292 (Low)	84 (Low)
Chesapeake Bay	2.59×10^{12}	3,830	85,800	69,280	119,929 (High)	16,813 (High)
Albemarle-Pamlico Sound	1.08×10^{12}	2,949	46,000	29,574	28,224 (High)	3,565 (High)
Bogue Sound	1.31×10^{10}	102	1,300	680	710 (Low)	56 (Low)
New River	5.18×10^{9}	32	800	470	616 (Low)	112 (Med.)
Cape Fear River	1.22×10^{10}	38	10,100	9,090	8,102 (Med.)	1,486 (High)

Source: Cooper and Lipton 1994

Table 29. Recent trends in selected parameters characterizing eutrophication, by estuary.

Parameter	St. Croix R./Cobscook Bay M	St. Croix R./Cobscook Bay S	Englishman Bay M	Englishman Bay S	Narraguagus Bay M	Narraguagus Bay S	Blue Hill Bay M	Blue Hill Bay S	Penobscot Bay T	Penobscot Bay M	Penobscot Bay S	Muscongus Bay M	Muscongus Bay S	Damariscotta River M	Damariscotta River S
CHLOROPHYLL A (μg/l)	●	●	?	?	?	?	?	●	?	?	?	?	●	?	●
TURBIDITY	V•	●	?	Λ	?	?	?	●	?	?	?	?	?	?	●
NUISANCE ALGAE – event duration	●	●	?	?	?	?	?	?	?	●	●	?	?	?	●
NUISANCE ALGAE – frequency of occurrence	●	●	?	?	?	?	?	?	?	●	●	?	?	●	●
TOXIC ALGAE – event duration	●	●	?	●	?	●	?	●	?	●	●	?	?	?	●
TOXIC ALGAE – frequency of occurrence	●	●	?	●	?	?	?	●	?	●	●	?	?	●	●
MACROALGAL	Λ	Λ•	?	Λ	?	?	?	●	?	?	?	●	●	?	●
EPIPHYTE ABUNDANCE	?	●	?	?	?	?	?	?	?	?	?	●	●	●	●
NITROGEN (mg/l)	●	●	?	●	?	?	●	●	?	V•	●	?	●	●	●
PHOSPHORUS (mg/l)	●	●	?	?	?	?	●	●	●	●	●	?	●	●	●
BOTTOM DO (mg/l)	Λ	●	?	●	?	?	●	●	Λ	Λ	●	●	●	●	●
ANOXIA – event duration	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
ANOXIA – frequency of occurrence	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
ANOXIA – spatial coverage	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
HYPOXIA – event duration	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
HYPOXIA – frequency of occurrence	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
HYPOXIA – spatial coverage	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
BIOLOGICAL STRESS – event duration	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
BIOLOGICAL STRESS – frequency of occurrence	?	●	?	?	?	?	●	●	V	V	●	●•	?	●	●
BIOLOGICAL STRESS – spatial coverage	?	●	?	?	?	?	●	●	V	V	?	●•	?	●	●
PRIMARY PRODUCTIVITY	●•	●•	?	?	?	?	●	●	?	?	?	?	?	●•	●•
PLANKTONIC COMMUNITY	?	●	?	●	?	?	?	●	?	?	?	?	?	●	●
BENTHIC COMMUNITY	?	●	?	●	?	?	?	●	?	●	●	?	?	●	●
SAV (spatial coverage)	●	Λ	?	?	?	?	●	●	?	?	?	?	?	●	●•

Parameter	Sheepscot Bay T	Sheepscot Bay M	Sheepscot Bay S	Kennebec/Andro River T	Kennebec/Andro River M	Kennebec/Andro River S	Casco Bay M	Casco Bay S	Saco Bay M	Saco Bay S	Great Bay M	Great Bay S	Hampton Harbor M	Hampton Harbor S	Merdmack River T	Merdmack River M	Plum Island Sound M	Plum Island Sound S	Massachusetts Bay S	Boston Harbor M	Boston Harbor S	Cape Cod Bay S
CHLOROPHYLL A (μg/l)	?	●	●	?	?	?	●	●	●	●	●	●	?	?	?	?	●	●	●	?	●	●
TURBIDITY	●	●	●	?	?	?	V	●	?	?	●	●	?	?	?	?	●	●	●	●	●	●
NUISANCE ALGAE – event duration	●	●	●	?	?	?	●	●	●	●	●	●	●	●	?	?	●	●	●	?	?	●
NUISANCE ALGAE – frequency of occurrence	●	●	●	?	?	?	●	●	●	●	●	●	●	●	?	?	●	●	●	?	?	●
TOXIC ALGAE – event duration	●	●	●	?	?	?	●	●	●	●	●	●	●	●	?	?	●	●	●	?	?	●
TOXIC ALGAE – frequency of occurrence	●	●	●	?	?	?	●	●	●	●	●	●	●	●	?	?	●	●	●	?	?	●
MACROALGAL	●	●	●	?	?	?	●	Λ•	?	?	Λ•	Λ•	●	●	?	?	?	?	Λ	?	Λ•	Λ
EPIPHYTE ABUNDANCE	●	●	●	?	?	?	●	●	?	?	●•	●•	●	●	?	?	?	?	●	?	?	●
NITROGEN (mg/l)	●	●	●	?	?	?	●	●	●	●	●	●	?	?	?	?	●	●	●	?	●	Λ•
PHOSPHORUS (mg/l)	●	●	●	?	?	?	●	●	●	●	V	●	?	?	?	?	●	●	●	?	●	●
BOTTOM DO (mg/l)	Λ•	?	●	?	?	?	Λ	Λ	Λ	●	●	●	?	?	?	?	●	●	●	?	●	V•
ANOXIA – event duration	?	?	●	?	?	?	?	V	?	?	●	●	?	?	?	?	●	●	●	?	?	●
ANOXIA – frequency of occurrence	?	?	?	?	?	?	?	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
ANOXIA – spatial coverage	?	?	●	?	?	?	?	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
HYPOXIA – event duration	?	?	●	?	?	?	V	V	?	?	●	●	?	?	?	?	●	●	●	?	?	●
HYPOXIA – frequency of occurrence	?	?	?	?	?	?	V	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
HYPOXIA – spatial coverage	?	?	●	?	?	?	V	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
BIOLOGICAL STRESS – event duration	?	?	●	?	?	?	V	V	?	?	●	●	?	?	?	?	●	●	●	?	?	●
BIOLOGICAL STRESS – frequency of occurrence	?	?	?	?	?	?	●	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
BIOLOGICAL STRESS – spatial coverage	?	?	●	?	?	?	V	V	?	?	●	●	?	?	?	?	●	●	●	?	●	●
PRIMARY PRODUCTIVITY	?	●	●	●•	●•	●•	?	?	?	?	●	●	?	?	?	?	●	●	●	?	●	●
PLANKTONIC COMMUNITY	?	●	●	●•	●•	●•	?	●	?	?	?	●	?	?	?	?	●	●	●	?	●	●
BENTHIC COMMUNITY	●	●	●	●•	●•	●•	●	●	?	?	●	●	?	?	?	?	●	●	①	●	②	●
SAV (spatial coverage)	?	?	?	●•	●•	●•	●	V	?	?	Λ	Λ	●	●	?	V	●	●	V	●	V	V

? - unknown V - decreasing trend • - speculative response ● - no trend or shift Λ - increasing trend ① - shift from annelids to diverse ② - shift from a mixture of annelids and and crustaceans to crustaceans to crustaceans

Source: NOAA 1996, 1997a-b

Table 29 (continued). Recent trends in selected parameters characterizing eutrophication, by estuary.

Parameter		Buzzards Bay		Narragansett Bay			Gardiners Bay		Long Island Sound			Connecticut River		Great South Bay		Hudson R./Raritan Bay			Barnegat Bay		NJ Inland Bays	
		M	S	T	M	S	M	S	T	M	S	T	M	M	S	T	M	S	M	S	M	S
CHLOROPHYLL A (μg/l)		?	Λ•	●	●	●	●	●	●	●	●	?	?	●	●	?	●	●•	●	●	Λ•	Λ•
TURBIDITY (concentration)		?	?	●	●	●	●	●	●•	V	V	?	?	●	●	?	?	?	?	?	?	?
NUISANCE ALGAE	event duration	?	?	Λ	Λ	Λ	●	?	?	Λ	Λ	?	?	?	?	?	●•	●•	●	●	●	Λ•
	frequency of occurrence	?	?	Λ	Λ	Λ	●	?	?	Λ	Λ	?	?	?	?	?	●•	●•	●	●	●	Λ•
TOXIC ALGAE	event duration	?	?	?	?	?	?	?	●	●	●	?	?	●	●	?	●•	●•	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	?	●	●	●	?	?	●	●	?	?	?	●	●	●	●
MACROALGAL ABUNDANCE		?	?	Λ	Λ	?	Λ	V	?	Λ	●	?	?	●	●	?	?	?	?	?	?	?
EPIPHYTE ABUNDANCE		?	?	?	?	?	?	?	?	Λ	●	?	?	●	●	?	?	?	?	?	?	?
NITROGEN (mg/l)		?	Λ•	●	●	●	●	V	●	Λ•	●	●	?	●	●	V	●	●	?	?	?	?
PHOSPHORUS (mg/l)		?	?	●	●	●	●	V	●	Λ	●	●	?	●	●	●	V	V	?	?	?	?
BOTTOM DO (mg/l)		?	?	Λ	Λ	●	●	●	Λ	Λ	V	?	?	●	●	?	Λ	V	?	?	?	?
ANOXIA	event duration	?	?	V	V	●	●	●	●	●	Λ	?	?	●	●	?	V	●	?	?	?	?
	frequency of occurrence	?	?	V•	V•	?	?	?	?	?	Λ	?	?	?	?	?	V	?	?	?	?	?
	spatial coverage	?	?	V	V	●	●	●	●	●	Λ	?	?	●	●	?	V	●	?	?	?	?
HYPOXIA	event duration	?	?	V	V	●	●	●	●	●	Λ	V	?	●	●	?	V	Λ	?	?	?	?
	frequency of occurrence	?	?	V•	V•	V•	?	?	?	?	Λ	?	?	?	?	?	V	?	?	?	?	?
	spatial coverage	?	?	V	V	●	●	●	●	●	Λ	V	?	●	●	?	V	●	?	?	?	?
BIOLOGICAL STRESS	event duration	?	?	V	V	●	●	●	●	●	Λ	?	?	●	●	?	V	●	?	?	?	?
	frequency of occurrence	?	?	V•	V•	V•	?	?	?	?	Λ	?	?	?	?	?	?	?	?	?	?	?
	spatial coverage	?	?	V	V	●	●	●	●	●	Λ	?	?	●	●	?	V	●	?	?	?	?
PRIMARY PRODUCTIVITY		?	③	?	?	?	●	●	?	●•	●	?	?	●	●	?	③	③	?	?	?	●•
PLANKTONIC COMMUNITY		?	?	④	●	④	●	●	?	●	●	?	?	●	●	?	●	●	●•	●•	?	●•
BENTHIC COMMUNITY		?	?	①	●	●	?	?	●	●	●	?	?	●	●	⑤	●	①	●•	●•	?	?
SAV (spatial coverage)		V	V	●	●	●	Λ	Λ	V	V	V	?	?	V	V	?	V	V	?	?	?	?

Parameter		Delaware Bay			DE Inland Bays		MD Inland Bays		Chincoteague Bay	Chesapeake Bay			Patuxent River		Potomac River	
		T	M	S	M	S	M	S	S	T	M	S	T	M	T	M
CHLOROPHYLL A (μg/l)		●	●	●	●	●	V•	●	?	●•	●	●	Λ	●	●	V
TURBIDITY (concentration)		●	●	●	●	●	●	?	●	●	●	●	●	●	●	V
NUISANCE ALGAE	event duration	●	●	●	●	●	●	●	?	●	●	●	●	?	V	●
	frequency of occurrence	●	●	●	●	●	●	●	?	●	●	●	●	●	V	V
TOXIC ALGAE	event duration	●	●	●	?	?	?	?	?	●	●	●	?	?	●	●
	frequency of occurrence	●	●	●	?	?	?	?	?	●	●	●	?	?	●	●
MACROALGAL ABUNDANCE		●	●	●	?	?	?	?	?	●	●	●	●	●	V	●
EPIPHYTE ABUNDANCE		●	●	●	●	●	?	?	?	●	?	●	?	?	?	?
NITROGEN (mg/l)		V	V	V	●	●	V•	?	V•	●	Λ•	●	V	V	●	●
PHOSPHORUS (mg/l)		Λ	Λ	Λ	●	●	V	●	V•	●	V•	●	V	V	V	●
BOTTOM DO (mg/l)		Λ	Λ	●	●	●	●	●	●	●	●	●	Λ	●	Λ	●
ANOXIA	event duration	V	V	●	?	?	●	?	?	●	●	●	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	?	?	●	●	?	●	●	●	●
	spatial coverage	●	V	●	?	?	●	●	?	●	Λ	●	●	●	?	●
HYPOXIA	event duration	V	V	●	●	●	●	?	?	●	●	●	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	?	?	●	●	?	●	●	●	●
	spatial coverage	●	V	●	●	●	●	●	?	●	Λ	●	●	●	Λ	●
BIOLOGICAL STRESS	event duration	V	V	●	●	●	●	●	?	●	●	●	V	●	●	●
	frequency of occurrence	?	?	?	?	?	?	?	?	●	●	?	?	●	●	V
	spatial coverage	V	V	●	●	●	●	●	?	●	Λ	●	V	●	V	●
PRIMARY PRODUCTIVITY		●	●	●	●	●	?	?	?	●	●	?	?	?	?	?
PLANKTONIC COMMUNITY		●	④	④	①	●	●	●	?	●	●	●	●	●	●	●
BENTHIC COMMUNITY		?	?	②	●	●	●	●	?	●	●	●	●	●	●	●
SAV (spatial coverage)		●	●	●	●	●	●	?	Λ	●	Λ	Λ	Λ	●	Λ	Λ

Parameter		Rappahannock River		York River		James River		Chester River		Choptank River		Tar-/Pam. Sounds	
		T	M	T	M	T	M	T	M	T	M	T	M
CHLOROPHYLL A (μg/l)		Λ	Λ	Λ	Λ	Λ	Λ	●	●	●	●	Λ	Λ
TURBIDITY (concentration)		●	●	●	●	●	●	●	●	●	V	●	V
NUISANCE ALGAE	event duration	●	●	●	●	●	●	?	?	●	●	?	●
	frequency of occurrence	●	●	●	●	●	●	?	?	●	●	?	●
TOXIC ALGAE	event duration	●	●	●	●	●	●	?	?	●	●	?	●
	frequency of occurrence	●	●	●	●	●	●	?	?	●	●	?	●
MACROALGAL ABUNDANCE		●	●	●	●	●	●	?	?	●	●	?	Λ
EPIPHYTE ABUNDANCE		●	●	●	●	●	●	?	?	●	V	?	Λ
NITROGEN (mg/l)		●	●	●	●	●	●	●	●	●	●	?	V
PHOSPHORUS (mg/l)		Λ	●	Λ	●	●	●	●	●	●	V	?	V
BOTTOM DO (mg/l)		●	V	●	●	●	V	●	●	●	●	●	●
ANOXIA	event duration	?	?	●	●	●	?	●	●	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	●	●	●	Λ	●	●
	spatial coverage	?	?	●	●	●	?	●	●	●	●	●	●
HYPOXIA	event duration	?	?	●	●	●	?	●	●	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	●	●	●	Λ	●	●
	spatial coverage	?	?	●	●	●	?	●	●	●	●	●	●
BIOLOGICAL STRESS	event duration	●	?	●	●	●	?	●	●	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	●	●	●	Λ	●	●
	spatial coverage	●	?	●	●	●	?	●	●	●	●	●	●
PRIMARY PRODUCTIVITY		?	?	?	?	?	?	?	?	?	?	?	?
PLANKTONIC COMMUNITY		●	●	●	●	●	●	?	●	●	●	?	?
BENTHIC COMMUNITY		●	●	●	●	●	●	●	●	●	●	?	?
SAV (spatial coverage)		●	Λ	●	●	●	Λ	●	Λ	●	Λ	?	Λ

? - unknown V - decreasing trend • * - speculative response Λ - increasing trend ● - no trend or shift ① - shift to diverse mixture ② - shift to annelids and crustaceans ③ - shift to pelagic ④ - shift to diatoms ⑤ - shift to mollusks

Source: NOAA 1996, 1997a-b

Table 29 (continued). Recent trends in selected parameters characterizing eutrophication, by estuary.

Parameter	Albemarle/Pamlico Sounds (T M S)	Pamlico River (M)	Neuse River (T M)	Bogue Sound (M S)	New River (M S)	Cape Fear River (T M S)	Winyah Bay (T M S)	N & S Santee River (T M)
CHLOROPHYLL *A* (μg/l)	? ? ●•	Λ	● Λ	? ●	? ?	? ? ●	? ? ●	? ?
TURBIDITY (concentrations)	V ? ?	?	● ?	? ●	? ?	Λ ? ?	Λ Λ ●	V V
NUISANCE ALGAE — *event duration*	? ● ?	?	V Λ	● ●	? ?	? ? ?	●• ●• ●•	●• ●•
frequency of occurrence	? ● ?	?	V Λ	● ●	? ?	? ? ?	●• ●• ●•	●• ●•
TOXIC ALGAE — *event duration*	? ● ?	?	V Λ	● ?	? ?	? ? ?	●• ●• ●•	●• ●•
frequency of occurrence	? ● ?	?	V Λ	● ●	? ?	? ? ?	●• ●• ●•	●• ●•
MACROALGAL ABUNDANCE	V ? ?	?	? ●	? ●	? ?	● ● ●	? ? ?	●• ●•
EPIPHYTE ABUNDANCE	? ? ?	?	? ●	? ?	? ?	● ● ●	? ? ?	●• ●•
NITROGEN (mg/l)	? ● ?	●	Λ Λ	● ●	? ?	? ? ?	V V V	V V
PHOSPHORUS (mg/l)	? ● ?	V	● ●	● ●	? ?	? ? ?	V V V	V V
BOTTOM DO (mg/l)	? ? ?	V	V V	●• ●	? ?	? ? ?	? ? ?	? ?
ANOXIA — *event duration*	? ? ?	●	? Λ	● ●	? ?	? ? ?	? ? ?	? ?
frequency of occurrence	? ? ?	●	? Λ	● ●	? ?	? ? ?	? ? ?	? ?
spatial coverage	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
HYPOXIA — *event duration*	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
frequency of occurrence	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
spatial coverage	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
BIOLOGICAL STRESS — *event duration*	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
frequency of occurrence	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
spatial coverage	? ? ?	●	Λ Λ	● ●	? ?	? ? ?	? ? ?	? ?
PRIMARY PRODUCTIVITY	● ? ?	●	●• ●	? ?	? ?	? ? ?	? ? ●	? ?
PLANKTONIC COMMUNITY	● ? ?	●	① ●	● ●	? ?	? ? ?	? ? ●	? ?
BENTHIC COMMUNITY	? ? ?	?	? ?	? ●•	? ?	? ? ?	? ? ●	? ?
SAV (spatial coverage)	V V ?	V	● V	? ?	? ?	? ? ?	? ? ●	? ?
WETLANDS (spatial coverage)	● ● ?	●	● ●	● ●	? ?	? ? ?	? ● ●	● ●

Parameter	Charleston Harbor (T M S)	Stono/N. Edisto River (M S)	St. Helena Sound (M S)	Broad River (M S)	Savannah River (T M S)	Ossabaw Sound (T M S)
CHLOROPHYLL *A* (μg/l)	? ? ?	? ?	? ?	? ?	? ? ?	? ●• ?
TURBIDITY (concentrations)	? Λ Λ	Λ Λ	● ?	Λ ●	Λ ● ?	? ? ?
NUISANCE ALGAE — *event duration*	? ● ●•	? ?	? ?	? ?	? ● ●	? ● ●
frequency of occurrence	? ● ●•	? ?	? ?	? ?	? ● ●	? ● ●
TOXIC ALGAE — *event duration*	? ● ●•	? ?	? ?	? ?	? ● ●	? ● ●
frequency of occurrence	? ● ●•	? ?	? ?	? ?	? ● ●	? ● ●
MACROALGAL ABUNDANCE	Λ ? ?	● ●	? ?	? ?	? ● ●	? ? ?
EPIPHYTE ABUNDANCE	? ? ?	● ●	? ?	? ?	? ● ●	? ? ?
NITROGEN (mg/l)	V V V	V ?	V ?	● ?	● ● ●	● ● ?
PHOSPHORUS (mg/l)	V V V	V V	● ?	● ●	● ● ●	● ● ?
BOTTOM DO (mg/l)	? ? ?	? ?	? ?	? ?	? Λ ?	? ? ?
ANOXIA — *event duration*	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
frequency of occurrence	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
spatial coverage	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
HYPOXIA — *event duration*	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
frequency of occurrence	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
spatial coverage	? ? ?	? ?	? ?	? ?	? Λ ?	? ? ?
BIOLOGICAL STRESS — *event duration*	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
frequency of occurrence	? ? ?	? ?	? ?	? ?	? ? ?	? ? ?
spatial coverage	? ? ?	? ?	? ?	? ?	? Λ ?	? ? ?
PRIMARY PRODUCTIVITY	? ? ?	? ?	● ?	? ?	? ? ?	? ? ?
PLANKTONIC COMMUNITY	● ? ?	? ?	? ?	? ?	? ? ?	? ? ?
BENTHIC COMMUNITY	? ● ●	● ●	? ?	? ?	? ● ?	? ? ?
SAV (spatial coverage)	? Λ ?	● ●	? ?	? ?	? ● ●	? ? ?
WETLANDS (spatial coverage)	? ● ●	● ●	● ●	● ●	? V• V•	? ? ?

Parameter	St. Catherine/Sapelo Sound (M S)	Altamaha River (T M S)	St. Andrews/ St. Simon Sound (T M S)	St. Marys/Cumberland Sound (M S)	St. Johns River (T M S)	Indian River (S)	Biscayne Bay (M S)
CHLOROPHYLL *A* (μg/l)	? ?	? ? ?	? ? ?	? ?	● ● ●	Λ•	● ●
TURBIDITY (concentrations)	? ?	? ● ?	? ? ?	? ?	● ● ●	●	● V
NUISANCE ALGAE — *event duration*	● ●	? ● ?	? ● ●	● ●	● ● ●	●	●• ●•
frequency of occurrence	● ●	? ● ●	? ● ●	● ●	● ● ●	●	●• ●•
TOXIC ALGAE — *event duration*	● ●	? ● ●	? ● ●	● ●	● ● ●	●	●• ●•
frequency of occurrence	● ●	? ● ●	? ● ●	● ●	● ● ●	●	●• ●•
MACROALGAL ABUNDANCE	● ●	? ● ●	● ● ●	● ●	● ● ●	●	● ●
EPIPHYTE ABUNDANCE	● ●	? ● ●	● ● ●	● ●	● ● ●	?	● ●
NITROGEN (mg/l)	Λ• ?	V V ?	Λ• Λ• ?	● ?	● ● ●	●•	V Λ
PHOSPHORUS (mg/l)	Λ• ?	● ● ?	Λ• Λ• ?	● ?	● ● ●	●•	● V
BOTTOM DO (mg/l)	? ?	? ? ?	? ? ?	? ?	● ● ●	●	V V
ANOXIA — *event duration*	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
frequency of occurrence	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
spatial coverage	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
HYPOXIA — *event duration*	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
frequency of occurrence	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
spatial coverage	? ?	? ? ?	? ? ?	? ?	● ● ●	●	● ●
BIOLOGICAL STRESS — *event duration*	●• ?	●• ●• ?	●• ●• ?	●• ?	● ● ●	●	● ●
frequency of occurrence	●• ?	● ● ?	●• ●• ?	●• ?	● ● ●	●	● ●
spatial coverage	●• ?	●• ●• ?	●• ●• ?	●• ?	● ● ●	●	● ●
PRIMARY PRODUCTIVITY	? ?	? ? ?	? ? ?	? ?	? ? ?	●•	? ●
PLANKTONIC COMMUNITY	? ?	? ? ?	? ? ?	? ?	● ● ●	?	? ●
BENTHIC COMMUNITY	? ?	? ? ?	? ? ?	? ?	● ● ●	②	? ●
SAV (spatial coverage)	● ●	? ● ●	? ● ●	● ●	V V ●	V•	● Λ
WETLANDS (spatial coverage)	? ?	? ? ?	? ? ?	? ?	? ? ?	V•	V V

? - unknown V - decreasing trend • - speculative response ● - no trend or shift Λ - increasing trend ① - shift to diverse mixture ② - shift to annelids and crustaceans s

Source: NOAA 1996, 1997a-b.

Table 30. Numbers and types of 1997 summer flounder, scup, and black sea bass permits.

	Commercial Only	Charter / Party Only	Both	Total
Summer Flounder	948	487	32	1,467
Scup	838	337	43	1,218
Black Sea Bass	539	219	24	782
Total	2,352	1,043	99	3,468

Note: Since some vessels have more than one permit, totals in this table equal more than 1,970.

Table 31. Vessel characteristics by primary port state for vessels holding some combination of summer flounder, scup, black sea bass.

Primary Port State	Avg. Length in Feet	Avg. Gross Registered Tons
Connecticut	49	47
Delaware	39	14
Florida	58	64
Massachusetts	55	68
Maryland	51	40
Maine	53	59
North Carolina	62	81
New Hampshire	37	18
New Jersey	51	50
New York	45	37
Pennsylvania	65	94
Rhode Island	51	56
Virginia	66	100

Table 32. Number of summer flounder, scup, and black sea bass recreational fishing trips from 1991 to 1996[a].

	Summer Flounder	Scup	Black Sea Bass
1991	4,645,993	763,284	None
1992	3,751,815	495,201	218,700
1993	4,829,252	252,017	296,370
1994	5,761,918	221,074	265,402
1995	4,742,194	153,008	315,165
1996	5,086,347	145,814	282,972

[a] Number of fishing trips as reported by anglers in the Intercept Survey indicating that the primary species sought was summer flounder, scup, or black sea bass. North Atlantic, Mid-Atlantic, and South Atlantic regions combined. Estimates are not expanded.

Source: MRFSS.

Table 33. Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of summer flounder, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
FLOUNDER, SUMMER	7,502,369	21.74%	12,603,688	43.46%
SQUID (*LOLIGO*)	6,274,031	18.18%	4,263,054	14.70%
HAKE, SILVER	4,800,527	13.91%	2,355,299	8.12%
ANGLER	4,796,911	13.90%	2,420,082	8.34%
SKATES	1,671,168	4.84%	293,327	1.01%
MACKEREL, ATLANTIC	1,638,570	4.75%	254,176	0.88%
FLOUNDER, WINTER	1,364,069	3.95%	1,661,362	5.73%
BUTTERFISH	1,289,783	3.74%	809,594	2.79%
SCUP	813,065	2.36%	1,105,011	3.81%
FLOUNDER, YELLOWTAIL	692,259	2.01%	1,028,141	3.54%
HAKE, RED	611,842	1.77%	184,522	0.64%
COD	427,837	1.24%	337,673	1.16%
DOGFISH SPINY	415,929	1.21%	53,002	0.18%
BLUEFISH	338,606	0.98%	83,083	0.29%
SEA BASS, BLACK	333,810	0.97%	469,535	1.62%
FLOUNDER, SAND-DAB	250,598	0.73%	137,228	0.47%
CRAB, HORSESHOE	183,662	0.53%	50,330	0.17%
CROAKER, ATLANTIC	142,762	0.41%	27,584	0.10%
CONCHS	125,620	0.36%	48,143	0.17%
TILEFISH	112,421	0.33%	104,519	0.36%
FLOUNDER, WITCH	89,544	0.26%	118,361	0.41%
WHELK, KNOBBEDLED	88,173	0.26%	35,266	0.12%
FLOUNDER, AM. PLAICE	86,429	0.25%	140,108	0.48%
SCALLOP, SEA	46,773	0.14%	32,993	0.11%
LOBSTER	45,803	0.13%	182,569	0.63%
DOGFISH (NK)	42,869	0.12%	11,117	0.04%
HADDOCK	42,688	0.12%	46,255	0.16%
WEAKFISH, SQUETEAGUE	38,612	0.11%	29,224	0.10%
WHELK, CHANNELED	26,230	0.08%	18,866	0.07%
JOHN DORY	21,878	0.06%	6,944	0.02%
EEL, CONGER	18,397	0.05%	5,670	0.02%
CRAB, JONAH	16,240	0.05%	8,243	0.03%
HAKE, WHITE	15,943	0.05%	8,206	0.03%
POLLOCK	15,341	0.04%	9,172	0.03%
SQUID (*ILLEX*)	14,222	0.04%	3,310	0.01%
HERRING, ATLANTIC	13,250	0.04%	600	0.00%
TAUTOG	10,797	0.03%	12,531	0.04%
POUT, OCEAN	8,987	0.03%	1,832	0.01%
OTHER FISH	8,890	0.03%	7,593	0.03%
HERRING (NK)	7,807	0.02%	1,513	0.01%
WHITING, KING	7,711	0.02%	4,503	0.02%
WOLFFISHES	6,605	0.02%	1,227	0.00%
SEA ROBINS	6,399	0.02%	921	0.00%
SHAD, AMERICAN	4,806	0.01%	905	0.00%
FLOUNDER, FOURSPOT	4,424	0.01%	1,790	0.01%
BASS, STRIPED	3,796	0.01%	7,110	0.02%
WHITING, BLACK	3,586	0.01%	1,825	0.01%
SQUID (NS)	3,294	0.01%	2,145	0.01%
REDFISH	2,271	0.01%	1,566	0.01%

Table 33. (continued). Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of summer flounder, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
BONITO	1,886	0.01%	819	0.00%
CRAB, NK	1,573	0.00%	798	0.00%
TRIGGERFISH	1,199	0.00%	943	0.00%
CRAB, ROCK	975	0.00%	531	0.00%
SHEESHEAD	924	0.00%	254	0.00%
COBIA	857	0.00%	887	0.00%
SEA RAVEN	680	0.00%	90	0.00%
HAKE MIX RED & WHITE	587	0.00%	121	0.00%
TUNA, LITTLE	573	0.00%	32	0.00%
DRUM, BLACK	543	0.00%	257	0.00%
PUFFER, NORTHERN	522	0.00%	87	0.00%
CUSK	503	0.00%	372	0.00%
HALIBUT, ATLNTIC	334	0.00%	859	0.00%
SHRIMP (MANTIS)	320	0.00%	306	0.00%
OTHER SHELLFISH	320	0.00%	80	0.00%
MACKEREL, SPAN	289	0.00%	379	0.00%
SHARK, NK	258	0.00%	109	0.00%
MULLETS	256	0.00%	65	0.00%
SHARK, THRESHER	243	0.00%	157	0.00%
SHARK, LARGE COASTAL	223	0.00%	81	0.00%
SWORDFISH	201	0.00%	453	0.00%
HERRING, BLUE BACK	180	0.00%	360	0.00%
SHARK, PORBEAGLE	173	0.00%	214	0.00%
SPOT	167	0.00%	79	0.00%
DRUM, RED	135	0.00%	101	0.00%
CUNNER	127	0.00%	25	0.00%
SHARK, MAKO	75	0.00%	43	0.00%
TUNA, ALBACORE	43	0.00%	8	0.00%
TOADFISH, OYSTER	39	0.00%	11	0.00%
SHARK, SANDBAR	32	0.00%	4	0.00%
SPADEFISH	28	0.00%	5	0.00%
OCTOPUS	23	0.00%	11	0.00%
GROUPER	20	0.00%	40	0.00%
LUMPFISH	18	0.00%	9	0.00%
EEL, AMERICAN	12	0.00%	9	0.00%
SHRIMP (PENAEID)	12	0.00%	12	0.00%
MENHADEN	10	0.00%	1	0.00%
MACKEREL, KING	8	0.00%	23	0.00%
WEAKFISH, SPOTTED	8	0.00%	8	0.00%
PORGY, RED	7	0.00%	4	0.00%
AMBER JACK	3	0.00%	2	0.00%
CREVALLE	2	0.00%	1	0.00%
RIBBONFISH	1	0.00%	1	0.00%
ALL SPECIES	34,513,311		29,003,952	

Note: records with unknown vessel identity excluded.
Number of trips = 10,012.

Source: NMFS Weighout data.

Table 34. Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of scup, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
SQUID (*LOLIGO*)	3,545,394	23.45%	2,567,694	22.99%
SCUP	3,134,341	20.73%	4,180,176	37.43%
MACKEREL, ATLANTIC	3,125,662	20.68%	575,196	5.15%
HAKE, SILVER	2,307,319	15.26%	1,248,497	11.18%
BUTTERFISH	740,668	4.90%	557,825	4.99%
ANGLER	557,988	3.69%	268,058	2.40%
SEA BASS, BLACK	398,715	2.64%	532,546	4.77%
FLOUNDER, SUMMER	265,984	1.76%	600,404	5.38%
BLUEFISH	230,224	1.52%	64,384	0.58%
HAKE, RED	186,317	1.23%	62,549	0.56%
SQUID (NS)	159,945	1.06%	168,031	1.50%
FLOUNDER, WINTER	77,926	0.52%	101,661	0.91%
DOGFISH SPINY	58,469	0.39%	6,546	0.06%
SKATES	54,546	0.36%	10,634	0.10%
DOGFISH (NK)	34,367	0.23%	7,495	0.07%
SCALLOP, SEA	29,463	0.19%	18,914	0.17%
WEAKFISH, SQUETEAGUE	26,240	0.17%	21,033	0.19%
TILEFISH	25,638	0.17%	31,806	0.28%
FLOUNDER, YELLOWTAIL	20,643	0.14%	29,894	0.27%
OTHER FISH	19,463	0.13%	15,580	0.14%
SQUID (*ILLEX*)	16,885	0.11%	2,826	0.03%
LOBSTER	10,828	0.07%	50,986	0.46%
JOHN DORY	9,094	0.06%	3,434	0.03%
HERRING, ATLANTIC	8,000	0.05%	1,600	0.01%
HAKE, WHITE	7,359	0.05%	3,512	0.03%
COD	7,347	0.05%	6,012	0.05%
TAUTOG	7,137	0.05%	7,962	0.07%
SEA ROBINS	5,908	0.04%	1,141	0.01%
FLOUNDER, FOURSPOT	5,564	0.04%	2,464	0.02%
HERRING (NK)	5,036	0.03%	1,115	0.01%
POLLOCK	5,028	0.03%	3,990	0.04%
POUT, OCEAN	4,803	0.03%	1,283	0.01%
FLOUNDER, SAND-DAB	4,257	0.03%	2,037	0.02%
CROAKER, ATLANTIC	3,700	0.02%	308	0.00%
EEL, CONGER	3,306	0.02%	1,611	0.01%
FLOUNDER, WITCH	2,730	0.02%	3,345	0.03%
WHELK, CHANNELED	1,966	0.01%	775	0.01%
SHAD, AMERICAN	1,073	0.01%	327	0.00%
WHITING, BLACK	933	0.01%	678	0.01%
TRIGGERFISH	909	0.01%	427	0.00%
BONITO	859	0.01%	446	0.00%
CONCHS	783	0.01%	261	0.00%
CRAB, JONAH	737	0.00%	448	0.00%
BASS, STRIPED	701	0.00%	878	0.01%
CRAB, ROCK	476	0.00%	247	0.00%
HAKE MIX RED & WHITE	395	0.00%	79	0.00%

Table 34. (continued). Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of scup, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
SHARK, THRESHER	363	0.00%	331	0.00%
FLOUNDER, AM. PLAICE	301	0.00%	433	0.00%
REDFISH	245	0.00%	215	0.00%
CUSK	232	0.00%	184	0.00%
WHITING, KING	228	0.00%	132	0.00%
SHARK, PORBEAGLE	192	0.00%	104	0.00%
CUNNER	171	0.00%	31	0.00%
PERCH, WHITE	150	0.00%	65	0.00%
HADDOCK	114	0.00%	107	0.00%
TUNA, ALBACORE	63	0.00%	10	0.00%
CRAB, NK	45	0.00%	20	0.00%
CRAB, BLUE	38	0.00%	19	0.00%
SEA RAVEN	30	0.00%	3	0.00%
MACKEREL, SPAN	26	0.00%	14	0.00%
GROUPER	20	0.00%	40	0.00%
SHARK, NK	20	0.00%	10	0.00%
WOLFFISHES	6	0.00%	4	0.00%
TOADFISH, OYSTER	5	0.00%	1	0.00%
MULLETS	4	0.00%	2	0.00%
EEL, AMERICAN	2	0.00%	2	0.00%
RIBBONFISH	1	0.00%	1	0.00%
ALL SPECIES	15,117,382		11,168,843	

Note: records with unknown vessel identity excluded.
Number of trips = 2,240.

Source: NMFS Weighout data.

Table 35. Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of black sea bass, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
SQUID (*LOLIGO*)	3,001,075	25.46%	2,157,610	25.14%
HAKE, SILVER	2,281,697	19.36%	1,278,106	14.89%
SCUP	1,495,245	12.69%	1,771,661	20.64%
MACKEREL, ATLANTIC	1,461,886	12.40%	199,037	2.32%
SEA BASS, BLACK	748,113	6.35%	995,715	11.60%
ANGLER	652,266	5.53%	318,021	3.71%
BUTTERFISH	644,135	5.47%	490,212	5.71%
FLOUNDER, SUMMER	468,755	3.98%	897,688	10.46%
HAKE, RED	180,366	1.53%	60,517	0.71%
CROAKER, ATLANTIC	155,294	1.32%	26,283	0.31%
BLUEFISH	139,735	1.19%	46,264	0.54%
WEAKFISH, SQUETEAGUE	63,136	0.54%	19,680	0.23%
SKATES	61,644	0.52%	10,812	0.13%
OTHER FISH	57,015	0.48%	42,702	0.50%
SQUID (*ILLEX*)	52,338	0.44%	14,152	0.16%
FLOUNDER, YELLOWTAIL	52,210	0.44%	73,126	0.85%
DOGFISH SPINY	39,413	0.33%	4,821	0.06%
TILEFISH	39,083	0.33%	46,623	0.54%
FLOUNDER, WINTER	31,539	0.27%	46,353	0.54%
DOGFISH (NK)	30,917	0.26%	5,676	0.07%
SCALLOP, SEA	26,764	0.23%	16,932	0.20%
JOHN DORY	13,786	0.12%	7,506	0.09%
HERRING, ATLANTIC	11,400	0.10%	1,850	0.02%
FLOUNDER, SAND-DAB	6,741	0.06%	2,781	0.03%
SEA ROBINS	6,423	0.05%	1,077	0.01%
COD	6,091	0.05%	6,055	0.07%
FLOUNDER, FOURSPOT	5,549	0.05%	2,480	0.03%
BASS, STRIPED	5,432	0.05%	5,764	0.07%
FLOUNDER, WITCH	5,402	0.05%	6,100	0.07%
POUT, OCEAN	5,324	0.05%	2,051	0.02%
HERRING (NK)	4,712	0.04%	1,103	0.01%
FLOUNDER, AM. PLAICE	4,562	0.04%	3,078	0.04%
HAKE, WHITE	4,477	0.04%	1,959	0.02%
SQUID (NS)	3,877	0.03%	1,588	0.02%
EEL, CONGER	3,725	0.03%	1,737	0.02%
WHITING, KING	2,616	0.02%	1,023	0.01%
LOBSTER	2,599	0.02%	9,305	0.11%
WHELK, CHANNELED	1,359	0.01%	1,249	0.01%
POLLOCK	1,263	0.01%	582	0.01%
MENHADEN	1,200	0.01%	60	0.00%
SHAD, AMERICAN	1,088	0.01%	224	0.00%
WHITING, BLACK	1,043	0.01%	617	0.01%
DOGFISH SMOOTH	600	0.01%	100	0.00%
PERCH, WHITE	422	0.00%	86	0.00%
HAKE MIX RED & WHITE	402	0.00%	84	0.00%
CRAB, ROCK	385	0.00%	195	0.00%

Table 35. (continued). Landings by species for otter trawl (bottom fish gear) trips harvesting 100 pounds or more of black sea bass, 1997.

Common Name	Pounds	Species % of Total Pounds	Value	Species % of Total Value
TAUTOG	342	0.00%	415	0.00%
REDFISH	301	0.00%	249	0.00%
CUNNER	297	0.00%	51	0.00%
BONITO	235	0.00%	134	0.00%
CONCHS	214	0.00%	161	0.00%
CRAB, JONAH	208	0.00%	186	0.00%
MACKEREL, SPAN	188	0.00%	89	0.00%
CRAB, RED	180	0.00%	81	0.00%
FLOUNDER (NK)	178	0.00%	134	0.00%
WHELK, KNOBBED	145	0.00%	101	0.00%
PORGY, RED	136	0.00%	262	0.00%
SHARK, THRESHER	120	0.00%	86	0.00%
SHARK, SILKY	88	0.00%	38	0.00%
TRIGGERFISH	64	0.00%	32	0.00%
TUNA, ALBACORE	63	0.00%	10	0.00%
CRAB, HORSESHOE	60	0.00%	30	0.00%
WOLFFISHES	50	0.00%	21	0.00%
GIZZARD SHAD	48	0.00%	82	0.00%
GROUPER	45	0.00%	78	0.00%
SHRIMP (PENAEID)	39	0.00%	39	0.00%
SEA RAVEN	20	0.00%	2	0.00%
CRAB, NK	20	0.00%	8	0.00%
SHARK, NK	15	0.00%	8	0.00%
EEL, AMERICAN	9	0.00%	3	0.00%
POMPANO, COMMON	6	0.00%	2	0.00%
HADDOCK	5	0.00%	5	0.00%
MACKEREL, KING	5	0.00%	8	0.00%
MULLETS	4	0.00%	2	0.00%
RIBBONFISH	1	0.00%	1	0.00%
ALL SPECIES	11,786,190		8,582,963	

Note: records with unknown vessel identity excluded.
Number of trips = 1,016.

Source: NMFS Weighout data.

Table 36. Catch disposition for trips that kept 100 or more pounds of summer flounder, 1996, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
ANGLER	774	82.17%	1.04%	168	17.83%	0.23%	942
BLUEFISH	0	0.00%	0.00%	1	100.00%	0.00%	1
BUTTERFISH	17	97.14%	0.02%	1	2.86%	0.00%	18
COD	0	0.00%	0.00%	7	100.00%	0.01%	7
FLOUNDER, WINTER	0	0.00%	0.00%	9	100.00%	0.01%	9
FLOUNDER, SUMMER	70,820	98.74%	94.87%	900	1.26%	1.21%	71,720
FLOUNDER, WITCH	40	100.00%	0.05%	0	0.00%	0.00%	40
SCUP	72	73.33%	0.10%	26	26.67%	0.04%	99
SEA BASS, BLACK	1,465	98.87%	1.96%	17	1.13%	0.02%	1,482
WEAKFISH, SQUETEAGUE	45	59.45%	0.06%	31	40.55%	0.04%	76
HAKE, SILVER	193	100.00%	0.26%	0	0.00%	0.00%	193
SQUID (ILLEX)	66	100.00%	0.09%	0	0.00%	0.00%	66
ALL SPECIES	73,492	98.45%		1,159	1.55%		74,651

Source: Preliminary Sea Sampling data, 1996.
Number of trips = 109.

Table 37. Catch disposition for trips that kept 100 or more pounds of scup, 1996, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
BLUEFISH	41	100.00%	0.03%	0	0.00%	0.00%	41
FLOUNDER, SUMMER	48	100.00%	0.04%	0	0.00%	0.00%	48
HERRING, ATLANTIC	0	0.00%	0.00%	780	100.00%	0.61%	780
MACKEREL, ATLANTIC	71,584	79.46%	55.55%	18,500	20.54%	14.36%	90,084
MENHADEN	1	100.00%	0.00%	0	0.00%	0.00%	1
SCUP	3,199	36.46%	2.48%	5,574	63.54%	4.33%	8,773
SEA BASS, BLACK	955	27.00%	0.74%	2,582	73.00%	2.00%	3,537
WEAKFISH, SQUETEAGUE	3	100.00%	0.00%	0	0.00%	0.00%	3
HAKE, SILVER	0	0.00%	0.00%	250	100.00%	0.19%	250
SQUID (*LOLIGO*)	25,204	100.00%	19.56%	0	0.00%	0.00%	25,204
SQUID (*ILLEX*)	0	0.00%	0.00%	150	100.00%	0.12%	150
ALL SPECIES	101,035	78.40%		27,836	21.60%		128,871

Source: Preliminary Sea Sampling data, 1996.
Number of trips = 27.

Table 38. Catch disposition for trips that kept 100 or more pounds of black sea bass, 1996, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
ALEWIFE	425	73.91%	0.23%	150	26.09%	0.08%	575
ANGLER	265	100.00%	0.14%	0	0.00%	0.00%	265
BLUEFISH	83	100.00%	0.04%	0	0.00%	0.00%	83
BUTTERFISH	52	100.00%	0.03%	0	0.00%	0.00%	52
HERRING, BLUE BACK	50	0.28%	0.03%	18,000	99.72%	9.56%	18,050
FLOUNDER, SUMMER	986	71.55%	0.52%	392	28.45%	0.21%	1,378
HADDOCK	2	100.00%	0.00%	0	0.00%	0.00%	2
HERRING, ATLANTIC	7,200	90.23%	3.83%	780	9.77%	0.41%	7,980
MACKEREL, ATLANTIC	100,934	84.51%	53.63%	18,500	15.49%	9.83%	119,434
SCUP	2,369	34.27%	1.26%	4,544	65.73%	2.41%	6,913
SEA BASS, BLACK	6,060	68.43%	3.22%	2,796	31.57%	1.49%	8,856
HAKE, SILVER	153	37.97%	0.08%	250	62.03%	0.13%	403
SQUID (*LOLIGO*)	24,004	100.00%	12.75%	0	0.00%	0.00%	24,004
SQUID (*ILLEX*)	66	30.56%	0.04%	150	69.44%	0.08%	216
ALL SPECIES	142,649	75.79%		45,562	24.21%		188,211

Source: Preliminary Sea Sampling data, 1996.
Number of trips = 40.

Table 39. Catch disposition for trips that kept 100 or more pounds of summer flounder, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
SKATES	7,631,541	92.89%	17.27%	584,535	7.11%	1.32%	8,216,076
FLOUNDER, SUMMER	6,925,676	98.72%	15.67%	90,124	1.28%	0.20%	7,015,800
SQUID (LOLIGO)	5,910,197	99.62%	13.37%	22,755	0.38%	0.05%	5,932,952
HAKE, SILVER	5,606,510	99.06%	12.69%	53,326	0.94%	0.12%	5,659,836
MACKEREL, ATLANTIC	2,249,877	99.26%	5.09%	16,865	0.74%	0.04%	2,266,742
BUTTERFISH	2,157,449	96.21%	4.88%	85,058	3.79%	0.19%	2,242,507
ANGLER	1,814,050	99.39%	4.10%	11,216	0.61%	0.03%	1,825,266
SQUID (NS)	1,622,895	99.92%	3.67%	1,355	0.08%	0.00%	1,624,250
FLOUNDER, WINTER	1,117,390	98.74%	2.53%	14,300	1.26%	0.03%	1,131,690
SCUP	926,888	98.70%	2.10%	12,214	1.30%	0.03%	939,102
FLOUNDER, YELLOWTAIL	892,436	99.02%	2.02%	8,836	0.98%	0.02%	901,272
CRAB, HORSESHOE	676,681	77.35%	1.53%	198,180	22.65%	0.45%	874,861
SCALLOP, SEA	657,655	99.86%	1.49%	905	0.14%	0.00%	658,560
HAKE, RED	606,921	90.44%	1.37%	64,166	9.56%	0.15%	671,087
COD	377,611	99.66%	0.85%	1,307	0.34%	0.00%	378,918
DOGFISH SPINY	357,289	64.12%	0.81%	199,899	35.88%	0.45%	557,188
SEA BASS, BLACK	260,747	99.40%	0.59%	1,579	0.60%	0.00%	262,326
HAKE, WHITE	234,775	96.67%	0.53%	8,088	3.33%	0.02%	242,863
BLUEFISH	231,528	95.93%	0.52%	9,827	4.07%	0.02%	241,355
FLOUNDER, SAND-DAB	212,320	95.33%	0.48%	10,393	4.67%	0.02%	222,713
CROAKER, ATLANTIC	208,059	99.85%	0.47%	320	0.15%	0.00%	208,379
FLOUNDER (NK)	206,268	99.63%	0.47%	757	0.37%	0.00%	207,025
FLOUNDER, AM. PLAICE	186,831	99.67%	0.42%	620	0.33%	0.00%	187,451
DOGFISH (NK)	178,680	96.72%	0.40%	6,067	3.28%	0.01%	184,747
WHELK, CHANNELED	139,213	98.84%	0.32%	1,636	1.16%	0.00%	140,849
FLOUNDER, WITCH	87,299	97.91%	0.20%	1,862	2.09%	0.00%	89,161
TILEFISH	86,956	99.55%	0.20%	396	0.45%	0.00%	87,352
SQUID (ILLEX)	78,577	85.34%	0.18%	13,500	14.66%	0.03%	92,077
WEAKFISH, SQUETEAGUE	77,752	98.23%	0.18%	1,403	1.77%	0.00%	79,155
HERRING, ATLANTIC	68,843	23.59%	0.16%	222,955	76.41%	0.50%	291,798
LOBSTER	67,002	94.82%	0.15%	3,659	5.18%	0.01%	70,661
WHELK, KNOBBED	66,580	97.99%	0.15%	1,369	2.01%	0.00%	67,949
HAKE MIX RED & WHITE	53,597	100.00%	0.12%	0	0.00%	0.00%	53,597
CRAB (NK)	47,862	56.15%	0.11%	37,385	43.85%	0.08%	85,247
HADDOCK	42,869	100.00%	0.10%	1	0.00%	0.00%	42,870
DOGFISH SMOOTH	41,061	91.79%	0.09%	3,671	8.21%	0.01%	44,732
WHITING, KING	36,865	100.00%	0.08%	0	0.00%	0.00%	36,865
SHRIMP (PANDALID)	35,750	100.00%	0.08%	0	0.00%	0.00%	35,750
WHITING, BLACK	34,005	100.00%	0.08%	0	0.00%	0.00%	34,005
OTHER FISH	32,099	99.18%	0.07%	265	0.82%	0.00%	32,364
POLLOCK	30,595	100.00%	0.07%	0	0.00%	0.00%	30,595
JOHN DORY	16,895	94.33%	0.04%	1,015	5.67%	0.00%	17,910
CRAB, BLUE	16,304	100.00%	0.04%	0	0.00%	0.00%	16,304
MACKEREL, CHUB	15,067	100.00%	0.03%	0	0.00%	0.00%	15,067
POUT, OCEAN	14,350	98.56%	0.03%	210	1.44%	0.00%	14,560
SHRIMP (NK)	12,391	100.00%	0.03%	0	0.00%	0.00%	12,391
SEA ROBINS	11,311	48.22%	0.03%	12,145	51.78%	0.03%	23,456
TAUTOG	10,992	98.17%	0.02%	205	1.83%	0.00%	11,197
PORGY, RED	9,875	100.00%	0.02%	0	0.00%	0.00%	9,875
SHEEPSHEAD	8,982	100.00%	0.02%	0	0.00%	0.00%	8,982
BASS, STRIPED	6,672	79.42%	0.02%	1,729	20.58%	0.00%	8,401

Table 39. (continued). Catch disposition for trips that kept 100 or more pounds of summer flounder, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
SCULPINS	5,570	98.24%	0.01%	100	1.76%	0.00%	5,670
SHAD, AMERICAN	5,310	98.15%	0.01%	100	1.85%	0.00%	5,410
WOLFFISHES	5,210	100.00%	0.01%	0	0.00%	0.00%	5,210
CRAB, ROCK	5,161	99.04%	0.01%	50	0.96%	0.00%	5,211
HERRING, BLUE BACK	4,495	59.58%	0.01%	3,050	40.42%	0.01%	7,545
FLOUNDER, FOURSPOT	4,484	81.74%	0.01%	1,002	18.26%	0.00%	5,486
EEL, CONGER	3,820	40.21%	0.01%	5,680	59.79%	0.01%	9,500
MENHADEN	3,710	100.00%	0.01%	0	0.00%	0.00%	3,710
OTHER SHELLFISH	3,153	43.47%	0.01%	4,100	56.53%	0.01%	7,253
SPOT	2,600	99.62%	0.01%	10	0.38%	0.00%	2,610
WEAKFISH, SPOTTED	2,499	93.98%	0.01%	160	6.02%	0.00%	2,659
STARFISH	2,025	36.45%	0.00%	3,530	63.55%	0.01%	5,555
SHARK, SANDBAR	1,953	100.00%	0.00%	0	0.00%	0.00%	1,953
CRAB, JONAH	1,650	66.67%	0.00%	825	33.33%	0.00%	2,475
SHARK, PORBEAGLE	1,440	100.00%	0.00%	0	0.00%	0.00%	1,440
MACKEREL, SPAN	1,286	100.00%	0.00%	0	0.00%	0.00%	1,286
BONITO	1,133	100.00%	0.00%	0	0.00%	0.00%	1,133
MULLETS	1,098	100.00%	0.00%	0	0.00%	0.00%	1,098
CUSK	1,095	91.63%	0.00%	100	8.37%	0.00%	1,195
CLAM (NK)	1,000	100.00%	0.00%	0	0.00%	0.00%	1,000
REDFISH	938	98.95%	0.00%	10	1.05%	0.00%	948
CONCHS	736	100.00%	0.00%	0	0.00%	0.00%	736
WHELK, LIGHTNING	689	99.42%	0.00%	4	0.58%	0.00%	693
COBIA	684	100.00%	0.00%	0	0.00%	0.00%	684
SHARK (NK)	655	19.82%	0.00%	2,650	80.18%	0.01%	3,305
TRIGGERFISH	615	100.00%	0.00%	0	0.00%	0.00%	615
TUNA, YELLOWFIN	367	100.00%	0.00%	0	0.00%	0.00%	367
HALIBUT, ATLANTIC	248	100.00%	0.00%	0	0.00%	0.00%	248
SEA RAVEN	245	100.00%	0.00%	0	0.00%	0.00%	245
TUNA, ALBACORE	182	100.00%	0.00%	0	0.00%	0.00%	182
SWORDFISH	176	100.00%	0.00%	0	0.00%	0.00%	176
LUMPFISH	171	100.00%	0.00%	0	0.00%	0.00%	171
SCALLOP, CALICO	130	100.00%	0.00%	0	0.00%	0.00%	130
CRAB, RED	100	100.00%	0.00%	0	0.00%	0.00%	100
PUFFER, NORTHERN	78	100.00%	0.00%	0	0.00%	0.00%	78
TUNA, BLUEFIN	70	100.00%	0.00%	0	0.00%	0.00%	70
SHARK, THRESHR BGEYE	52	100.00%	0.00%	0	0.00%	0.00%	52
TUNA (NK)	45	100.00%	0.00%	0	0.00%	0.00%	45
MACKEREL, FRIGATE	38	100.00%	0.00%	0	0.00%	0.00%	38
SHARK, DUSKY	38	100.00%	0.00%	0	0.00%	0.00%	38
SHARK, THRESHER	37	100.00%	0.00%	0	0.00%	0.00%	37
SHARK, MAKO SHORTFIN	25	100.00%	0.00%	0	0.00%	0.00%	25
MACKEREL, KING	13	100.00%	0.00%	0	0.00%	0.00%	13
SHARK, BLUE	5	100.00%	0.00%	0	0.00%	0.00%	5
CUNNER	2	100.00%	0.00%	0	0.00%	0.00%	2
ALL SPECIES	42,465,069	96.09%		1,727,469	3.91%		44,192,538

Number of trips = 9,232

Source: Vessel Trip Report data, 1997.

Table 40. Catch disposition for trips that kept 100 or more pounds of scup, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
MACKEREL, ATLANTIC	3,673,253	97.74%	22.05%	84,985	2.26%	0.51%	3,758,238
SQUID (LOLIGO)	3,546,807	99.79%	21.29%	7,450	0.21%	0.04%	3,554,257
SCUP	3,014,710	98.20%	18.10%	55,209	1.80%	0.33%	3,069,919
HAKE, SILVER	2,185,973	99.44%	13.12%	12,230	0.56%	0.07%	2,198,203
BUTTERFISH	990,841	96.98%	5.95%	30,895	3.02%	0.19%	1,021,736
SQUID (NS)	849,722	99.96%	5.10%	375	0.04%	0.00%	850,097
SEA BASS, BLACK	324,061	99.07%	1.95%	3,027	0.93%	0.02%	327,088
FLOUNDER, SUMMER	237,430	96.77%	1.43%	7,924	3.23%	0.05%	245,354
SKATES	230,607	93.75%	1.38%	15,372	6.25%	0.09%	245,979
HAKE, RED	187,511	98.26%	1.13%	3,318	1.74%	0.02%	190,829
BLUEFISH	182,554	98.97%	1.10%	1,903	1.03%	0.01%	184,457
ANGLER	148,987	99.48%	0.89%	777	0.52%	0.00%	149,764
HERRING, ATLANTIC	130,754	81.21%	0.78%	30,251	18.79%	0.18%	161,005
WHITING, BLACK	80,558	99.63%	0.48%	300	0.37%	0.00%	80,858
FLOUNDER, WINTER	74,556	98.09%	0.45%	1,451	1.91%	0.01%	76,007
HAKE, WHITE	74,383	98.00%	0.45%	1,515	2.00%	0.01%	75,898
CROAKER, ATLANTIC	67,100	100.00%	0.40%	0	0.00%	0.00%	67,100
SQUID (ILLEX)	51,621	99.81%	0.31%	100	0.19%	0.00%	51,721
DOGFISH SPINY	47,621	40.35%	0.29%	70,400	59.65%	0.42%	118,021
DOGFISH (NK)	41,269	92.35%	0.25%	3,420	7.65%	0.02%	44,689
TILEFISH	19,144	99.87%	0.11%	25	0.13%	0.00%	19,169
LOBSTER	17,304	98.03%	0.10%	347	1.97%	0.00%	17,651
WHITING, KING	12,739	92.72%	0.08%	1,000	7.28%	0.01%	13,739
OTHER FISH	12,605	100.00%	0.08%	0	0.00%	0.00%	12,605
SCALLOP, SEA	11,914	99.67%	0.07%	40	0.33%	0.00%	11,954
WEAKFISH, SQUETEAGUE	10,302	98.78%	0.06%	127	1.22%	0.00%	10,429
TAUTOG	9,108	97.40%	0.05%	243	2.60%	0.00%	9,351
HAKE MIX RED & WHITE	7,660	100.00%	0.05%	0	0.00%	0.00%	7,660
FLOUNDER, YELLOWTAIL	7,341	99.86%	0.04%	10	0.14%	0.00%	7,351
DOGFISH SMOOTH	7,165	95.28%	0.04%	355	4.72%	0.00%	7,520
BASS, STRIPED	6,241	71.85%	0.04%	2,445	28.15%	0.01%	8,686
MENHADEN	6,000	100.00%	0.04%	0	0.00%	0.00%	6,000
FLOUNDER (NK)	4,468	100.00%	0.03%	0	0.00%	0.00%	4,468
FLOUNDER, AM. PLAICE	4,272	100.00%	0.03%	0	0.00%	0.00%	4,272
WHELK, CHANNELED	4,101	100.00%	0.02%	0	0.00%	0.00%	4,101
JOHN DORY	3,926	100.00%	0.02%	0	0.00%	0.00%	3,926
SCULPINS	3,750	100.00%	0.02%	0	0.00%	0.00%	3,750
WEAKFISH, SPOTTED	2,893	98.47%	0.02%	45	1.53%	0.00%	2,938
COD	2,783	100.00%	0.02%	0	0.00%	0.00%	2,783
SEA ROBINS	2,713	26.00%	0.02%	7,722	74.00%	0.05%	10,435
FLOUNDER, SAND-DAB	2,494	86.48%	0.01%	390	13.52%	0.00%	2,884
MACKEREL, CHUB	1,687	100.00%	0.01%	0	0.00%	0.00%	1,687
TRIGGERFISH	1,332	99.55%	0.01%	6	0.45%	0.00%	1,338
FLOUNDER, FOURSPOT	1,295	100.00%	0.01%	0	0.00%	0.00%	1,295
POUT, OCEAN	1,217	100.00%	0.01%	0	0.00%	0.00%	1,217
FLOUNDER, WITCH	1,102	100.00%	0.01%	0	0.00%	0.00%	1,102

Table 40. (continued). Catch disposition for trips that kept 100 or more pounds of scup, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
CRAB, RED	969	100.00%	0.01%	0	0.00%	0.00%	969
CRAB, BLUE	838	100.00%	0.01%	0	0.00%	0.00%	838
SHAD, AMERICAN	786	100.00%	0.00%	0	0.00%	0.00%	786
CRAB (NK)	636	38.71%	0.00%	1,007	61.29%	0.01%	1,643
WOLFFISHES	525	100.00%	0.00%	0	0.00%	0.00%	525
POLLOCK	444	100.00%	0.00%	0	0.00%	0.00%	444
EEL, CONGER	412	100.00%	0.00%	0	0.00%	0.00%	412
BONITO	345	100.00%	0.00%	0	0.00%	0.00%	345
REDFISH	296	100.00%	0.00%	0	0.00%	0.00%	296
SHARK, THRESHER	257	100.00%	0.00%	0	0.00%	0.00%	257
CRAB, ROCK	229	100.00%	0.00%	0	0.00%	0.00%	229
CUNNER	189	97.42%	0.00%	5	2.58%	0.00%	194
HADDOCK	75	100.00%	0.00%	0	0.00%	0.00%	75
HERRING, BLUE BACK	50	3.70%	0.00%	1,300	96.30%	0.01%	1,350
TUNA, ALBACORE	50	100.00%	0.00%	0	0.00%	0.00%	50
TUNA (NK)	45	100.00%	0.00%	0	0.00%	0.00%	45
MARLIN WHITE	40	100.00%	0.00%	0	0.00%	0.00%	40
SHARK (NK)	40	100.00%	0.00%	0	0.00%	0.00%	40
SCALLOP, BAY	40	100.00%	0.00%	0	0.00%	0.00%	40
MACKEREL, FRIGATE	23	100.00%	0.00%	0	0.00%	0.00%	23
SEA RAVEN	22	100.00%	0.00%	0	0.00%	0.00%	22
HALIBUT, ATLANTIC	20	100.00%	0.00%	0	0.00%	0.00%	20
CUSK	10	100.00%	0.00%	0	0.00%	0.00%	10
SHARK, BLUE	5	100.00%	0.00%	0	0.00%	0.00%	5
CRAB, HORSESHOE	0	0.00%	0.00%	95	100.00%	0.00%	95
ALL SPECIES	16,312,220	97.92%		346,064	2.08%		16,658,284

Number of trips = 1,848

Source: Vessel Trip Report data, 1997.

Table 41. Catch disposition for trips that kept 100 or more pounds of black sea bass, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
SQUID (LOLIGO)	2,514,627	99.68%	19.03%	8,070	0.32%	0.06%	2,522,697
SEA BASS, BLACK	2,065,918	97.55%	15.64%	51,959	2.45%	0.39%	2,117,877
HAKE, SILVER	1,866,772	99.18%	14.13%	15,482	0.82%	0.12%	1,882,254
MACKEREL, ATLANTIC	1,493,772	99.93%	11.31%	1,020	0.07%	0.01%	1,494,792
SCUP	1,355,067	98.75%	10.26%	17,218	1.25%	0.13%	1,372,285
BUTTERFISH	810,954	93.31%	6.14%	58,110	6.69%	0.44%	869,064
CROAKER, ATLANTIC	426,234	100.00%	3.23%	0	0.00%	0.00%	426,234
FLOUNDER, SUMMER	401,680	97.28%	3.04%	11,249	2.72%	0.09%	412,929
SQUID (NS)	365,180	99.62%	2.76%	1,400	0.38%	0.01%	366,580
ANGLER	188,584	99.35%	1.43%	1,236	0.65%	0.01%	189,820
HAKE, RED	167,722	97.08%	1.27%	5,036	2.92%	0.04%	172,758
BLUEFISH	153,147	98.43%	1.16%	2,450	1.57%	0.02%	155,597
SKATES	99,688	83.90%	0.75%	19,136	16.10%	0.14%	118,824
COD	97,021	98.86%	0.73%	1,115	1.14%	0.01%	98,136
OTHER FISH	85,838	100.00%	0.65%	0	0.00%	0.00%	85,838
WHITING, BLACK	83,455	95.64%	0.63%	3,800	4.36%	0.03%	87,255
LOBSTER	83,177	80.01%	0.63%	20,787	19.99%	0.16%	103,964
DOGFISH SPINY	44,697	25.55%	0.34%	130,216	74.45%	0.99%	174,913
SQUID (ILLEX)	41,946	89.35%	0.32%	5,000	10.65%	0.04%	46,946
FLOUNDER, YELLOWTAIL	36,469	99.70%	0.28%	108	0.30%	0.00%	36,577
SCALLOP, SEA	34,911	99.18%	0.26%	290	0.82%	0.00%	35,201
WHELK, CHANNELED	29,275	100.00%	0.22%	0	0.00%	0.00%	29,275
TAUTOG	27,598	96.37%	0.21%	1,040	3.63%	0.01%	28,638
FLOUNDER (NK)	27,172	100.00%	0.21%	0	0.00%	0.00%	27,172
FLOUNDER, WINTER	25,879	99.98%	0.20%	6	0.02%	0.00%	25,885
HAKE, WHITE	24,481	97.90%	0.19%	525	2.10%	0.00%	25,006
PORGY, RED	21,395	100.00%	0.16%	0	0.00%	0.00%	21,395
TILEFISH	21,239	99.88%	0.16%	25	0.12%	0.00%	21,264
HERRING, ATLANTIC	18,135	82.30%	0.14%	3,900	17.70%	0.03%	22,035
DOGFISH (NK)	17,592	99.72%	0.13%	50	0.28%	0.00%	17,642
FLOUNDER, AM. PLAICE	15,897	99.66%	0.12%	55	0.34%	0.00%	15,952
CRAB, JONAH	14,827	100.00%	0.11%	0	0.00%	0.00%	14,827
BASS, STRIPED	14,817	77.41%	0.11%	4,325	22.59%	0.03%	19,142
POLLOCK	13,010	100.00%	0.10%	0	0.00%	0.00%	13,010
WEAKFISH, SQUETEAGUE	12,788	99.84%	0.10%	20	0.16%	0.00%	12,808
HAKE MIX RED & WHITE	12,062	100.00%	0.09%	0	0.00%	0.00%	12,062
MACKEREL, CHUB	10,585	100.00%	0.08%	0	0.00%	0.00%	10,585
WHITING, KING	9,423	88.70%	0.07%	1,200	11.30%	0.01%	10,623
FLOUNDER, WITCH	8,292	99.76%	0.06%	20	0.24%	0.00%	8,312
HADDOCK	7,505	100.00%	0.06%	0	0.00%	0.00%	7,505
FLOUNDER, SAND-DAB	6,925	100.00%	0.05%	0	0.00%	0.00%	6,925
EEL, CONGER	6,322	100.00%	0.05%	0	0.00%	0.00%	6,322
HERRING, BLUE BACK	6,176	100.00%	0.05%	0	0.00%	0.00%	6,176
JOHN DORY	5,356	96.40%	0.04%	200	3.60%	0.00%	5,556
SEA RAVEN	4,537	100.00%	0.03%	0	0.00%	0.00%	4,537
LUMPFISH	4,445	100.00%	0.03%	0	0.00%	0.00%	4,445
POUT, OCEAN	3,725	98.94%	0.03%	40	1.06%	0.00%	3,765
DOGFISH SMOOTH	3,249	99.24%	0.02%	25	0.76%	0.00%	3,274

Table 41. (continued). Catch disposition for trips that kept 100 or more pounds of black sea bass, 1997, all gears combined.

Common Name	Kept lbs	% species	% total	Discarded lbs	% species	% total	Total lbs
SEA ROBINS	2,700	9.36%	0.02%	26,160	90.64%	0.20%	28,860
CRAB, HORSESHOE	2,675	100.00%	0.02%	0	0.00%	0.00%	2,675
TRIGGERFISH	2,241	100.00%	0.02%	0	0.00%	0.00%	2,241
REDFISH	1,929	100.00%	0.01%	0	0.00%	0.00%	1,929
GRUNTS	1,854	100.00%	0.01%	0	0.00%	0.00%	1,854
WHELK, KNOBBED	1,731	100.00%	0.01%	0	0.00%	0.00%	1,731
MENHADEN	1,600	57.14%	0.01%	1,200	42.86%	0.01%	2,800
WEAKFISH, SPOTTED	1,500	93.75%	0.01%	100	6.25%	0.00%	1,600
CONCHS	1,400	100.00%	0.01%	0	0.00%	0.00%	1,400
WOLFFISHES	1,375	100.00%	0.01%	0	0.00%	0.00%	1,375
FLOUNDER, FOURSPOT	1,233	100.00%	0.01%	0	0.00%	0.00%	1,233
CUNNER	1,204	96.86%	0.01%	39	3.14%	0.00%	1,243
WHELK, LIGHTNING	1,200	100.00%	0.01%	0	0.00%	0.00%	1,200
MACKEREL, KING	832	97.65%	0.01%	20	2.35%	0.00%	852
CRAB (NK)	764	26.82%	0.01%	2,085	73.18%	0.02%	2,849
CRAB, ROCK	562	99.47%	0.00%	3	0.53%	0.00%	565
MULLETS	491	100.00%	0.00%	0	0.00%	0.00%	491
CUSK	440	100.00%	0.00%	0	0.00%	0.00%	440
SHAD, AMERICAN	395	100.00%	0.00%	0	0.00%	0.00%	395
SHARK, THRESHER	337	100.00%	0.00%	0	0.00%	0.00%	337
MACKEREL, SPAN	181	100.00%	0.00%	0	0.00%	0.00%	181
SHARK, MAKO SHORTFIN	155	100.00%	0.00%	0	0.00%	0.00%	155
BONITO	130	100.00%	0.00%	0	0.00%	0.00%	130
TUNA, SKIPJACK	118	100.00%	0.00%	0	0.00%	0.00%	118
TUNA, ALBACORE	108	100.00%	0.00%	0	0.00%	0.00%	108
HALIBUT, ATLANTIC	95	100.00%	0.00%	0	0.00%	0.00%	95
SPADEFISH	90	100.00%	0.00%	0	0.00%	0.00%	90
SCULPINS	50	100.00%	0.00%	0	0.00%	0.00%	50
SHARK (NK)	40	100.00%	0.00%	0	0.00%	0.00%	40
DOLPHIN FISH	31	100.00%	0.00%	0	0.00%	0.00%	31
TUNA, BLUEFIN	30	100.00%	0.00%	0	0.00%	0.00%	30
TUNA, YELLOWFIN	22	100.00%	0.00%	0	0.00%	0.00%	22
GROUPER	20	100.00%	0.00%	0	0.00%	0.00%	20
TUNA, LITTLE	20	100.00%	0.00%	0	0.00%	0.00%	20
TUNA (NK)	15	100.00%	0.00%	0	0.00%	0.00%	15
EEL, AMERICAN	12	100.00%	0.00%	0	0.00%	0.00%	12
SHARK, MAKO	7	100.00%	0.00%	0	0.00%	0.00%	7
STURGEON, ATLANTIC	0	0.00%	0.00%	100	100.00%	0.00%	100
SHARK, HAMMERHEAD	0	0.00%	0.00%	15	100.00%	0.00%	15
ALL SPECIES	12,817,153	97.01%		394,835	2.99%		13,211,988

Number of trips = 2,420

Source: Vessel Trip Report data, 1997.

Table 42. Summary of 1989-1997 sea sampling data for trips catching summer flounder. Data are provided on: total trips (trips are not split for multiple areas), observed tows, summer flounder catch (lb), summer flounder kept (lb), summer flounder discard (lb), and percentage of summer flounder discard (lb) to summer flounder total catch (lb).

Year	Gear	Trips	Observed Tows	Total Summer Flounder Catch	Total Summer Flounder Kept	Total Summer Flounder Discard	Discard: Catch (%)
1989	All	57	413	53,714	48,406	5,308	9.9
1990	All	61	463	47,954	35,972	11,982	25.0
1991	All	82	635	61,650	50,410	11,240	18.2
1992	Trawl	66	643	136,632	118,026	18,606	13.6
	Scallop	8	178	1,477	767	710	48.1
	All	74	821	138,109	118,793	19,316	14.0
1993	Trawl	37	410	74,982	67,603	7,379	9.8
	Scallop	15	671	2,967	1,158	1,809	61.0
	All	52	1,081	77,949	68,761	9,188	11.8
1994	Trawl	51	574	174,347	163,734	10,612	6.1
	Scallop	14	651	5,811	435	5,376	92.5
	All	65	1,225	180,158	164,169	15,988	8.9
1995	Trawl	134	1,004	242,784	235,011	7,773	3.2
	Scallop	19	1,051	10,044	2,247	7,778	77.4
	All	153	2,055	252,828	237,258	15,551	6.2
1996	Trawl	111	653	101,389	90,789	10,600	10.5
	Scallop	24	1,083	9,575	1,345	8,230	86.0
	All	135	1,736	110,964	92,134	18,830	17.0
1997	Trawl	59	334	31,707	26,475	5,232	16.5
	Scallop	23	835	5,721	583	5,138	89.8
	All	82	1,169	37,428	27,058	10,370	27.7

Source: Terceiro pers. comm.

Table 43. Summary of 1994-1997 commercial vessel trip report (VTR) data for trips reporting discard of any species and catching summer flounder. Data are presented on: total trips, summer flounder catch (lb), summer flounder kept (lb), summer flounder discard (lb), and percentage of summer flounder discarded (lb) to summer flounder caught (lb).

Year	Gear	Trips	Total Summer Flounder Catch	Total Summer Flounder Kept	Total Summer Flounder Discard	Discard: Catch (%)
1994	Trawl	4,267	2,149,332	2,015,296	134,036	6.2
	Scallop	85	70,353	22,877	47,476	67.5
	All	4,352	2,219,685	2,038,173	181,512	8.2
1995	Trawl	3,733	2,444,231	2,332,516	111,715	4.6
	Scallop	113	78,758	25,084	53,674	68.2
	All	3,846	2,522,989	2,357,600	165,389	6.6
1996	Trawl	2,990	1,662,313	1,459,155	203,158	12.2
	Scallop	79	69,557	16,657	52,900	76.1
	All	3,069	1,731,870	1,475,812	256,058	14.8
1997	Trawl	3,044	988,599	851,090	137,509	13.9
	Scallop	51	21,553	4,665	16,888	78.4
	All	3,095	1,010,152	855,755	154,397	15.3

Source: Terceiro pers. comm.

Table 44. Commercial and recreational landings of summer flounder (1000 lbs) from Maine to Cape Hatteras, NC, 1981-1997.

Year	Commercial Landings	Commercial Discards	Percent Discards	Recreational Landings	Recreational Discards	Percent Discards	Total Catch
1984	37,765	N/A	N/A	18,766	2,286	11	58,817
1985	32,353	N/A	N/A	12,489	505	4	45,347
1986	26,866	N/A	N/A	17,862	3,183	15	47,911
1987	27,053	N/A	N/A	12,167	2,881	19	42,102
1988	32,377	N/A	N/A	14,844	1,889	11	49,110
1989	17,913	1,563	8	3,164	251	7	22,891
1990	9,257	2,676	22	5,135	1,294	20	18,362
1991	13,722	2,319	14	7,961	2,368	23	26,369
1992	16,599	1,521	8	7,147	1,894	21	27,161
1993	12,599	1,865	13	7,681	4,057	35	26,202
1994	14,524	1,997	12	9,063	3,179	26	28,764
1995	15,382	679	4	5,503	3,935	42	25,499
1996	12,721	1,021	7	10,371	3,602	26	27,714
1997	8,975	719	7	11,856	3,743	24	24,293

N/A = Not Available
Source: 1984-1996 SAW 25th, 1997 and Terceiro pers. comm..

Table 45. Commercial and recreation landings of scup (1000 lbs) from Maine to Cape Hatteras, NC, 1981-1997.

Year	Commercial Landings	Commercial Discards	Percent Discards	Recreational Landings	Recreational Discards	Percent Discards	Total Catch
1984	17,123	4,758	22	2,416	66	3	24,363
1985	14,822	9,224	38	6,094	119	2	30,258
1986	15,252	4,420	22	11,605	192	2	31,469
1987	13,382	5,593	29	6,186	84	1	25,245
1988	12,624	3,653	22	4,268	68	2	20,613
1989	8,181	4,914	38	5,558	86	2	18,739
1990	9,520	8,618	48	4,140	84	2	22,361
1991	15,141	7,782	34	8,087	172	2	31,182
1992	13,230	12,496	49	4,411	104	2	30,241
1993	9,839	3,166	24	3,197	62	2	16,264
1994	9,149	1,779	16	2,628	82	3	13,638
1995	6,378	4,535	42	1,314	73	5	12,300
1996	5,926	3,355	36	2,238	104	4	11,623
1997	4,804	3,953	45	1,056	55	5	9,868
Mean	11,098	5,589	33	4,514	96	2	21,297

Source: SAW 27th.

Table 46. Commercial, recreational, and foreign landings of black sea bass (1000 lbs) from Maine to Cape Hatteras, NC, 1981-1997.

Year	Comm. Landings	Rec. Landings	Foreign Landings	Comm. Discards	Percent Discards	Rec. Discards	Percent Discards	Total Catch
1984	4,332	1,470	40	386	8	75	5	6,303
1985	3,419	2,319	73	278	7	146	6	6,235
1986	4,191	12,394	22	315	7	324	3	17,247
1987	4,167	1,986	9	311	7	146	7	6,618
1988	4,142	2,736		300	7	302	10	7,480
1989	2,919	3,327		234	7	152	4	6,632
1990	3,501	2,795		218	6	298	10	6,812
1991	2,804	4,160		121	4	315	7	7,401
1992	3,007	2,643		324	10	337	11	6,312
1993	3,113	4,478		152	5	212	5	7,954
1994	1,975	2,976		152	7	247	8	5,351
1995	2,039	5,714		29	1	452	7	8,234
1996	3,245	5,814		35	1	364	6	9,458
1997	2,458	3,153		278	10	N/A	N/A	N/A
Mean (84-96)	3,297	4,063	11	220	6	259	7	7,849

N/A = Not Available
Source: 1984-1996 SAW 25, 1997 SAW 27th.

Table 47. The percentage (%) of summer flounder caught and landed by recreational fishermen for each mode, North Atlantic, Mid-Atlantic, and North Carolina, 1986-1997.

	Catch (Number)			Landing (Weight)		
Mode	North Atlantic	Mid-Atlantic	North Carolina	North Atlantic	Mid-Atlantic	North Carolina
Shore	6.3	7.6	48.6	3.5	4.2	42.4
Party / Charter	1.6	11.7	0.4	1.8	15.7	0.5
Private / Rental	92.1	80.7	51.0	94.6	80.1	57.1

Source: Unpublished MRFSS data.

Table 48. The percentage (%) of scup caught and landed by recreational fishermen for each mode, North Atlantic, Mid-Atlantic, and North Carolina, 1986-1997.

	Catch (Number)			Landing (Weight)		
Mode	North Atlantic	Mid-Atlantic	North Carolina	North Atlantic	Mid-Atlantic	North Carolina
Shore	8.5	7.9	47.6	5.5	4.7	30.2
Party / Charter	11.9	18.6	4.5	13.1	18.3	10.9
Private / Rental	79.5	73.5	47.8	81.4	77.0	58.9

Source: Unpublished MRFSS data.

Table 49. The percentage (%) of black sea bass caught and landed by recreational fishermen for each mode, North Atlantic, Mid-Atlantic, and North Carolina, 1986-1997.

	Catch (Number)			Landing (Weight)		
Mode	North Atlantic	Mid-Atlantic	North Carolina	North Atlantic	Mid-Atlantic	North Carolina
Shore	5.1	9.8	12.2	2.2	2.2	1.9
Party / Charter	17.6	47.8	18.4	19.6	67.4	46.5
Private / Rental	77.3	42.4	69.4	78.2	30.4	51.6

Source: Unpublished MRFSS data.

Table 50. 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 51. 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 52. 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 53. Mean recreational anglers' ratings of reasons for marine fishing, by subregion.

	New England			Mid-Atlantic		
Statement	Not Important	Somewhat Important	Very Important	Not Important	Somewhat Important	Very Important
To Spend Quality Time with Friends and Family	4.4%	14.3%	81.3%	3.0%	12.0%	85.0%
To Enjoy Nature and the Outdoors	1.4%	10.1%	88.5%	1.1%	11.6%	87.3%
To Catch Fish to Eat	42.2%	37.4%	20.4%	29.3%	40.1%	30.6%
To Experience the Excitement or Challenge of Sport Fishing	6.2%	24.9%	68.8%	8.4%	26.0%	65.6%
To be Alone	55.0%	27.9%	17.1%	57.7%	25.8%	16.4%
To Relax and Escape from my Daily Routine	3.4%	13.3%	83.3%	2.6%	11.9%	85.5%
To Fish in a Tournament of when Citations are Available	78.6%	14.0%	7.4%	73.4%	17.1%	9.5%

Source: Steinback and O'Neil. MS.

Table 54. Mean recreational anglers' ratings of fishing regulation methods, by subregion.

	New England		Mid-Atlantic	
Type of Regulation	Support	Oppose	Support	Oppose
Limits on Minimum Size of Fish You Can Keep	92.5%	7.5%	93.2%	6.8%
Limits on the Number of Fish You Can Keep	91.1%	8.9%	88.3%	11.7%
Limits on the Times of the Year When You Can Keep the Fish You Catch	78.8%	21.2%	77.1%	22.9%
Limits on the Areas You Can Catch Fish	67.9%	32.1%	66.0%	34.0%

Source: Steinback and O'Neil. MS.

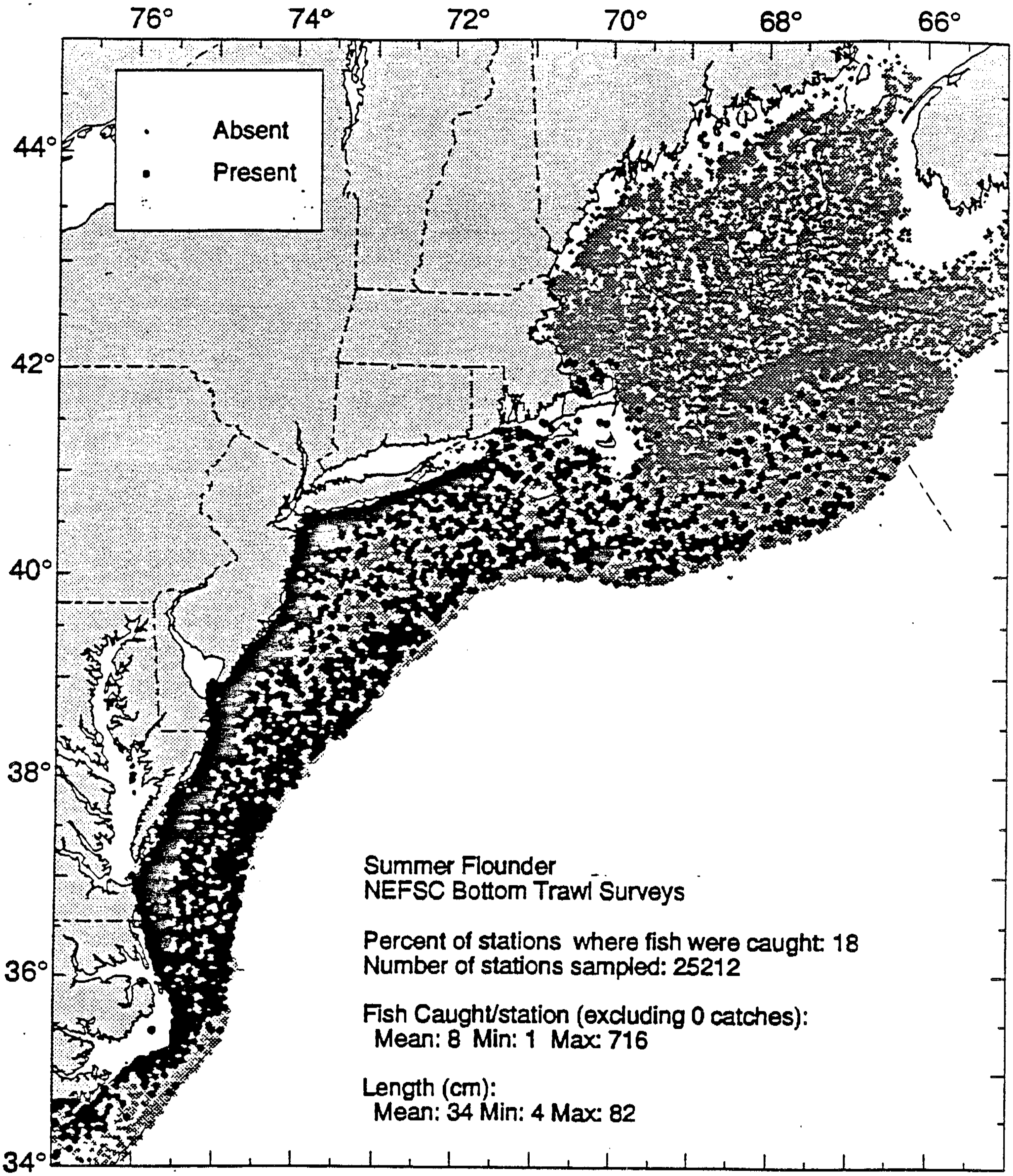


Figure 1. Distribution of summer flounder adults and juveniles. From National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) groundfish surveys for spring (1968-1997), summer (1964-1995), fall (1963-1996), and winter (1964-1997). Sampling was conducted by stratified random design using 0.5 hr tows and a #36 Yankee trawl with a 12.7 mm mesh liner in the codend.
Source: Packer and Griesbach 1998.

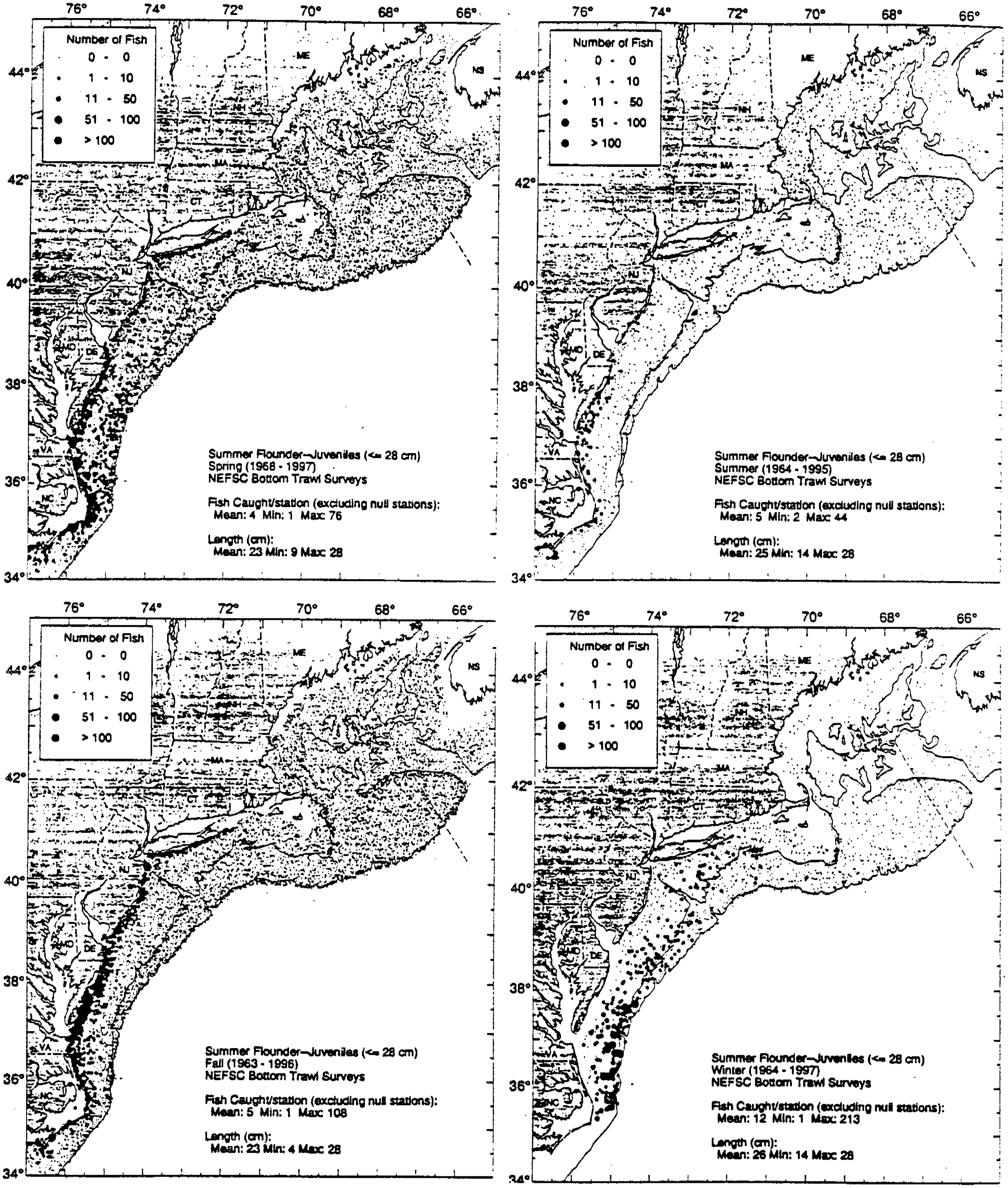


Figure 2. Distribution of juvenile summer flounder (<28.0 cm TL) by season. From National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) groundfish surveys for a) spring (1968-1997) b) summer (1964-1995) c) fall (1963-1996) and d) winter (1964-1997). Sampling was conducted by stratified random design using 0.5 hr tows and a #36 Yankee trawl with a 12.7 mm mesh liner in the codend. Collections where no juveniles were caught are shown as small dots.
Source: Packer and Griesbach 1998.

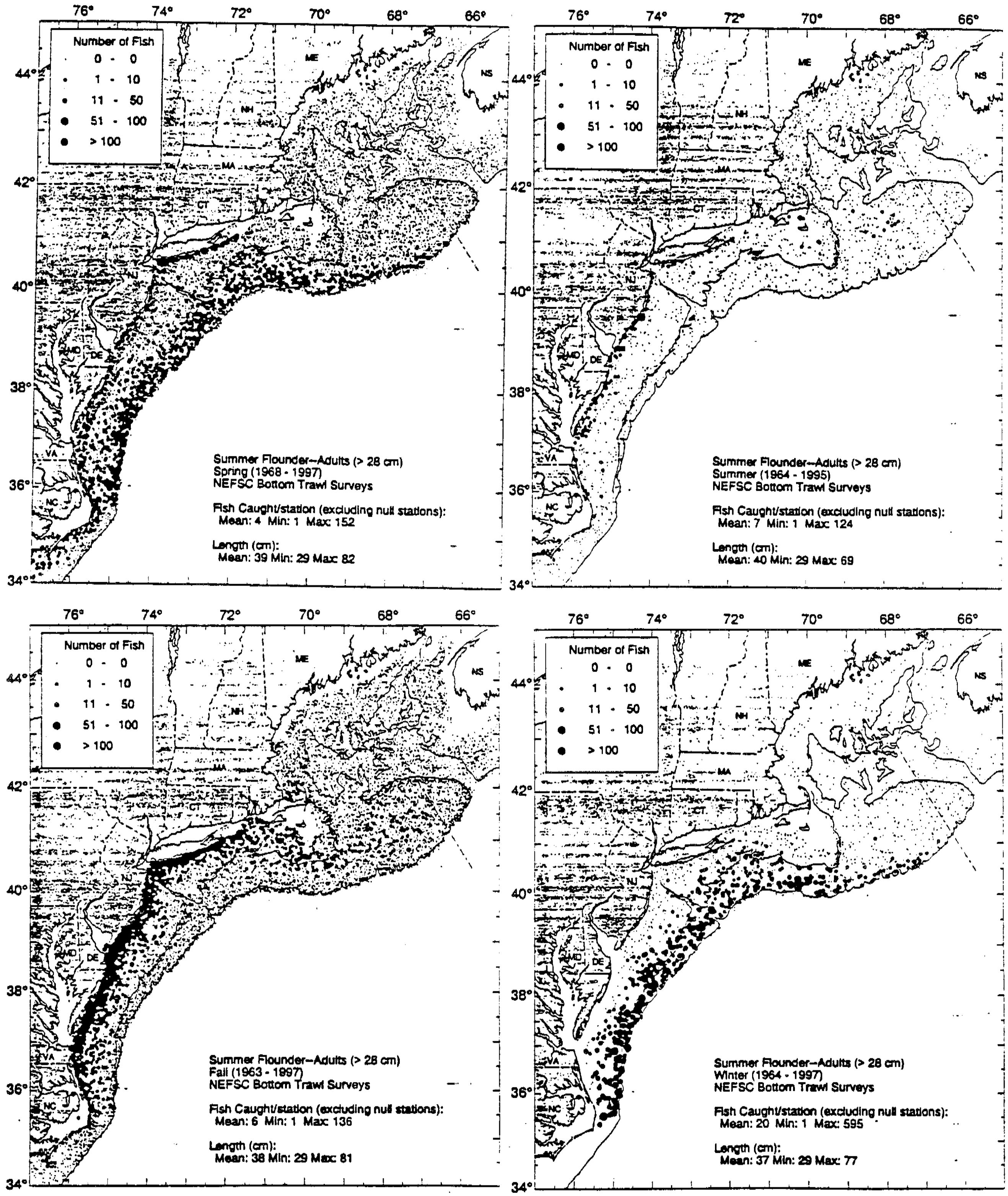


Figure 3. Distribution of adult summer flounder (>28.1 cm TL) by season. From National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) groundfish surveys for a) spring (1968-1997), b) summer (1964-1995), c) fall (1963-1996), and d) winter (1964-1997). Sampling was conducted by stratified random design using 0.5 hr tows and a #36 Yankee trawl with a 12.7 mm mesh liner in the codend. Collections where no adults were caught are shown as small dots.
Source: Packer and Griesbach 1998.

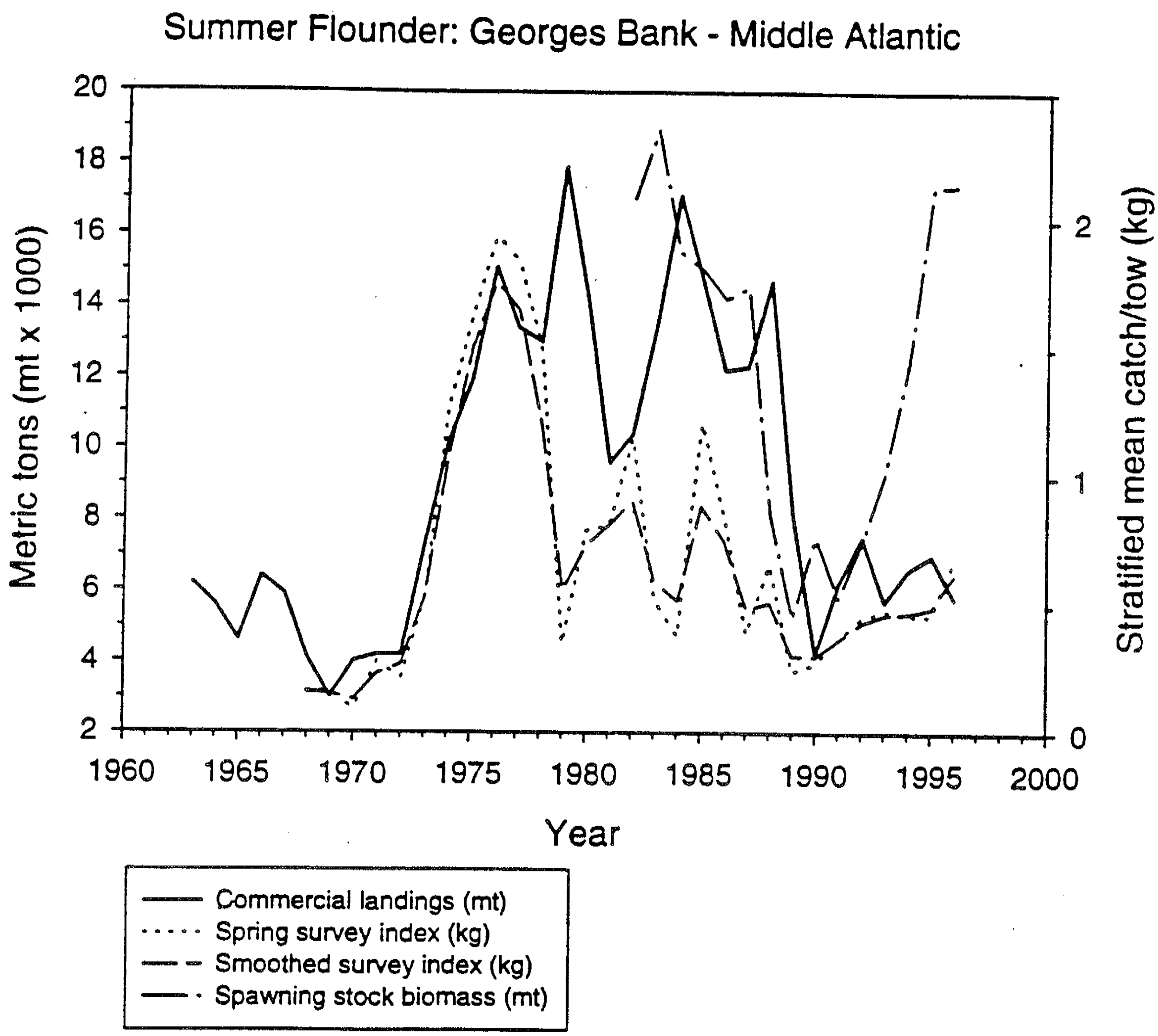


Figure 4. Commercial landings, NEFSC survey indices, and stock biomass for summer flounder in the Mid-Atlantic.
Source: Packer and Griesbach 1998.

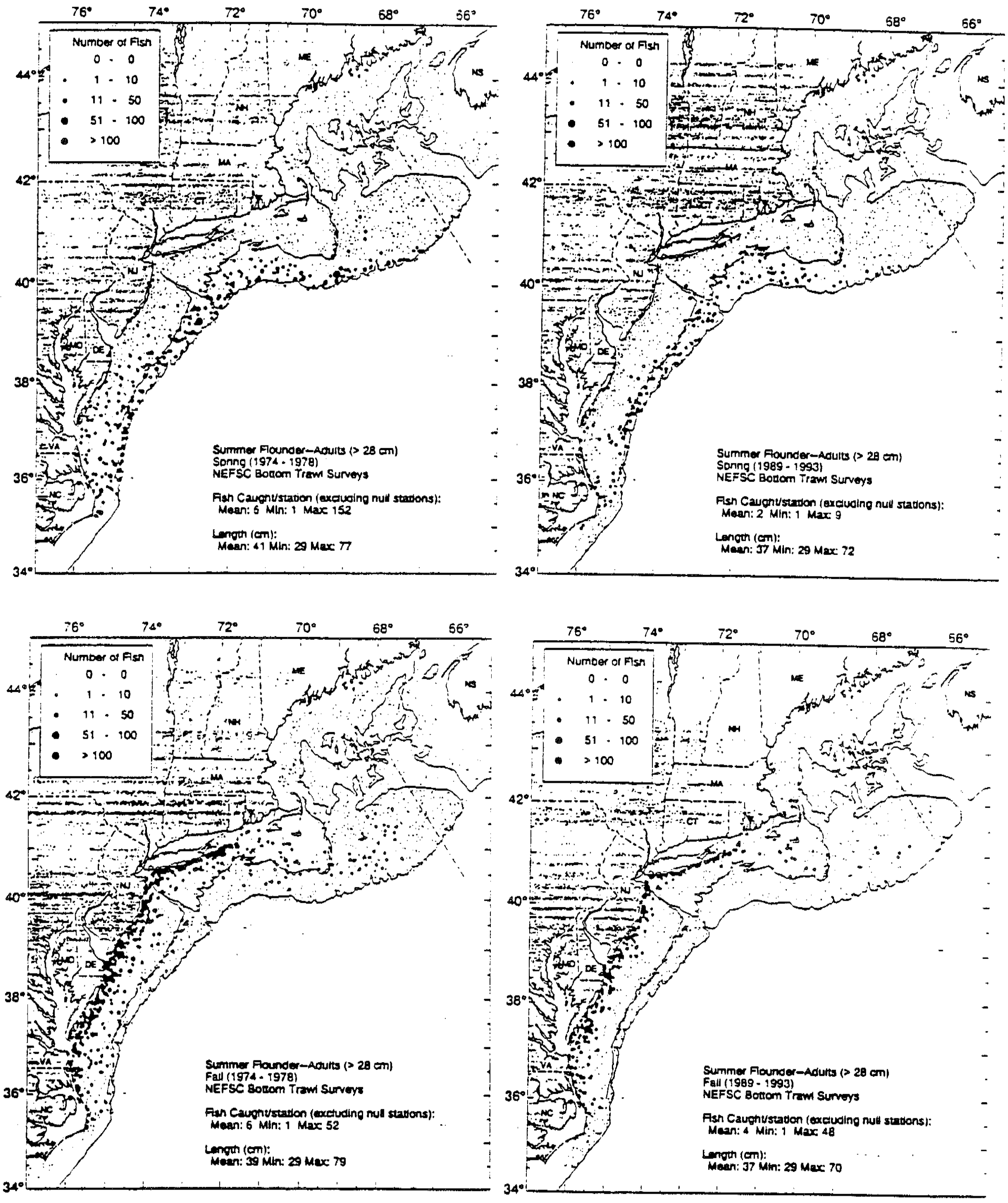


Figure 5. Distribution of adult (>28.1 cm TL) summer flounder during years of high abundances (1974-1978) and years of low abundances (1989-1993). From National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) groundfish surveys for a) spring -- high abundance, b) spring -- low abundance, c) fall -- high abundance, and d) fall -- low abundance. Sampling was conducted by stratified random design using 0.5 hr tows and a #36 Yankee trawl with a 12.7 mm mesh liner in the codend. Collections where no fish were caught are shown as small dots.
Source: Packer and Griesbach 1998.

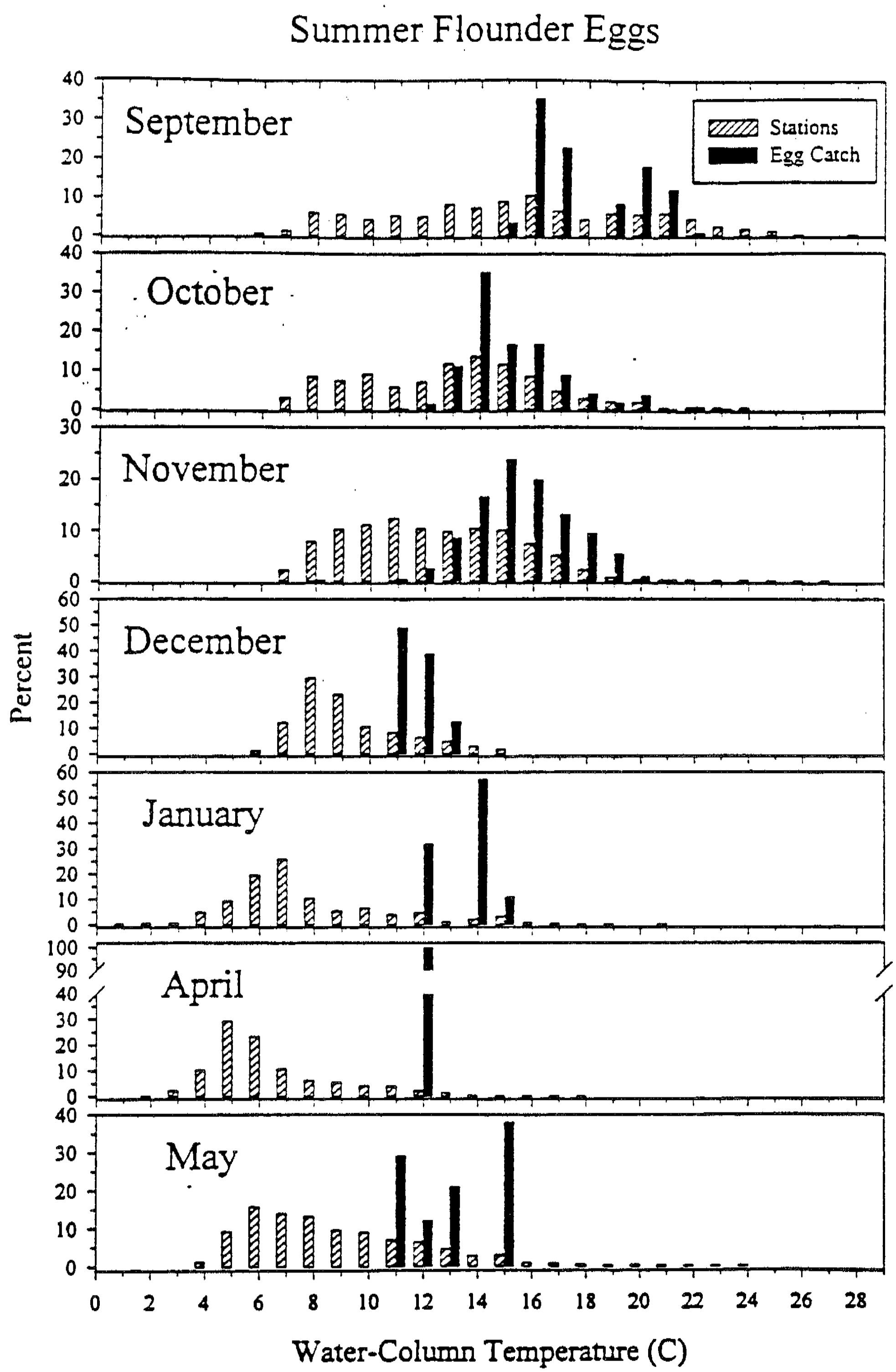


Figure 6. Monthly histograms from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton surveys from Cape Sable to Cape Hatteras during 1978-1987, showing the background of water column mean temperature (to a maximum of 200 m) at all stations occupied, and water column mean temperature at stations where summer flounder eggs were collected. Percentages for each month are of all stations (open bars) and the sum of all standardized catches (no./10m^2) at those stations where summer flounder eggs were collected (solid bars).
Source: Packer and Griesbach 1998.

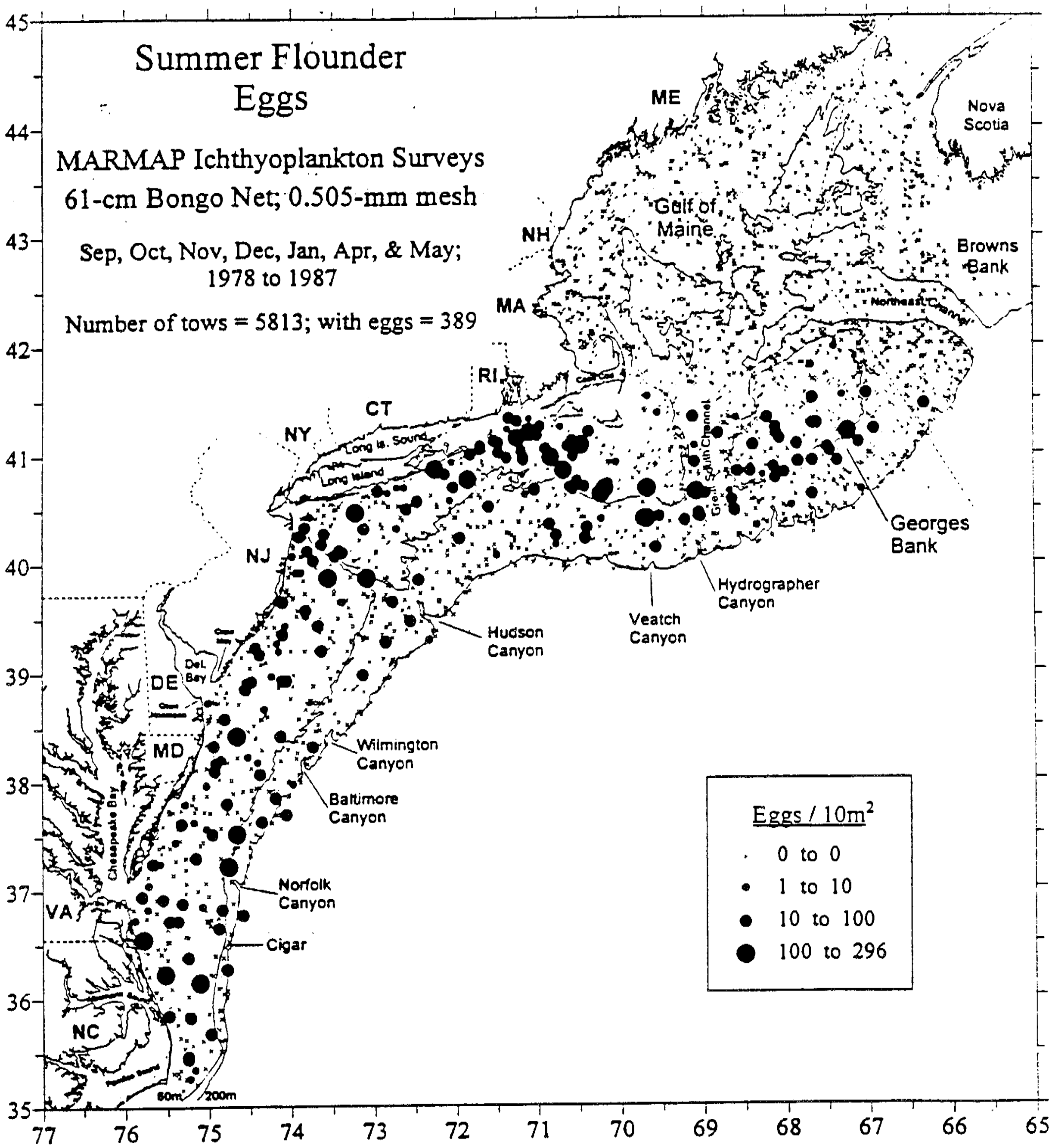


Figure 7. Monthly distribution and mean abundances of summer flounder eggs. From National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore surveys from Cape Sable to Cape Hatteras during 1978-1987, and Berrien & Sibunka (in press). Showing the months of September, October, November, December, January, April, and May, combined. Plankton sampling was conducted using 61-cm bongo frames fitted with 0.51-mm mesh. Stations where no eggs were collected are also shown, as are the 60 and 200 m contour lines.
Source: Packer and Griesbach 1998.

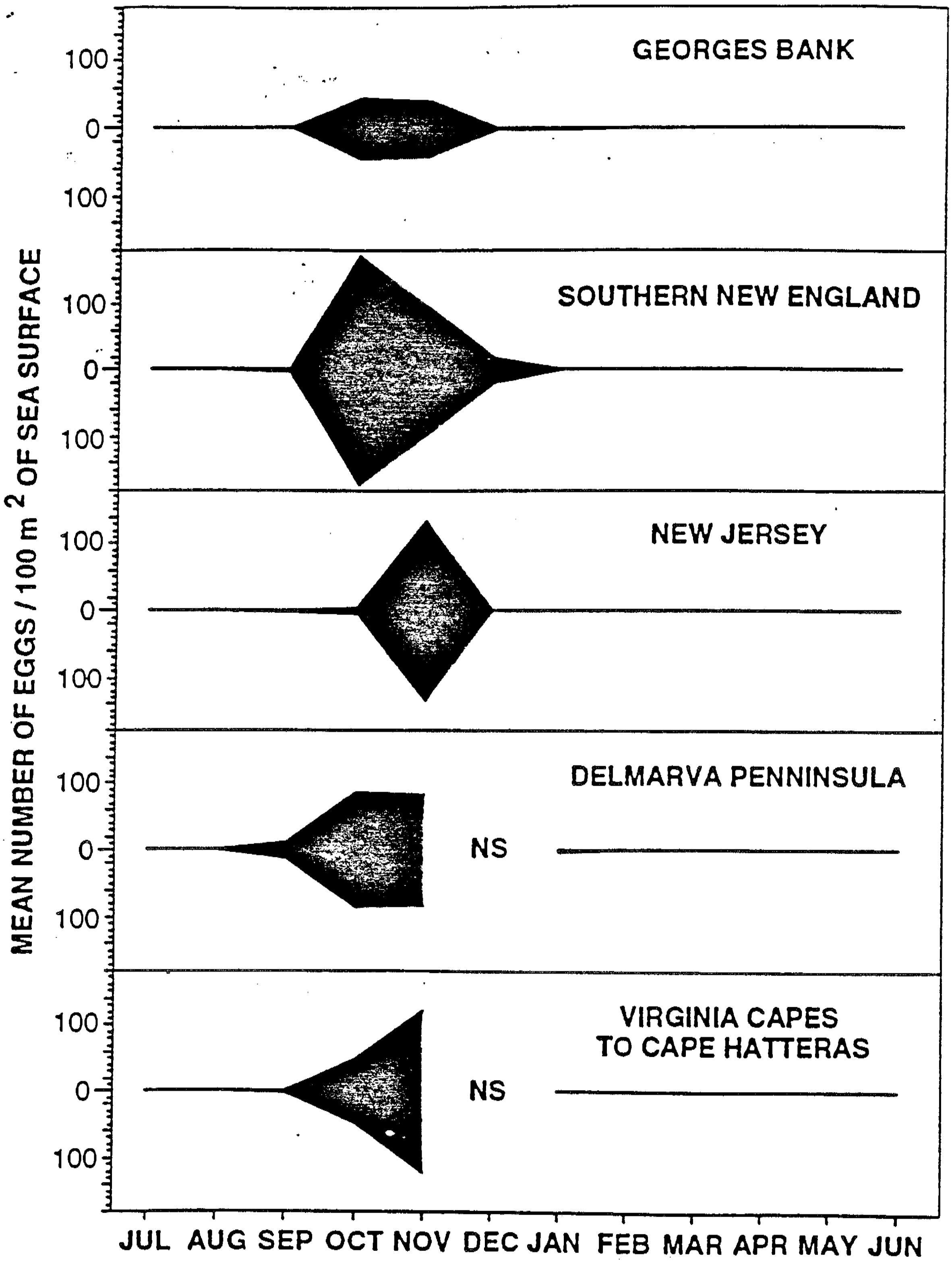


Figure 8. Adapted from Able & Kaiser (1994). Monthly abundance of summer flounder eggs by region from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore surveys from Cape Sable to Cape Hatteras during 1979-81, 1984, and 1985. Plankton sampling was conducted using 61-cm bongo frames fitted with 0.51-mm mesh. Southern New England is the offshore region between southeastern Cape Cod and northern coastal New Jersey. Delmarva is the peninsula between Delaware and Chesapeake Bays that is part of Delaware, Maryland, and Virginia. NS = no samples.
Source: Packer and Griesbach 1998.

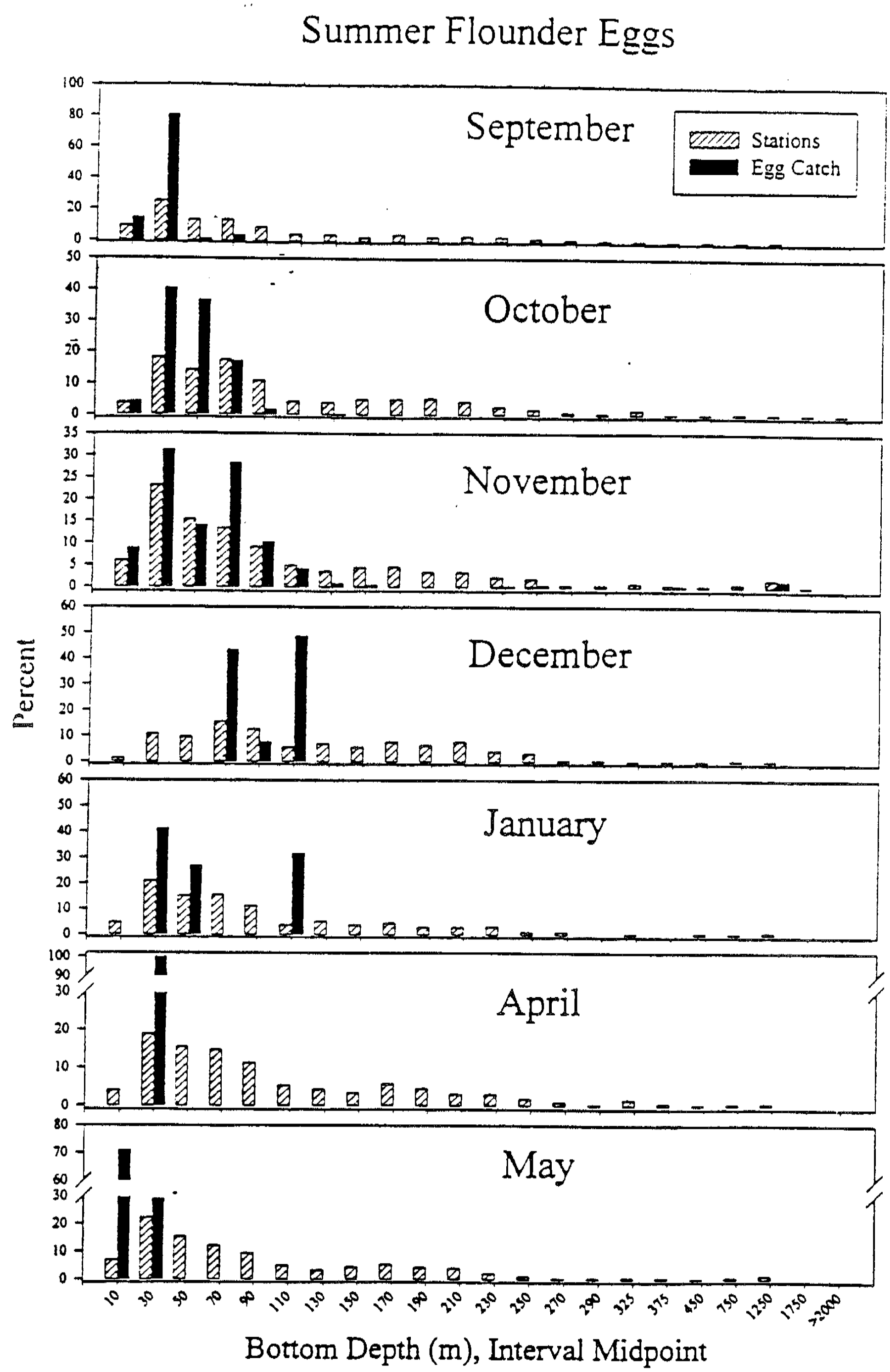


Figure 9. Monthly histograms from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton surveys from Cape Sable to Cape Hatteras during 1978-1987, showing the background of water depths at all stations occupied, and water depths at stations where summer flounder eggs were collected. Percentages for each month are of all stations (open bars) and the sum of all standardized catches (no./10m²) at those stations where summer flounder eggs were collected (solid bars).
Source: Packer and Griesbach 1998.

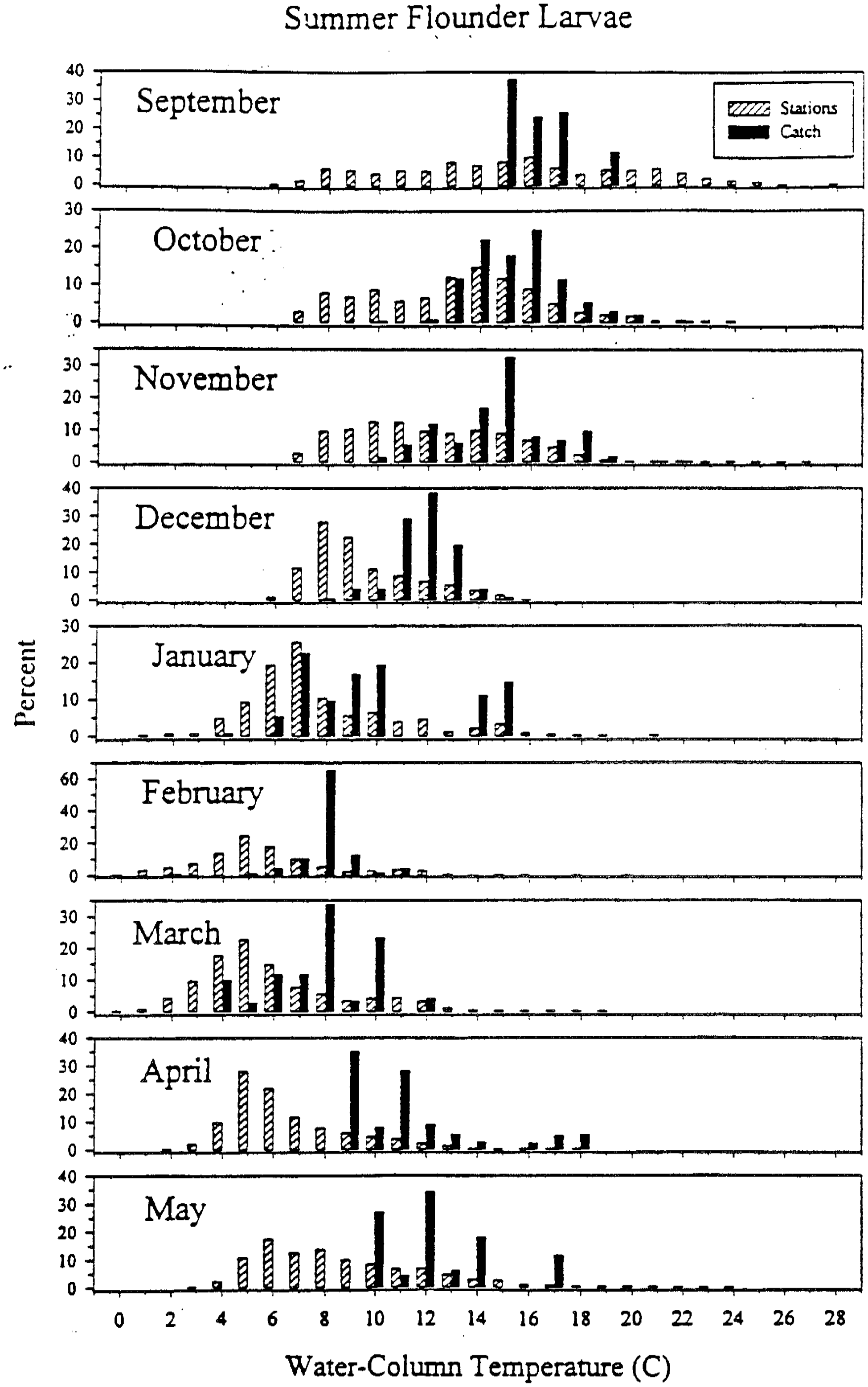


Figure 10. Monthly histograms from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton surveys from Cape Sable to Cape Hatteras during 1977-1987, showing the background of water column mean temperature (to a maximum of 200 m) at all stations occupied, and water column mean temperature at stations where summer flounder larvae were collected. Percentages for each month are of all stations (open bars) and the sum of all standardized catches (no./10m^2) at those stations where summer flounder larvae were collected (solid bars).
Source: Packer and Griesbach 1998.

SUMMER FLOUNDER

National Marine Fisheries Service Bottom Trawl Surveys

Juvenile Fish: total fish length < 28 cm

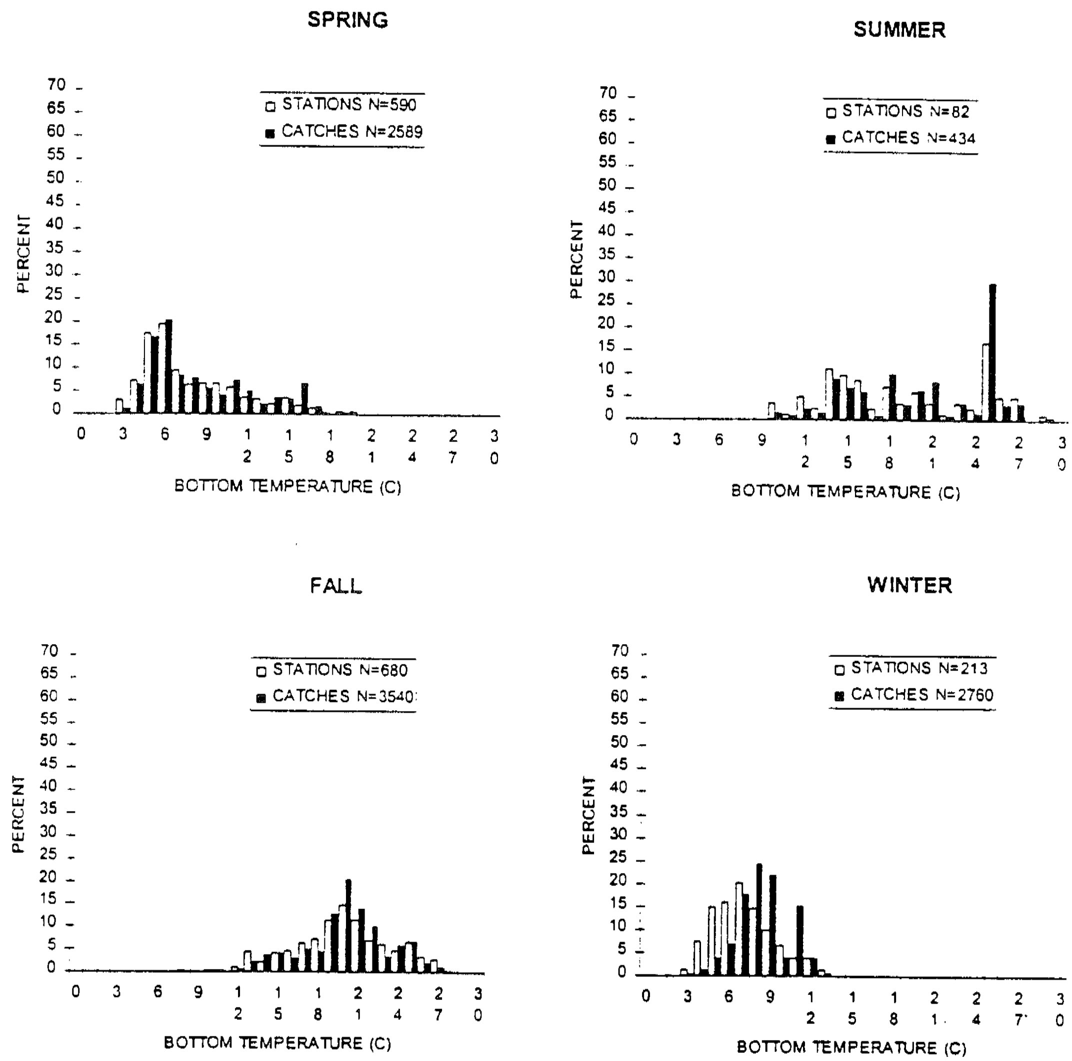


Figure 11a. Seasonal histograms of juvenile summer flounder abundance relative to bottom temperature from National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) offshore groundfish surveys, all years combined. Gray bars represent the proportion of all stations surveyed, while the black bars represent the proportion of the sum of all standardized catches (no./10m^2).
Source: Packer and Griesbach 1998.

SUMMER FLOUNDER

National Marine Fisheries Service Bottom Trawl Surveys

Juvenile Fish: total fish length <28 cm

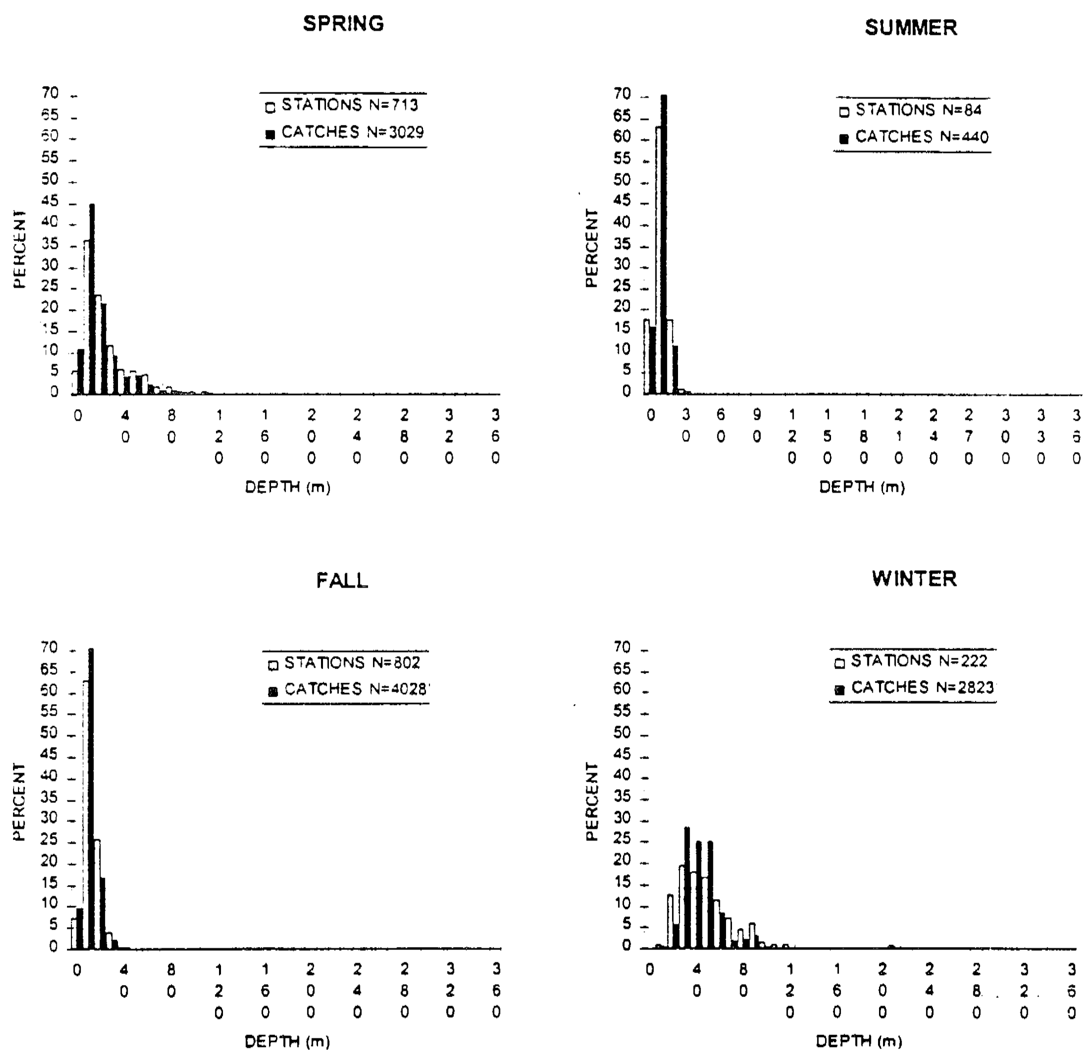


Figure 11b. Seasonal histograms of juvenile summer flounder abundance relative to water depth from National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) offshore groundfish surveys, all years combined. Gray bars represent the proportion of all stations surveyed, while the black bars represent the proportion of the sum of all standardized catches (no./10m^2). Source: Packer and Griesbach 1998.

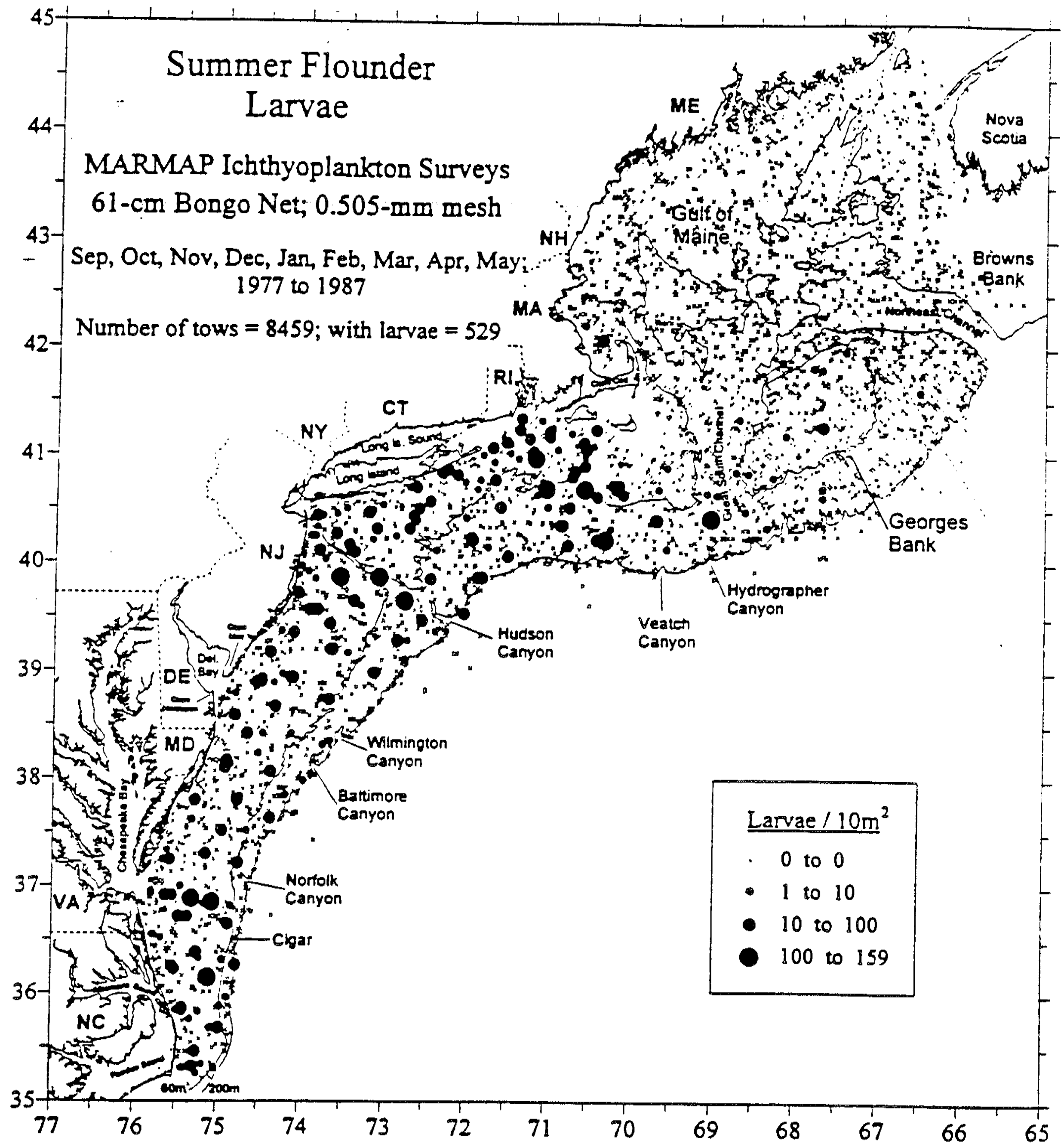


Figure 12. Monthly distribution and mean abundances of summer flounder larvae. From National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore surveys from Cape Sable to Cape Hatteras during 1977-1987. Showing the months of September, October, November, December, January, February, March, April, and May, combined. Plankton sampling was conducted using 61-cm bongo frames fitted with 0.51-mm mesh. Stations where no larvae were collected are also shown, as are the 60 and 200 m contour lines.
Source: Packer and Griesbach 1998.

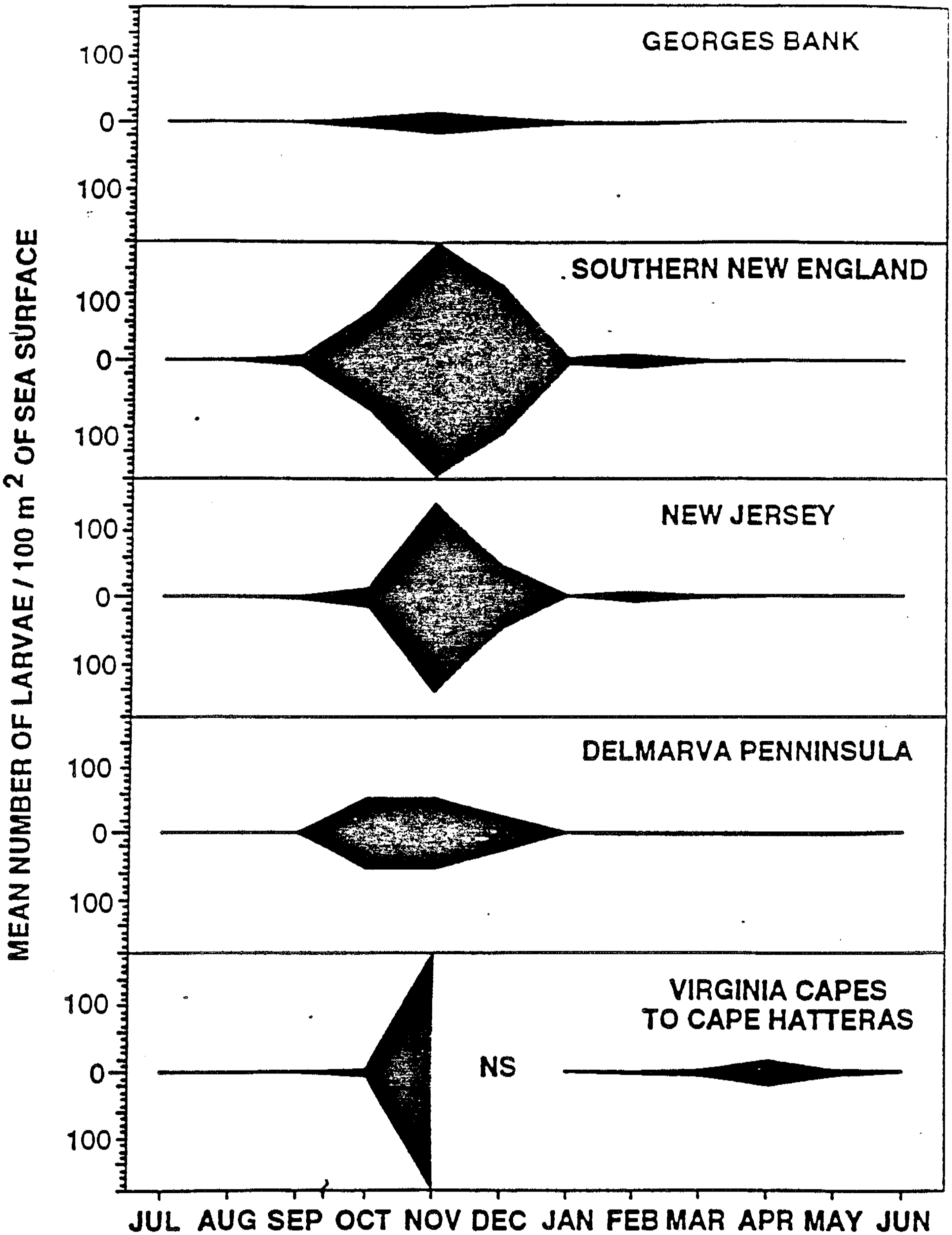


Figure 13. Adapted from Able & Kaiser (1994). Monthly abundance of summer flounder larvae by region from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore surveys from Cape Sable to Cape Hatteras during 1979-81, 1984, and 1985. Plankton sampling was conducted using 61-cm bongo frames fitted with 0.51-mm mesh. Southern New England is the offshore region between southeastern Cape Cod and northern coastal New Jersey. Delmarva is the peninsula between Delaware and Chesapeake Bays that is part of Delaware, Maryland, and Virginia. NS = no samples.
Source: Packer and Griesbach 1998.

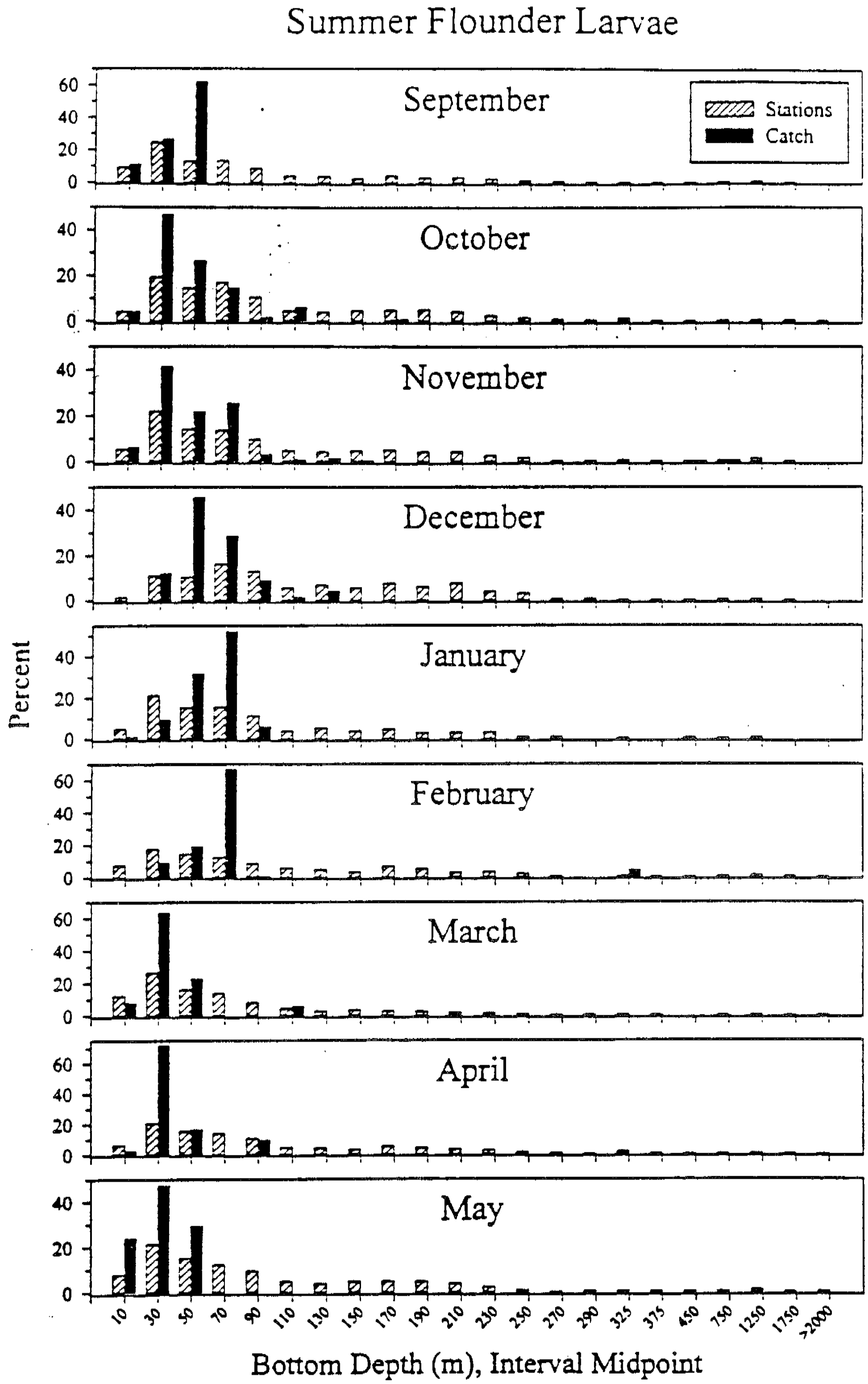


Figure 14. Monthly histograms from National Marine Fisheries Service (NMFS) Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton surveys from Cape Sable to Cape Hatteras during 1977-1987, showing the background of water depths at all stations occupied, and water depths at stations where summer flounder larvae were collected. Percentages for each month are of all stations (open bars) and the sum of all standardized catches (no./10m²) at those stations where summer flounder larvae were collected (solid bars).
Source: Packer and Griesbach 1998.

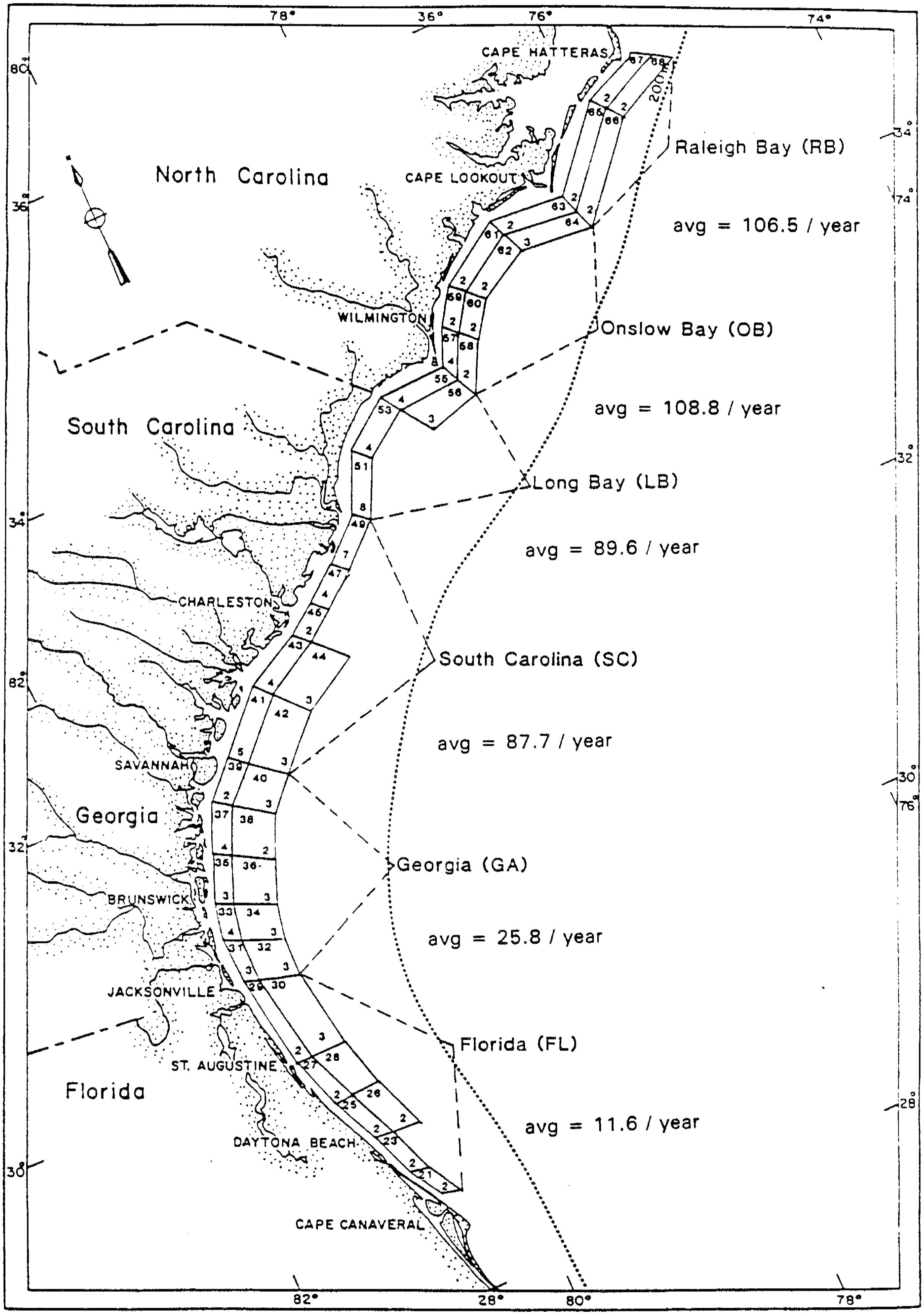


Figure 15. Average catch of juvenile and adult summer flounder (combined) from 1986 through 1996 (all four seasons), by region in the SEAMAP trawl survey.
Source: Adapted from Boylan pers. comm.

SUMMER FLOUNDER

National Marine Fisheries Service Bottom Trawl Surveys

Adult Fish: total fish length >= 28 cm

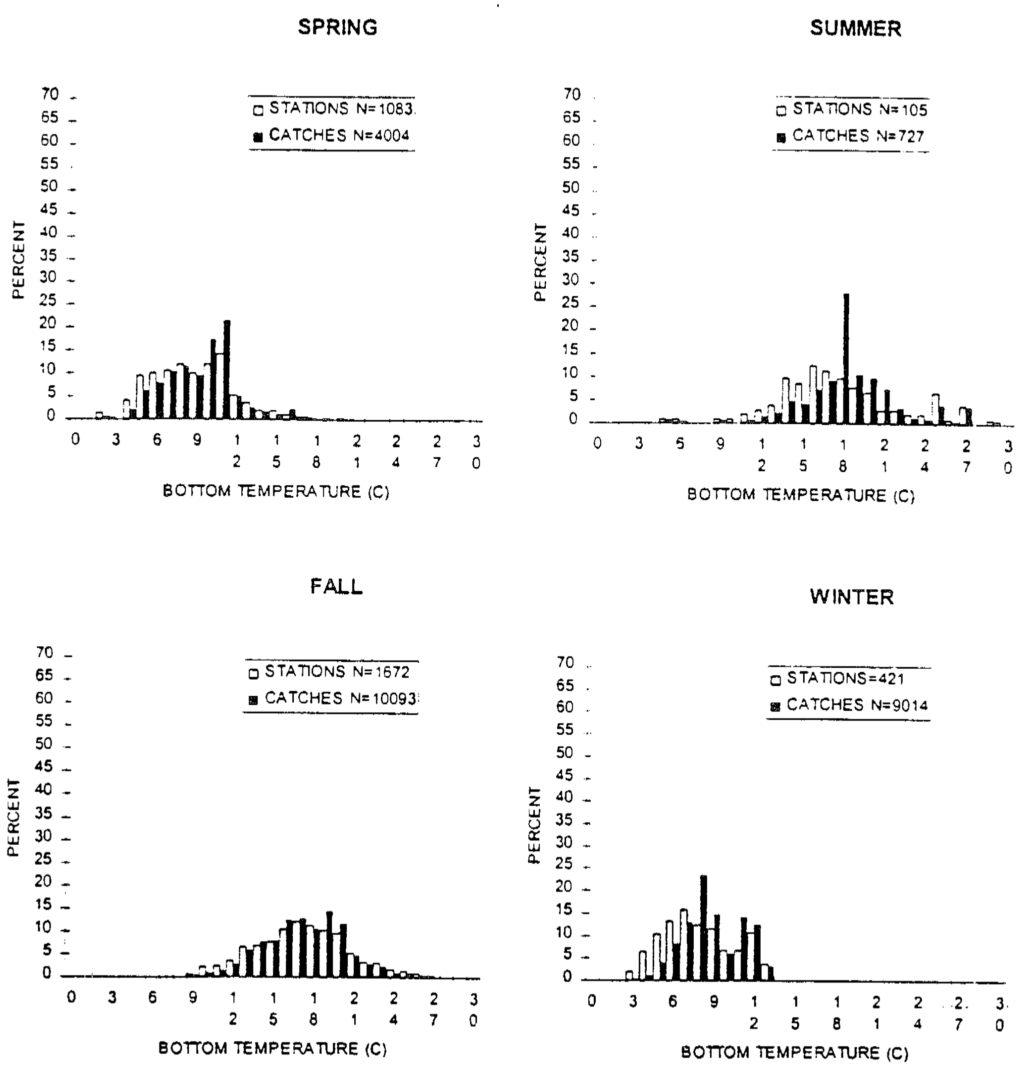


Figure 16a. Seasonal histograms of adult summer flounder abundance relative to bottom temperature from National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) offshore groundfish surveys, all years combined. Gray bars represent the proportion of all stations surveyed, while the black bars represent the proportion of the sum of all standardized catches (no./10m²).
Source: Packer and Griesbach 1998.

SUMMER FLOUNDER

National Marine Fisheries Service Bottom Trawl Surveys

Adult Fish: total fish length >= 28cm

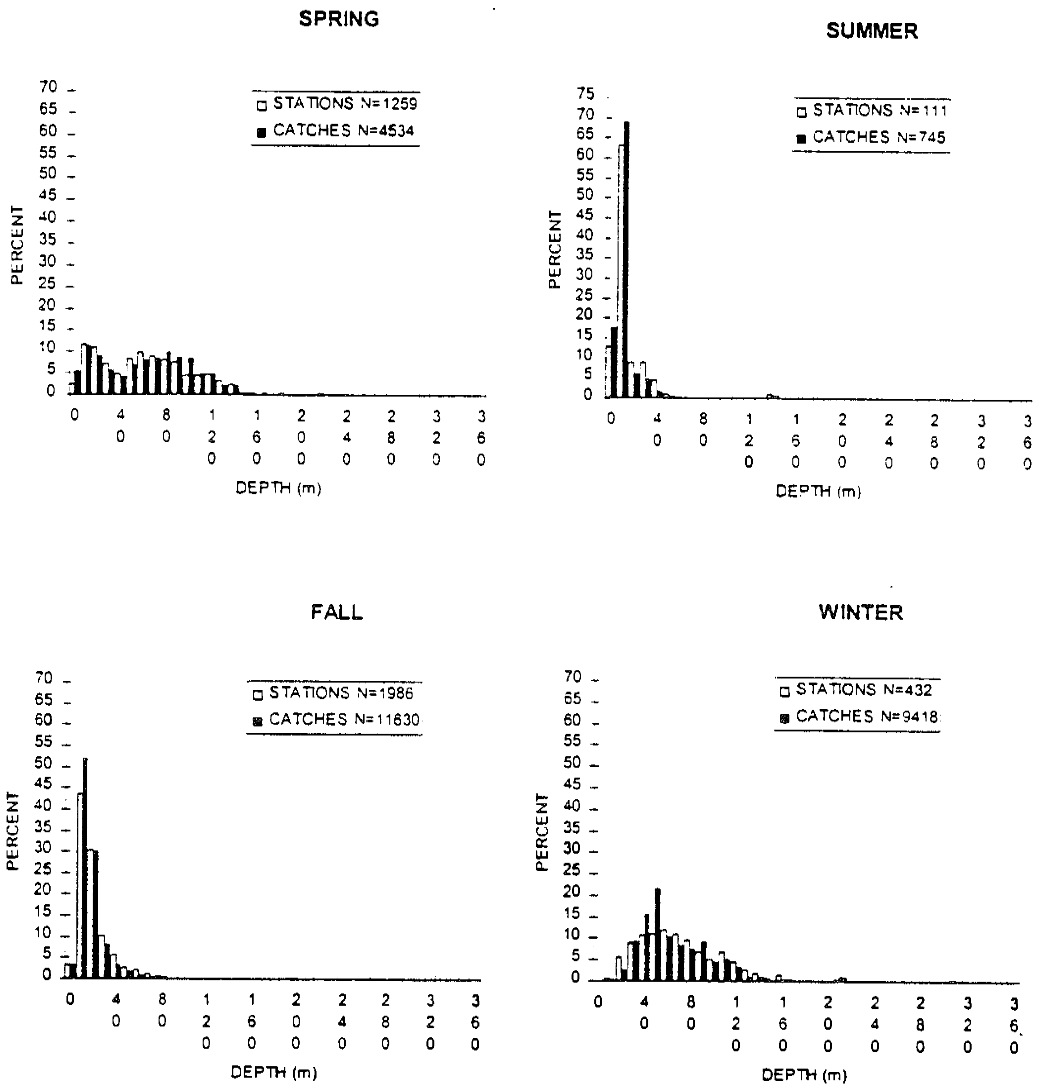


Figure 16b. Seasonal histograms of adult summer flounder abundance relative to water depth from National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) offshore groundfish surveys, all years combined. Gray bars represent the proportion of all stations surveyed, while the black bars represent the proportion of the sum of all standardized catches (no./10m^2). Source: Packer and Griesbach 1998.

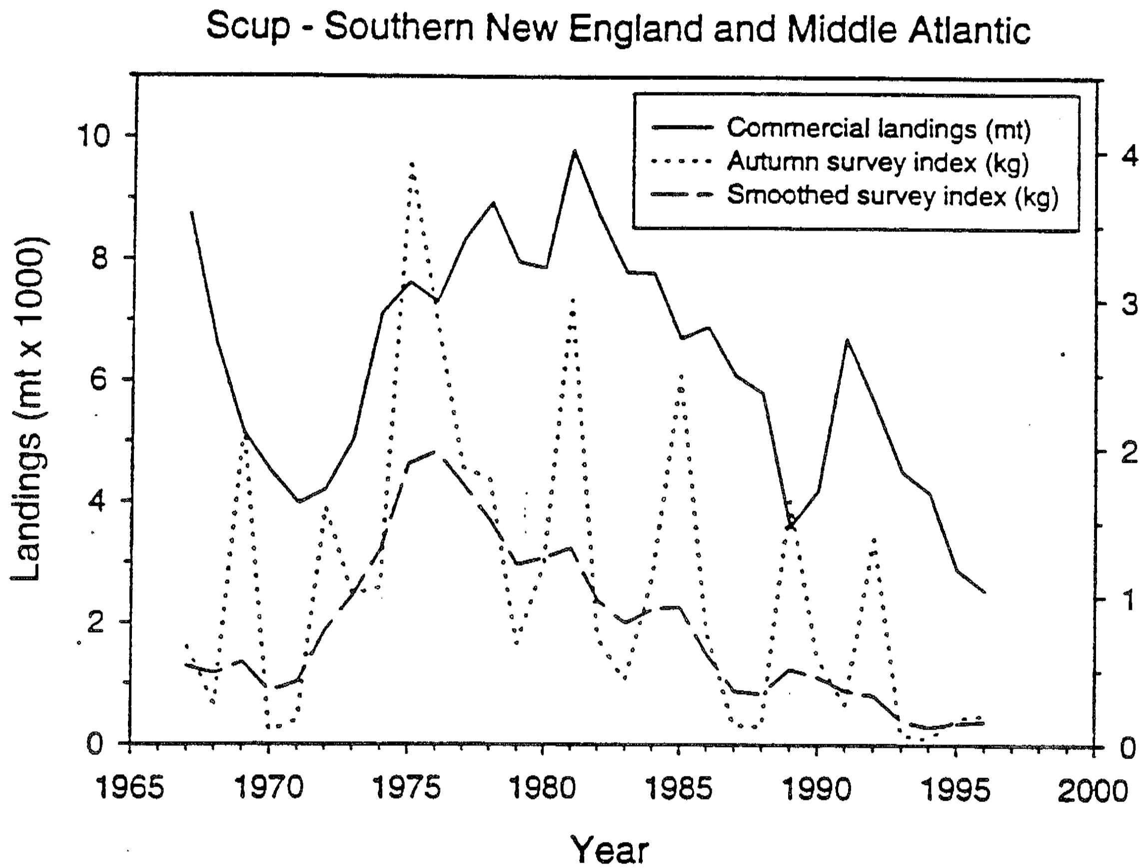


Figure 17. Summary of commercial landings and NEFSC bottom trawl survey stratified mean catch per tow (kg) index (1963-1993) for scup, North Carolina to New England, since 1996. (Dotted line represents raw survey index, dashed line represents the index smoothed to compensate for between-year variability using first order autoregression model.)
Source: Steimle *et al.* 1998a.

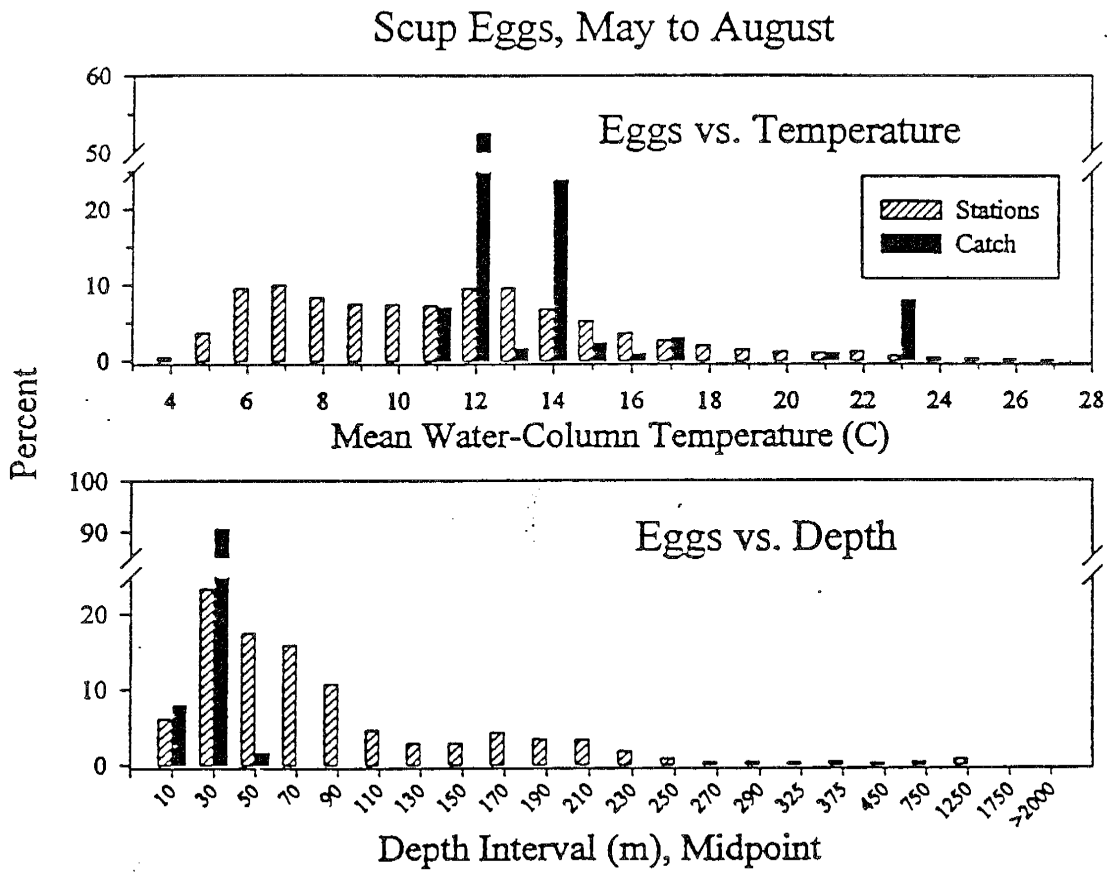


Figure 18. Association of scup egg abundances with water column temperatures and depths in the Middle Atlantic Bight, based on 1977-1987 MARMAP ichthyoplankton survey data. Source: Steimle *et al.* 1998a.

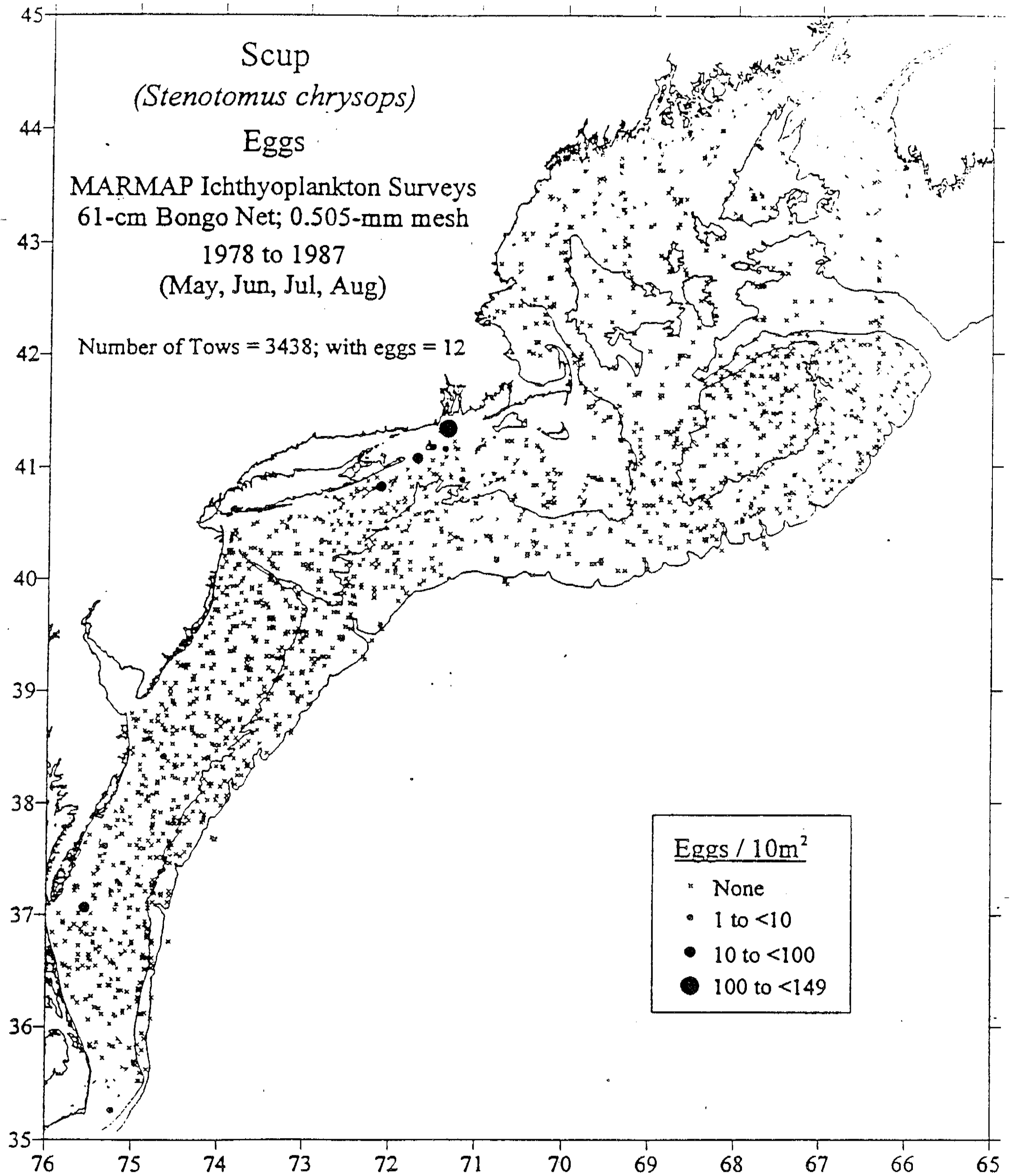


Figure 19. Distribution and relative abundance of all scup eggs collected north of Cape Hatteras NC during 1977-1987 MARMAP ichthyoplankton surveys.
Source: Steimle *et al.* 1998a.

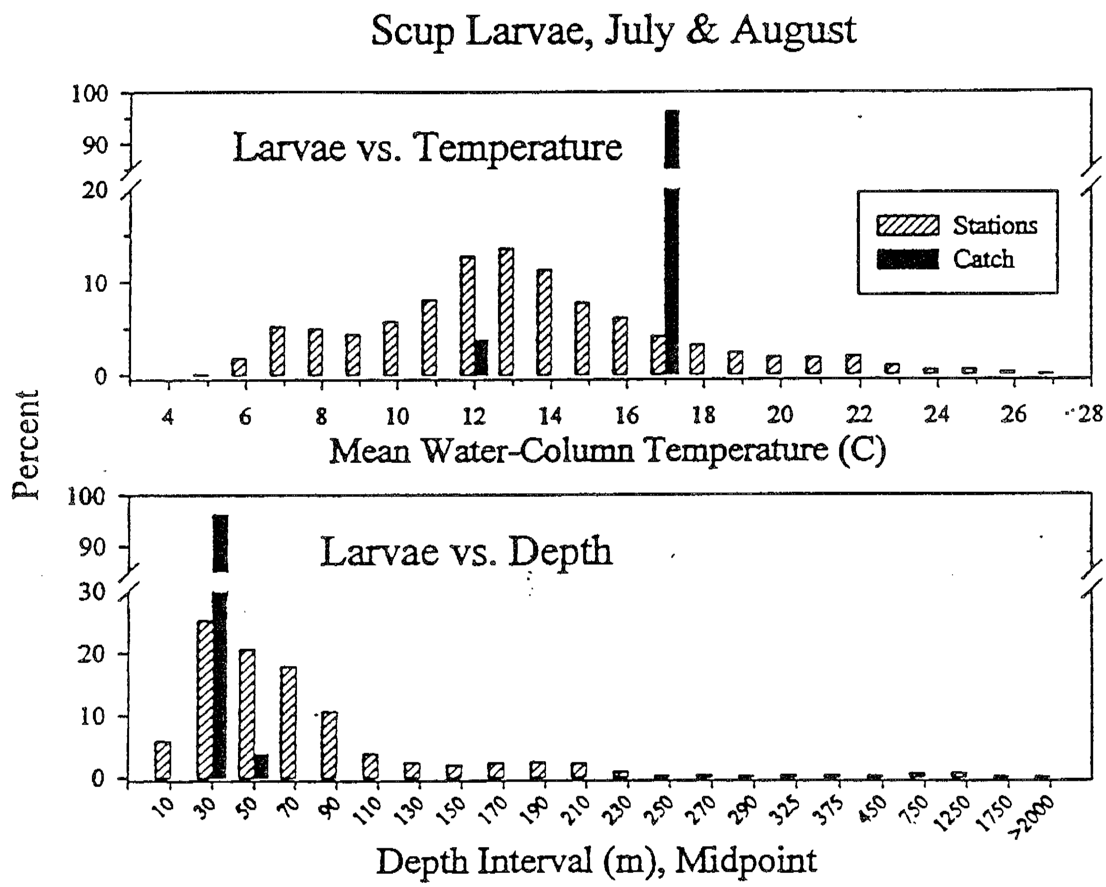


Figure 20. Association of scup larval abundances, during period of peak abundance, with integrated water column temperatures and depths in the Middle Atlantic Bight, based on 1977-1987 MARMAP ichthyoplankton survey data.
Source: Steimle *et al.* 1998a.

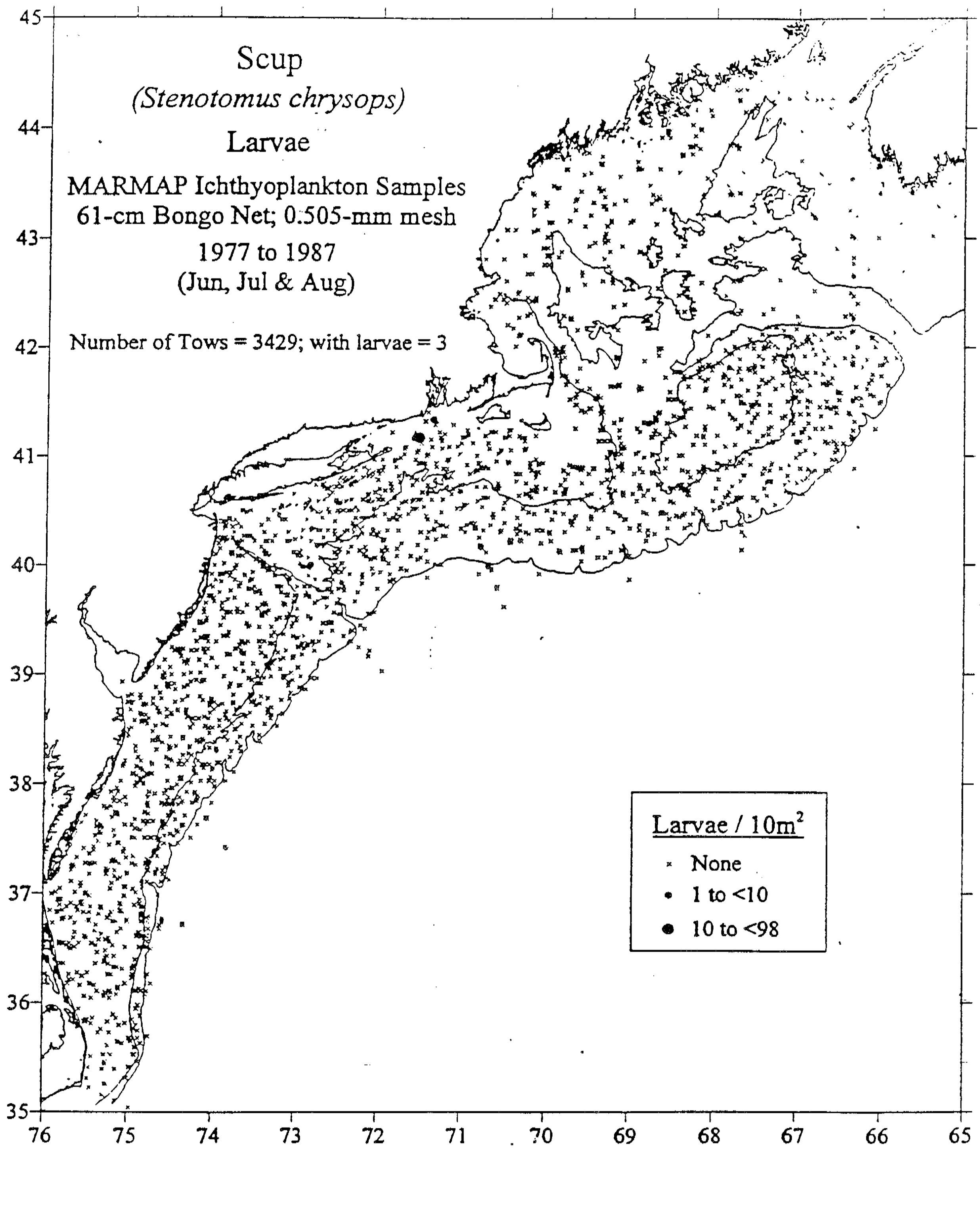


Figure 21. Distribution and relative abundance of all scup larvae collected in the Middle Atlantic Bight during 1977-1987 MARMAP ichthyoplankton surveys.
Source: Steimle *et al.* 1998a.

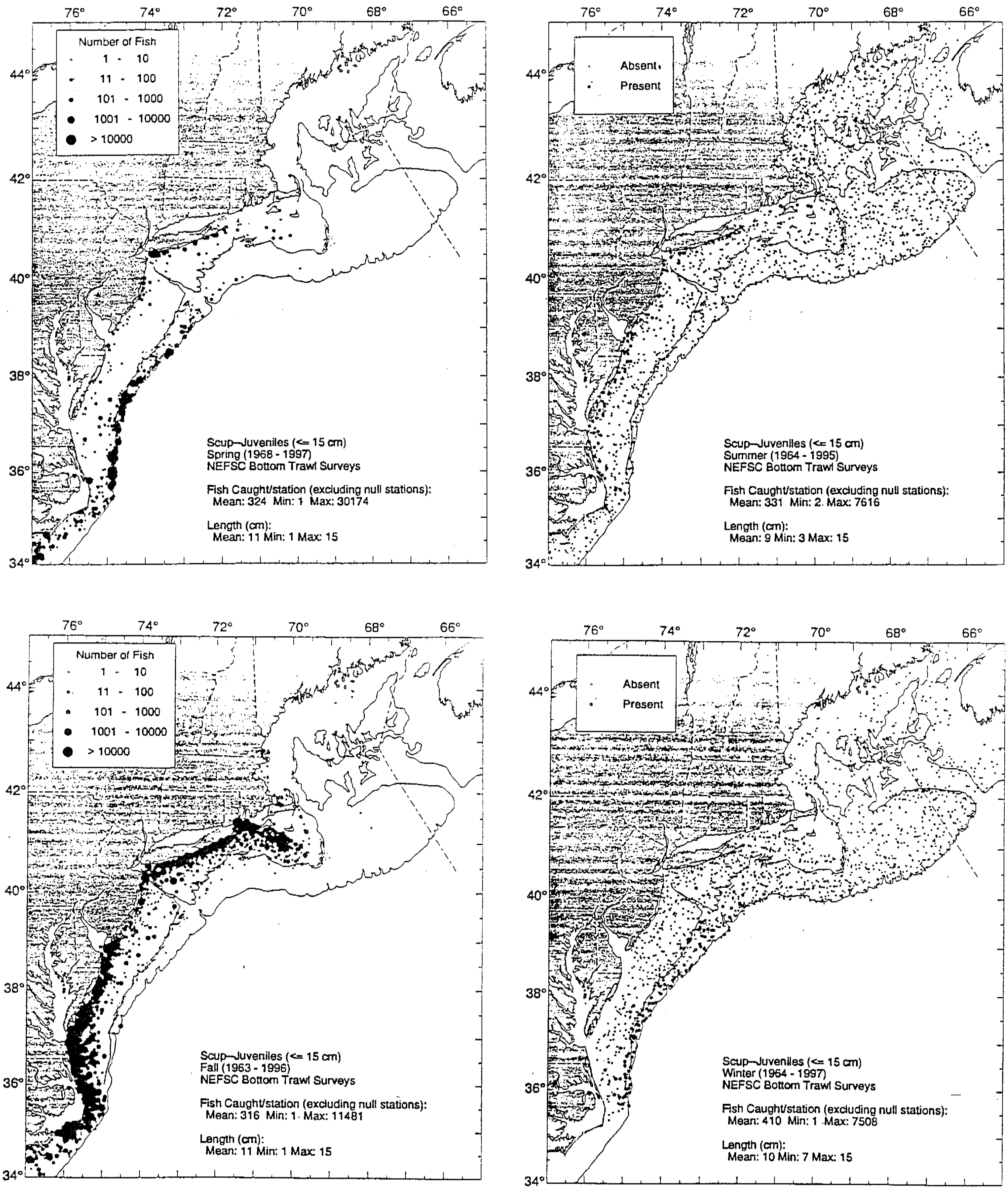


Figure 22. Seasonal distribution and relative abundance of juvenile (≤ 15.0 cm FL) scup in the Middle Atlantic Bight, based on NEFSC bottom trawl survey data, 1963-1997, for a) spring, b) summer, c) fall, and d) winter.
Source: Steimle *et al.* 1998a.

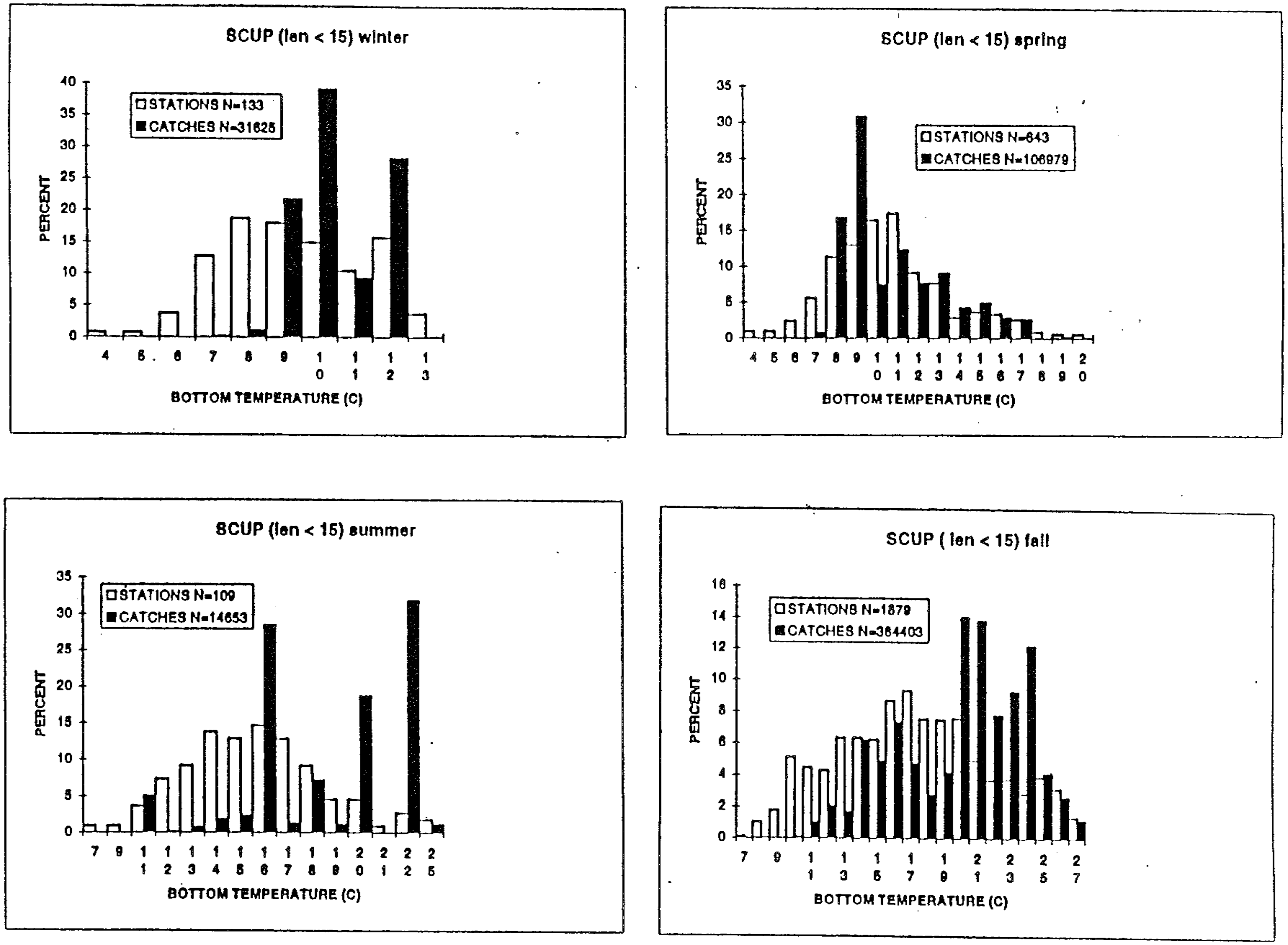


Figure 23. Association of juvenile scup abundance to bottom water a) temperatures and b) depth where juveniles were collected north of Cape Hatteras, NC, based on NEFSC bottom trawl survey data.
Source: Steimle *et al.* 1998a.

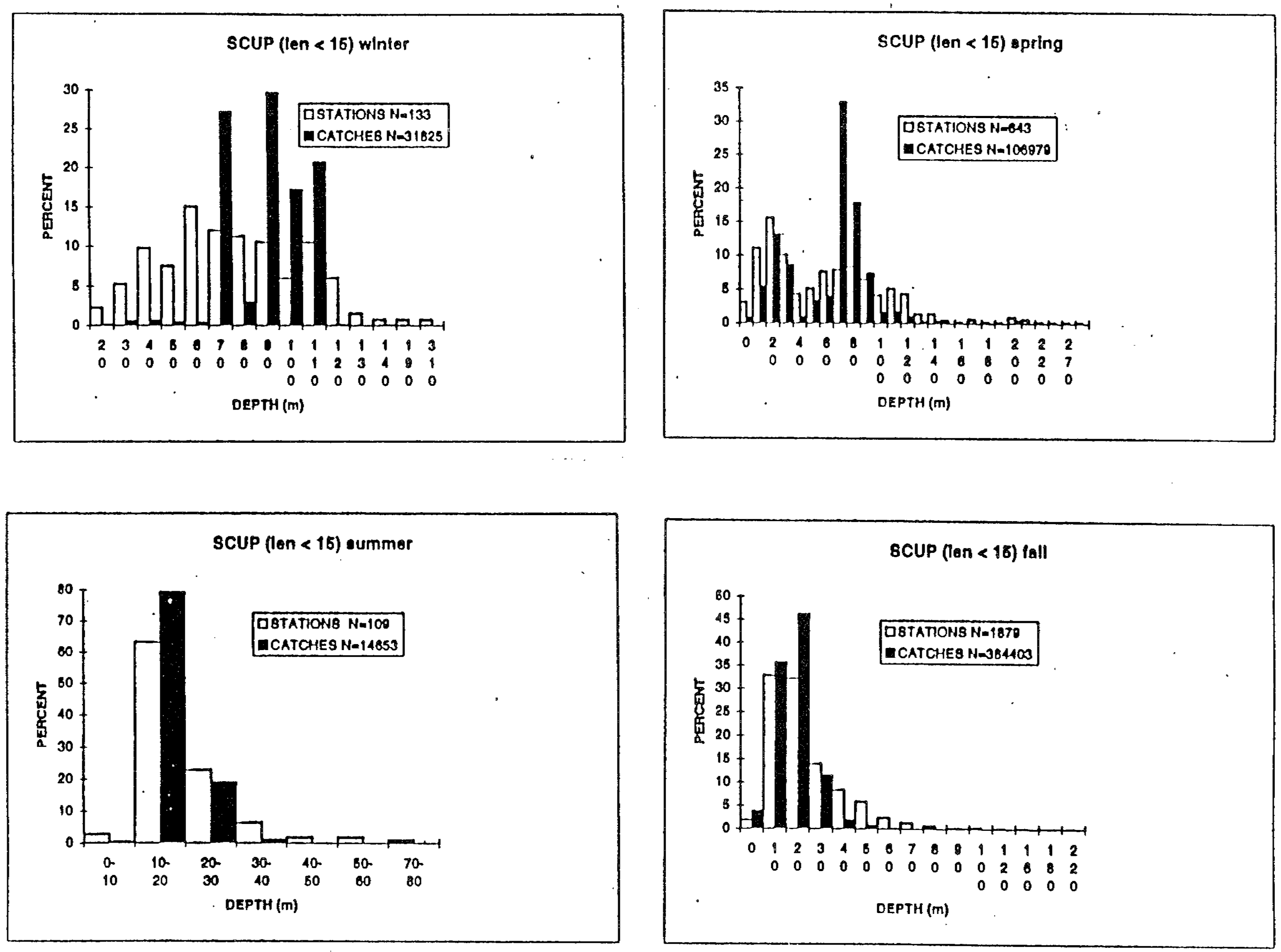


Figure 23 (continued). Association of juvenile scup abundance to bottom water a) temperatures and b) depth where juveniles were collected north of Cape Hatteras, NC, based on NEFSC bottom trawl survey data.
Source: Steimle *et al.* 1998a.

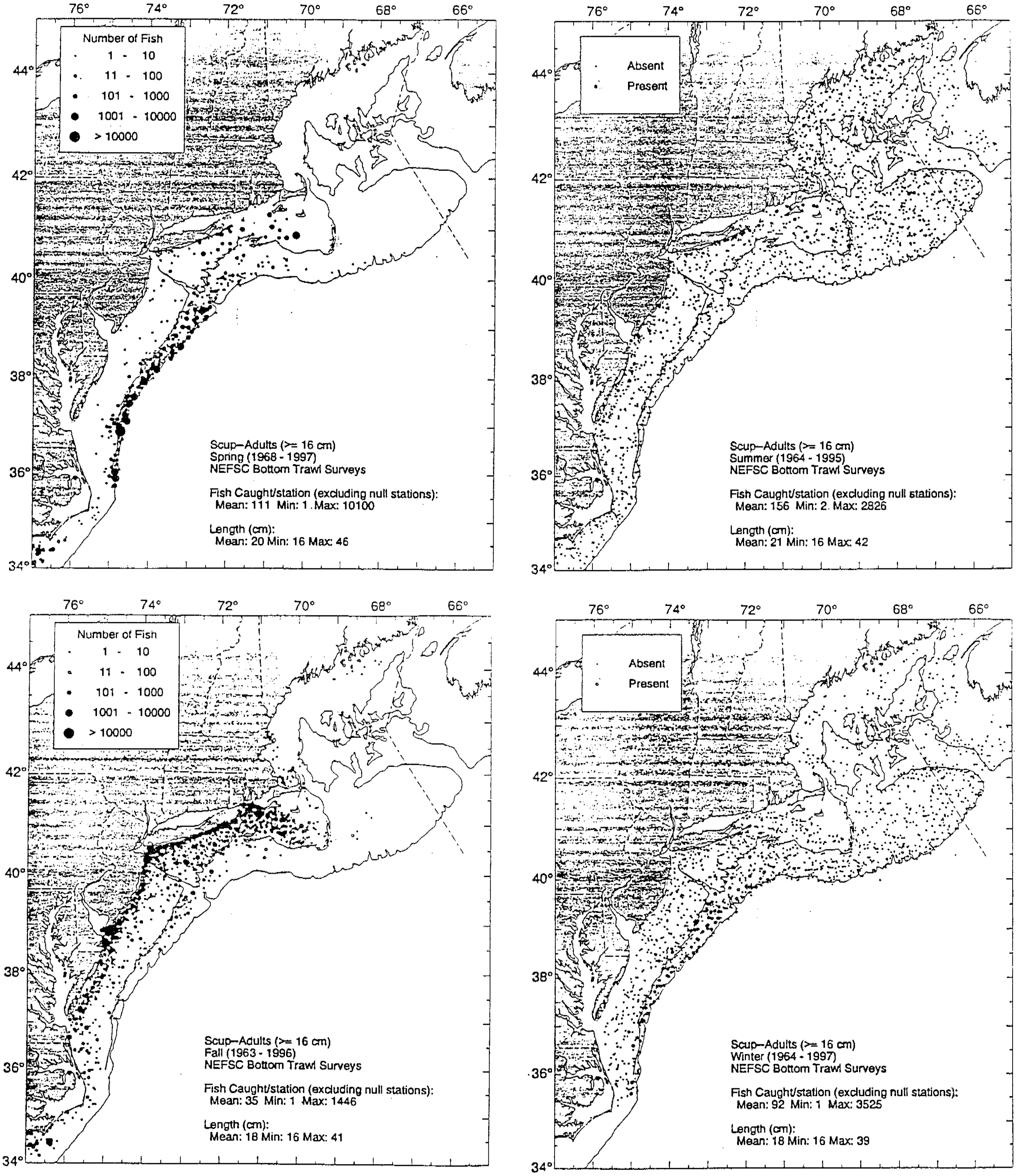


Figure 24. Seasonal distribution and relative abundance of adult scup north of Cape Hatteras, NC, based on NEFSC bottom trawl survey data, 1963-1997, for a) spring, b) summer, c) fall, and d) winter.
Source: Steimle *et al.* 1998a.

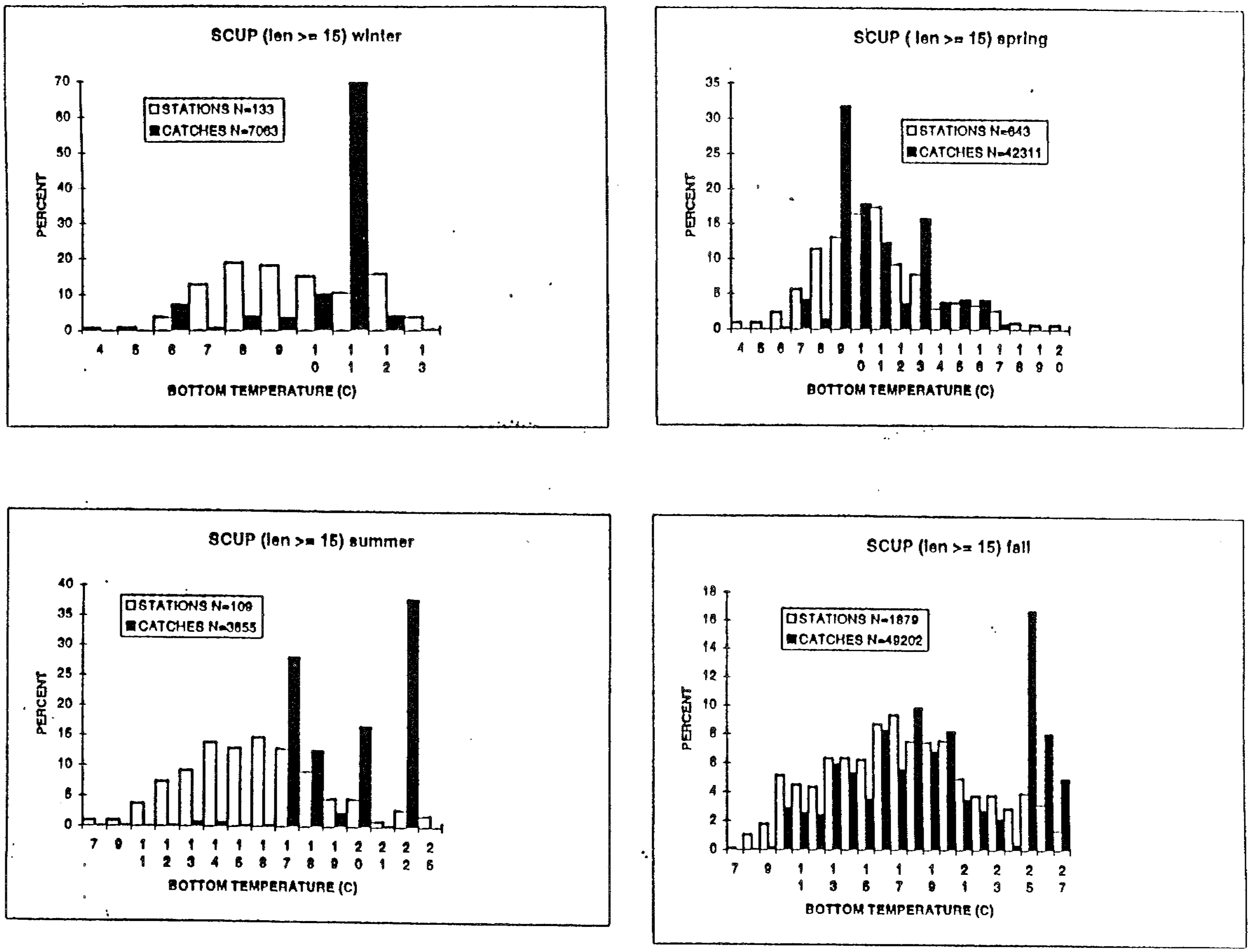


Figure 25. Association of adult scup abundance to bottom water a) temperatures and b) depth where juveniles were collected north of Cape Hatteras, NC, based on NEFSC bottom trawl survey data since 1963.
Source: Steimle *et al.* 1998a.

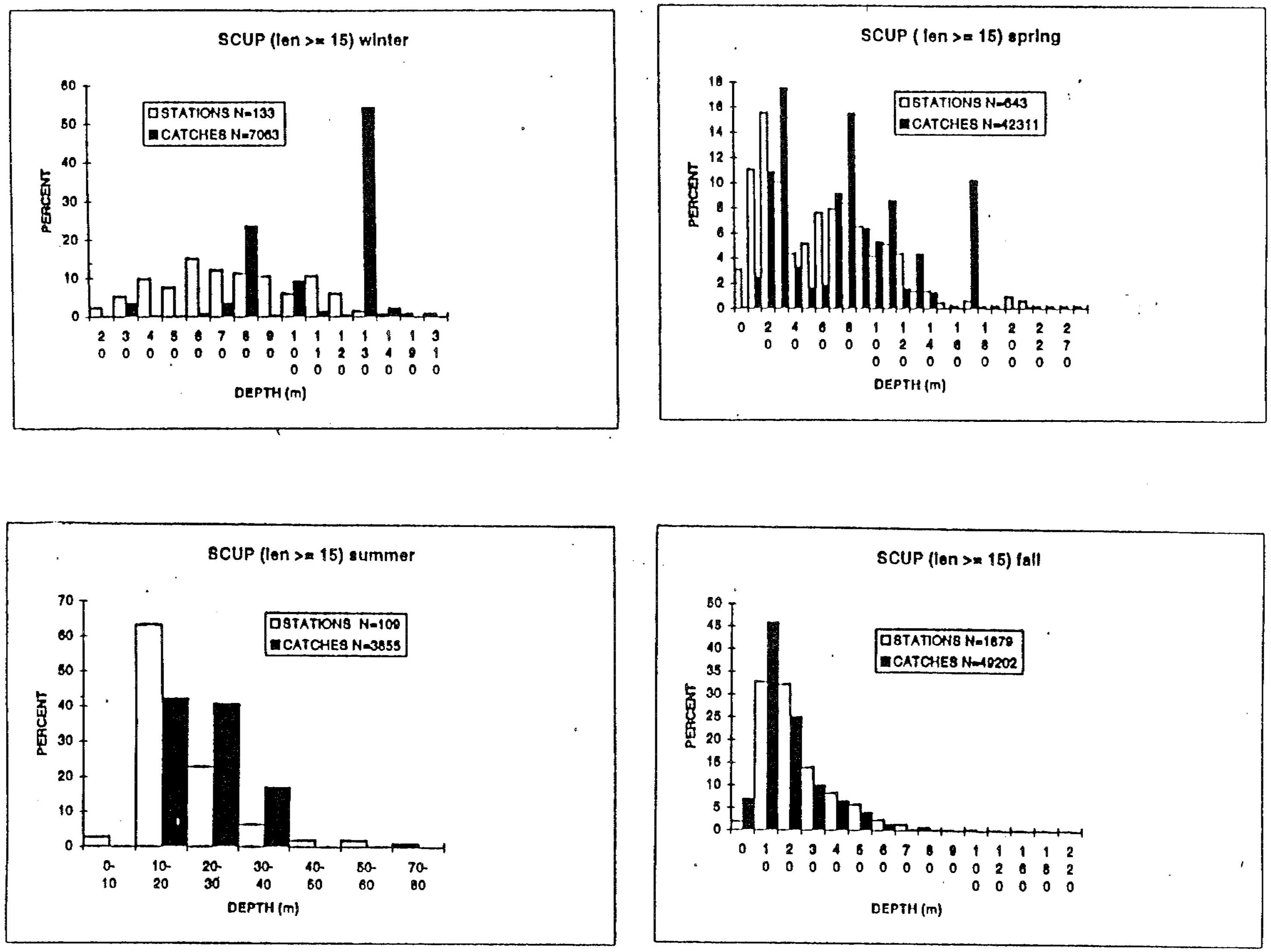


Figure 25 (continued). Association of adult scup abundance to bottom water a) temperatures and b) depth where juveniles were collected north of Cape Hatteras, NC, based on NEFSC bottom trawl survey data since 1963.
Source: Steimle *et al.* 1998a.

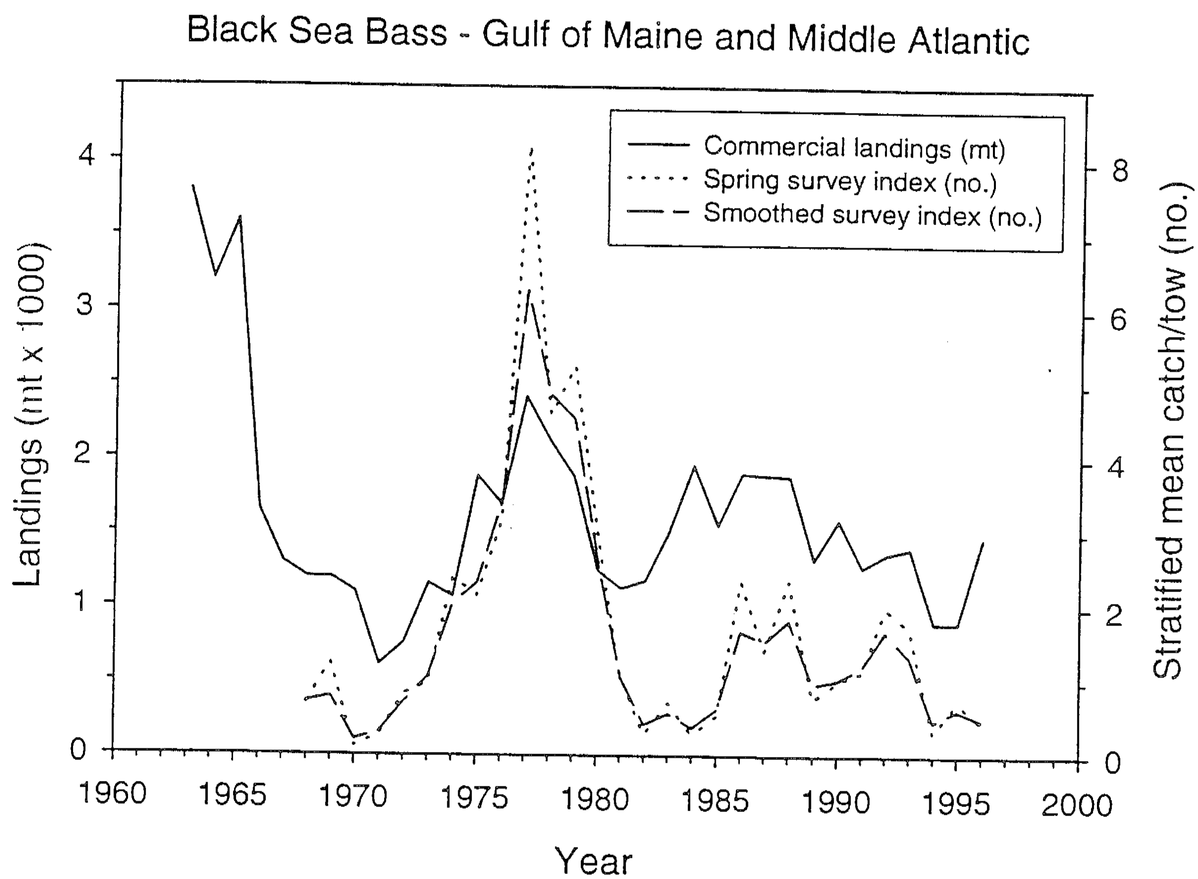
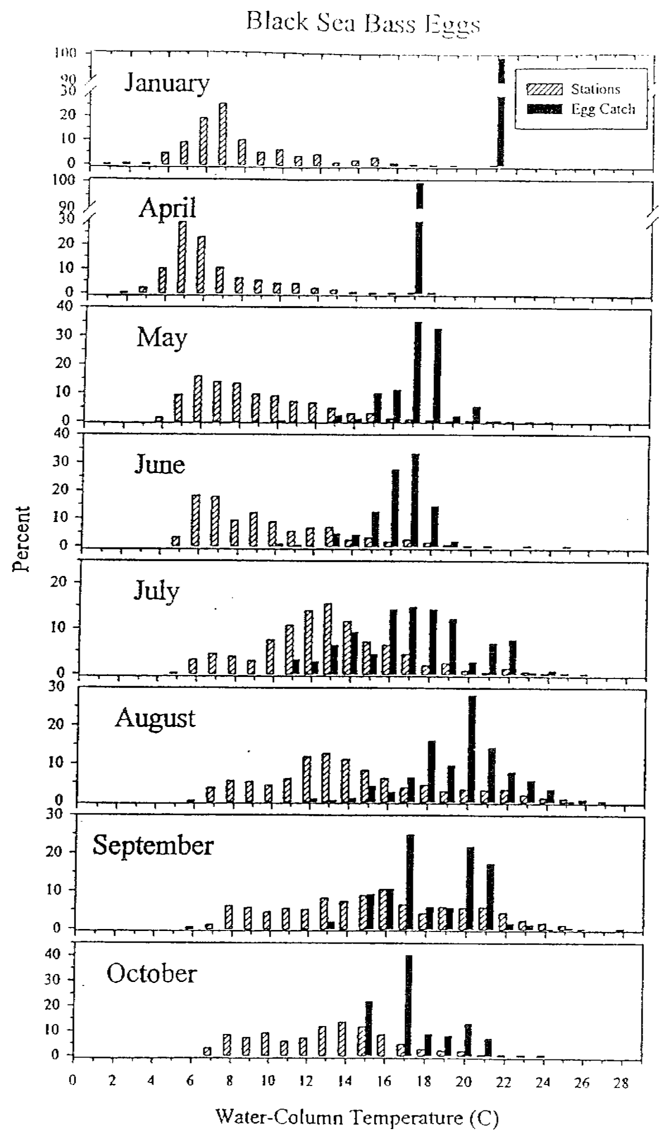


Figure 26. Summary of commercial landings and NEFSC bottom trawl survey stratified mean catch per tow index (1963-1995) for the black sea bass population north of Cape Hatteras. (The spring NEFSC survey index represents raw data, while the smoothed index compensates for between-year variability using first order autoregression model.)
Source: Steimle *et al.* 1998b.



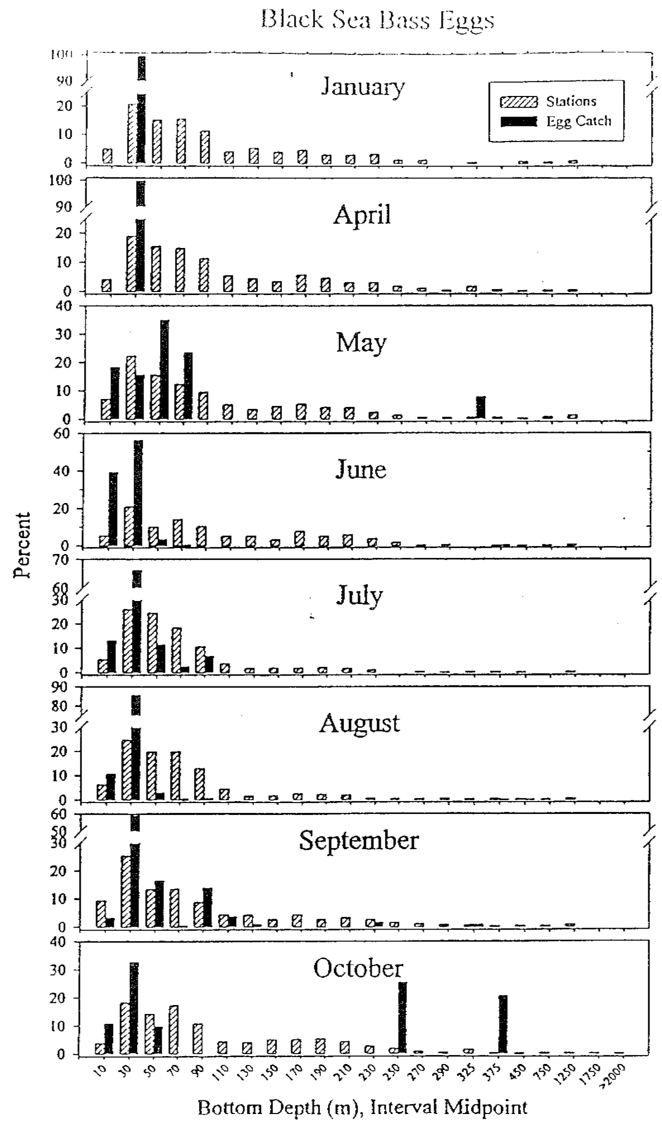


Figure 27. Association of black sea bass eggs abundance, by month, with a) integrated water column temperatures and b) bottom depths where eggs were collected during NEFSC MARMAP ichthyoplankton surveys, 1978-1987. The shaded bars represent the percent distribution of all sampling sites, and the filled bars represent the percent of all egg collections for that month.
Source: Berrien and Sibunka in press in Steimle *et al.* 1998b.

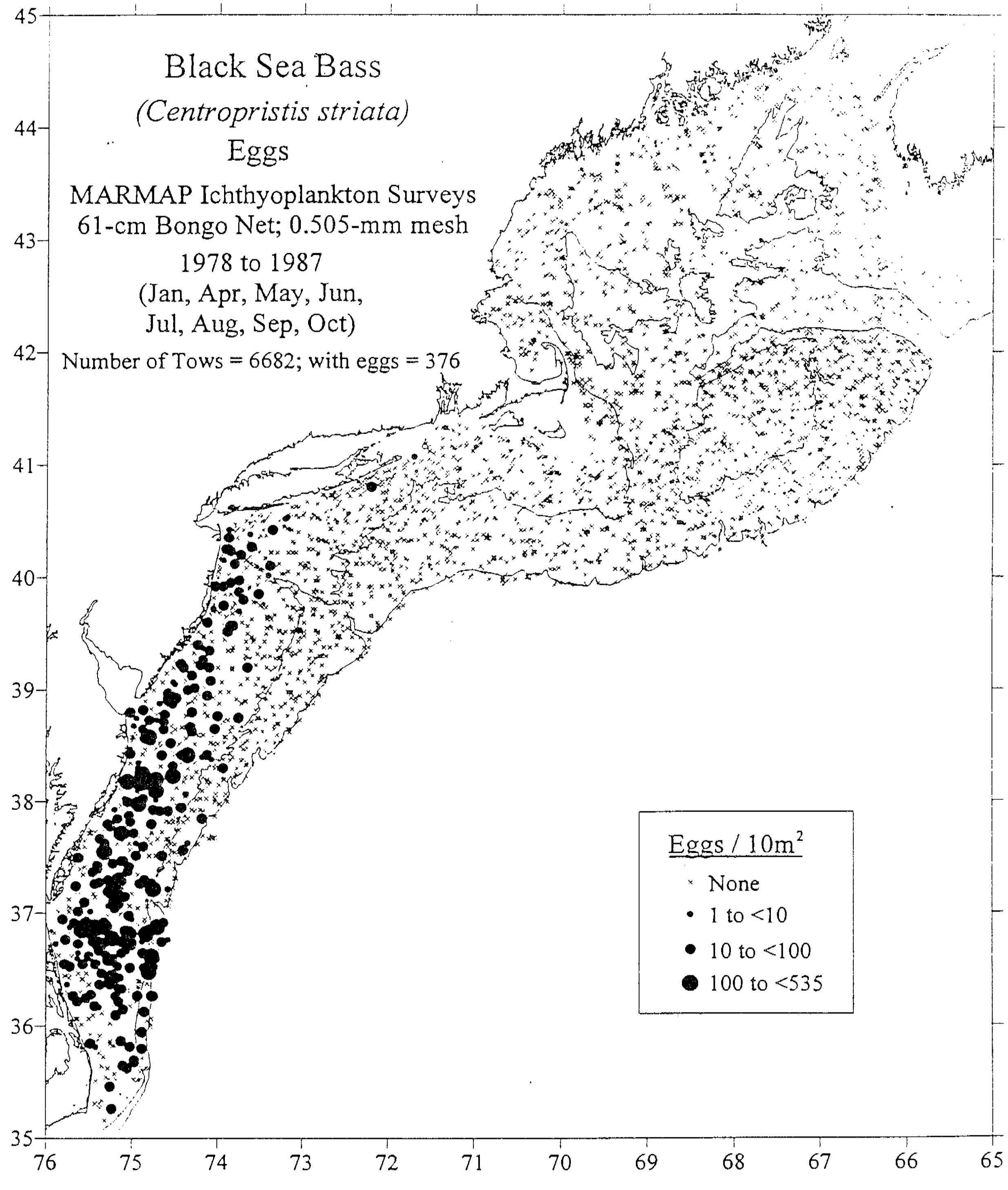


Figure 28. Overall distribution and relative abundance of black sea bass eggs collected from NEFSC MARMAP ichthyoplankton surveys, 1978-1987. (Note: eggs collected in 1977 were lost in lab fire.)
Source: Berrien and Sibunka in press in Steimle *et al.* 1998b.

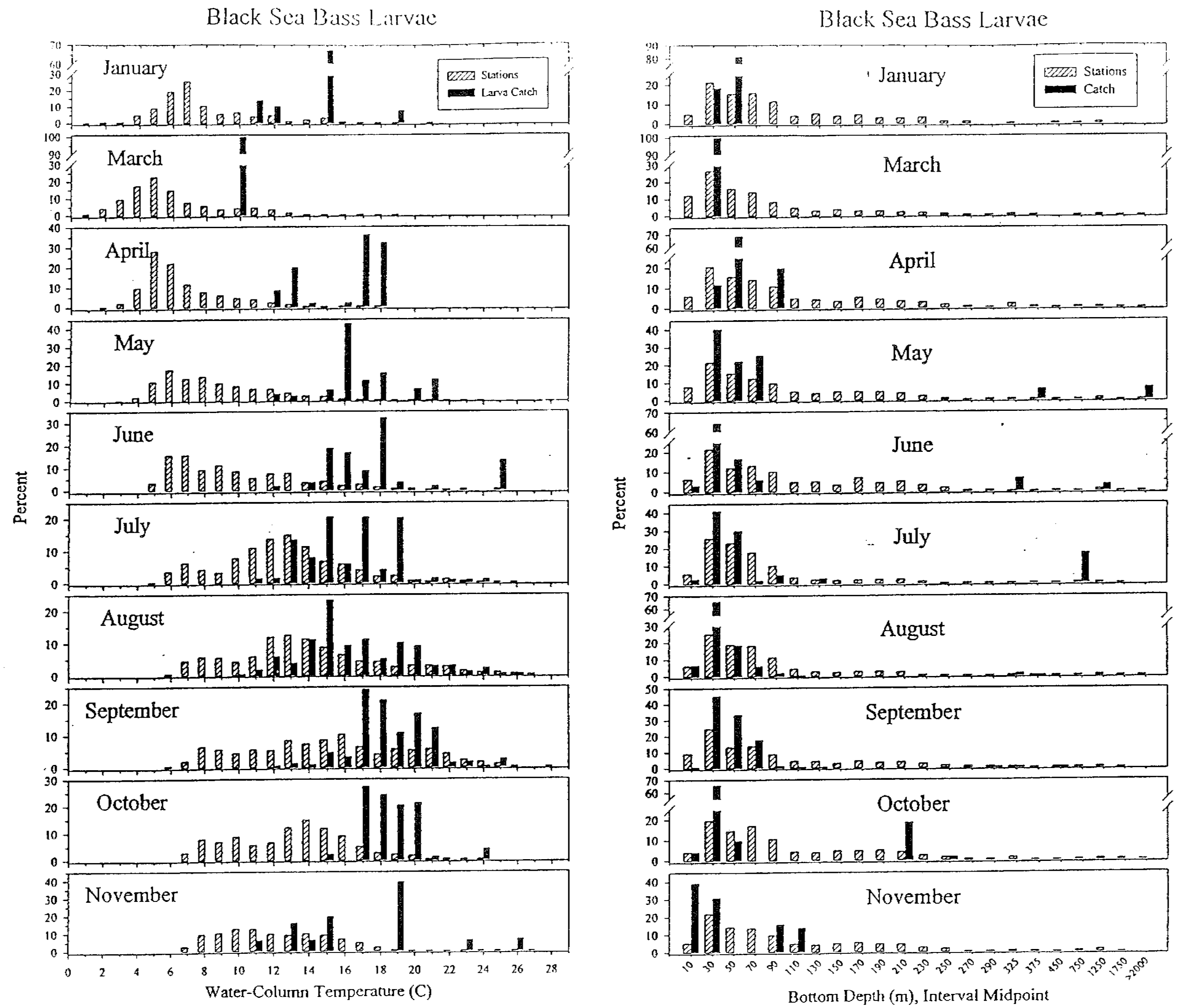


Figure 29. Association of black sea bass larval abundance, by month, with a) integrated water column temperatures and b) bottom depths, where larvae were collected during MARMAP ichthyoplankton surveys, 1977-1987. The shaded bars represent the percent distribution of all sampling sites and the filled bar represent the percent of all larval collections for that month. Source: P. Berrien, NEFSC, Sandy Hook Laboratory, Highlands, NJ unpubl. data in Steimle *et al.* 1998b.

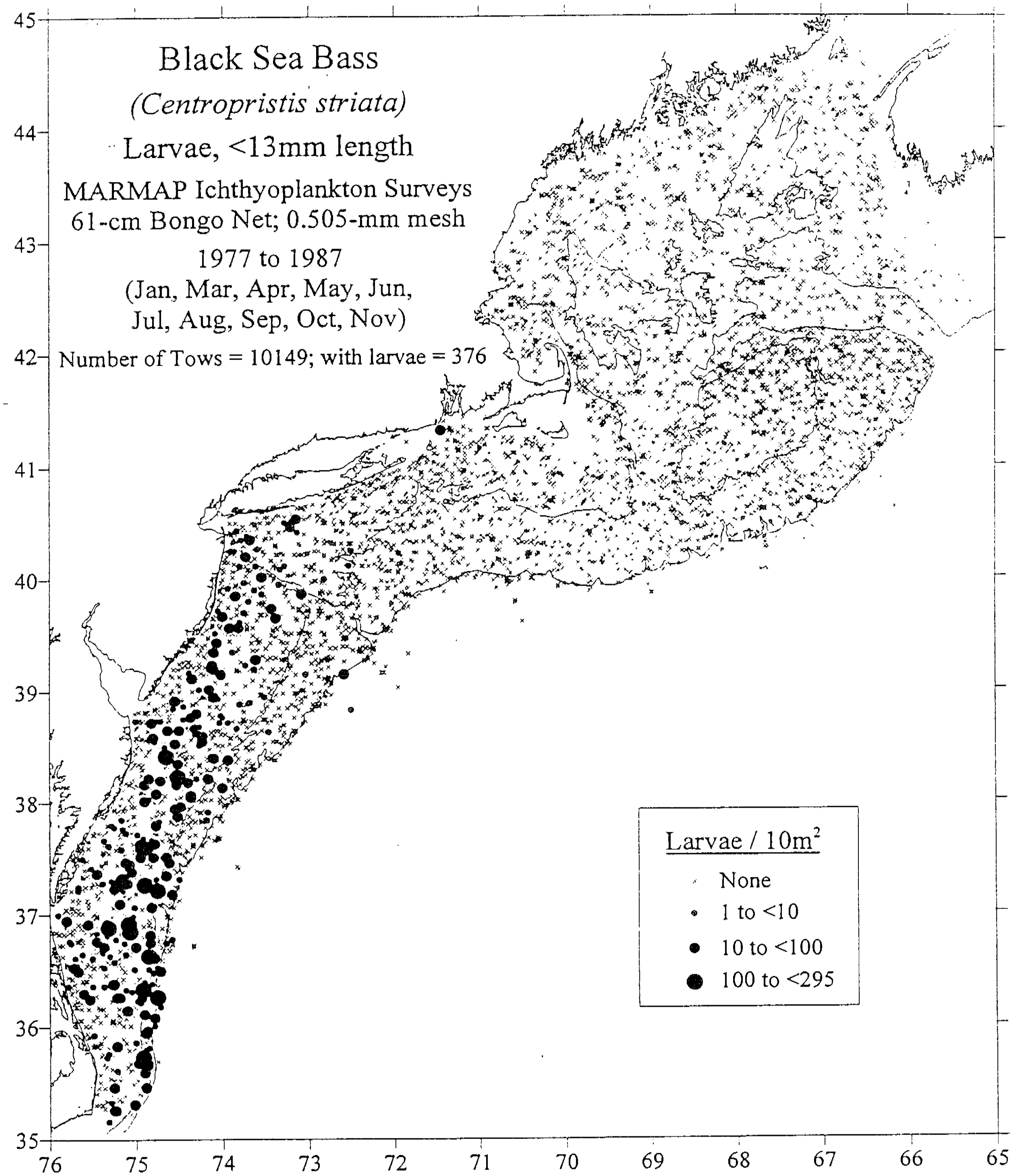


Figure 30. The overall distribution and relative abundance and sampling sites of black sea bass larvae from MARMAP ichthyoplankton surveys, 1977-1987 (P. Berrien, unpubl. data in Steimle *et al.* 1998b).

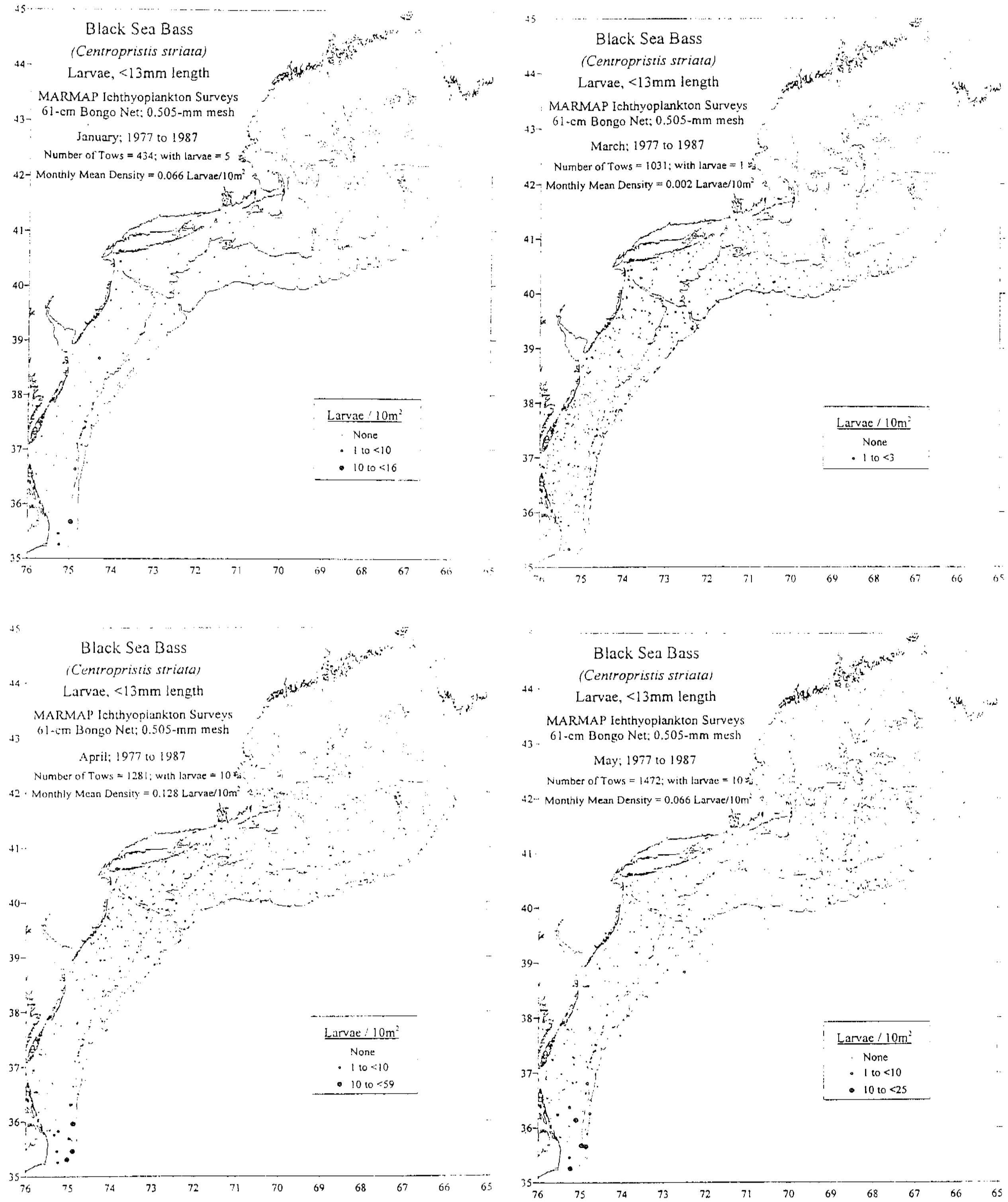


Figure 31a-j. The relative abundance and distribution of black sea bass larvae by month of collection, (a) January, (b) March, (c) April, (d) May, (e) June, (f) July, (g) August, (h) September, (i) October, and (j) November, with no survey data available for February. Source: P. Berrien, unpubl. data in Steimle *et al.* 1998b.

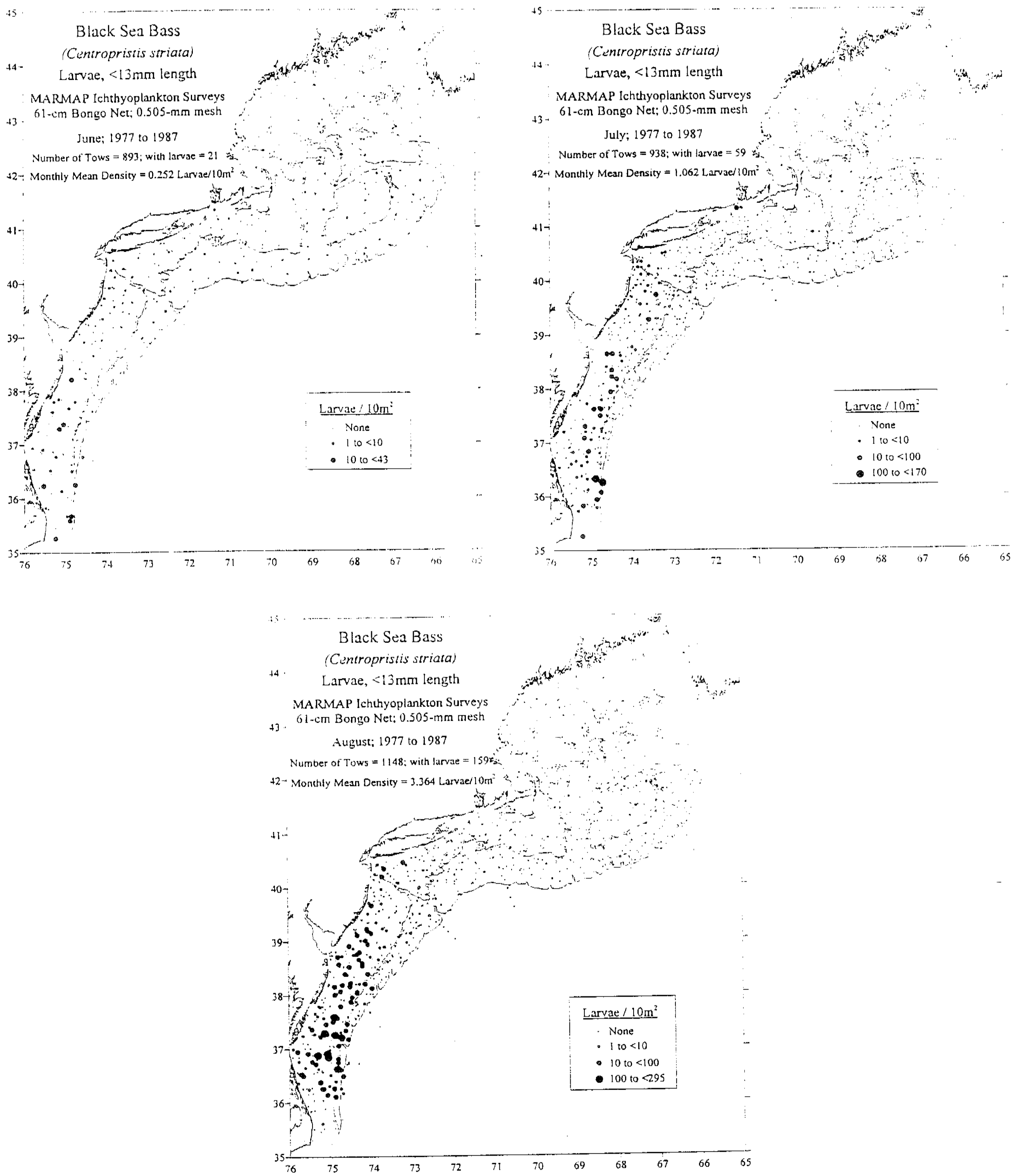


Figure 31a-j (continued). The relative abundance and distribution of black sea bass larvae by month of collection, (a) January, (b) March, (c) April, (d) May, (e) June, (f) July, (g) August, (h) September, (i) October, and (j) November, with no survey data available for February. Source: P. Berrien, unpubl. data in Steimle *et al.* 1998b.

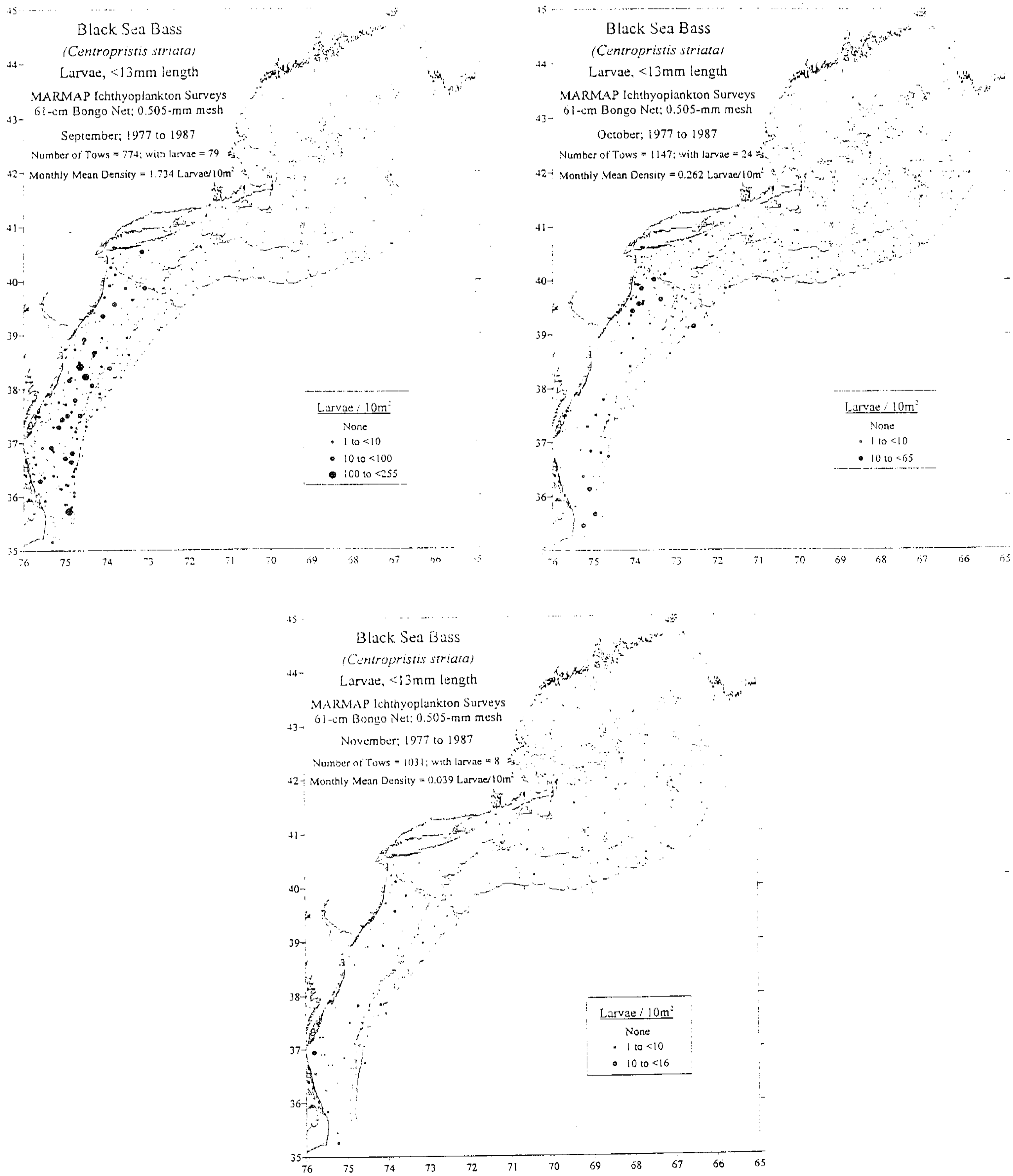
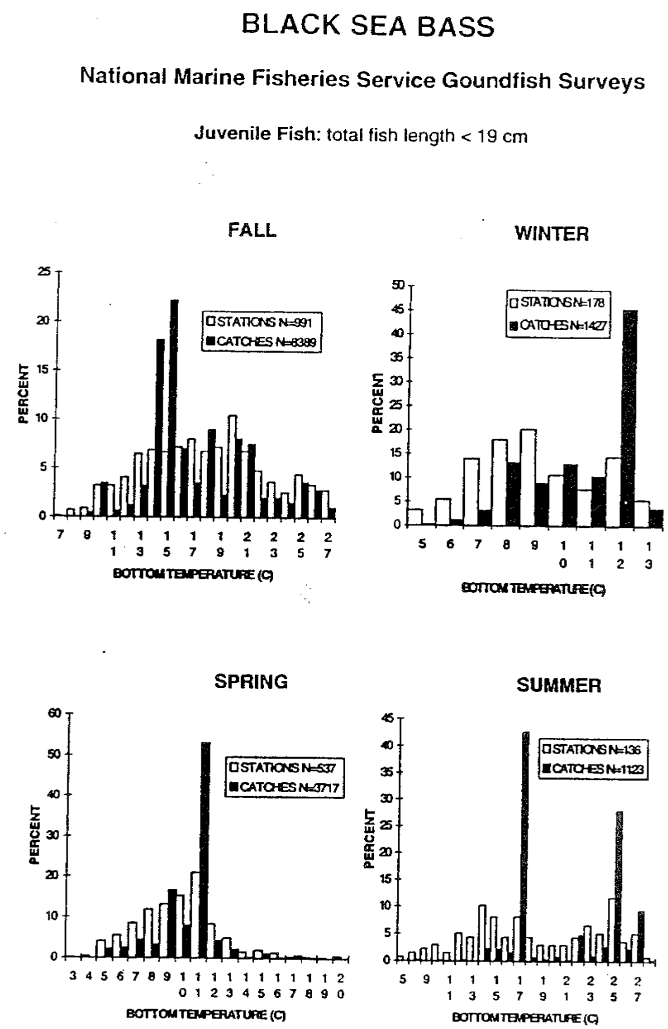


Figure 31a-j (continued). The relative abundance and distribution of black sea bass larvae by month of collection, (a) January, (b) March, (c) April, (d) May, (e) June, (f) July, (g) August, (h) September, (i) October, and (j) November, with no survey data available for February. Source: P. Berrien, unpubl. data in Steimle *et al.* 1998b.



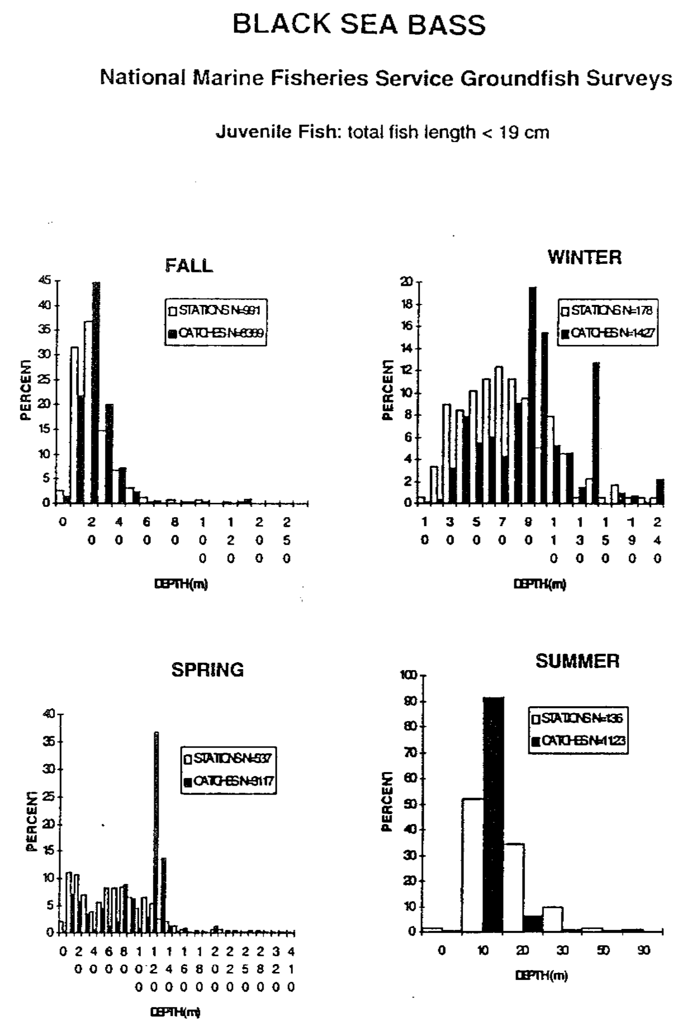


Figure 32a-b. Relative abundance of juvenile black sea bass as associated with, bottom (a) water temperatures, (b) water depth, by seasons, collected on NEFSC bottom trawl surveys.

Source: Steimle *et al.* 1998b.

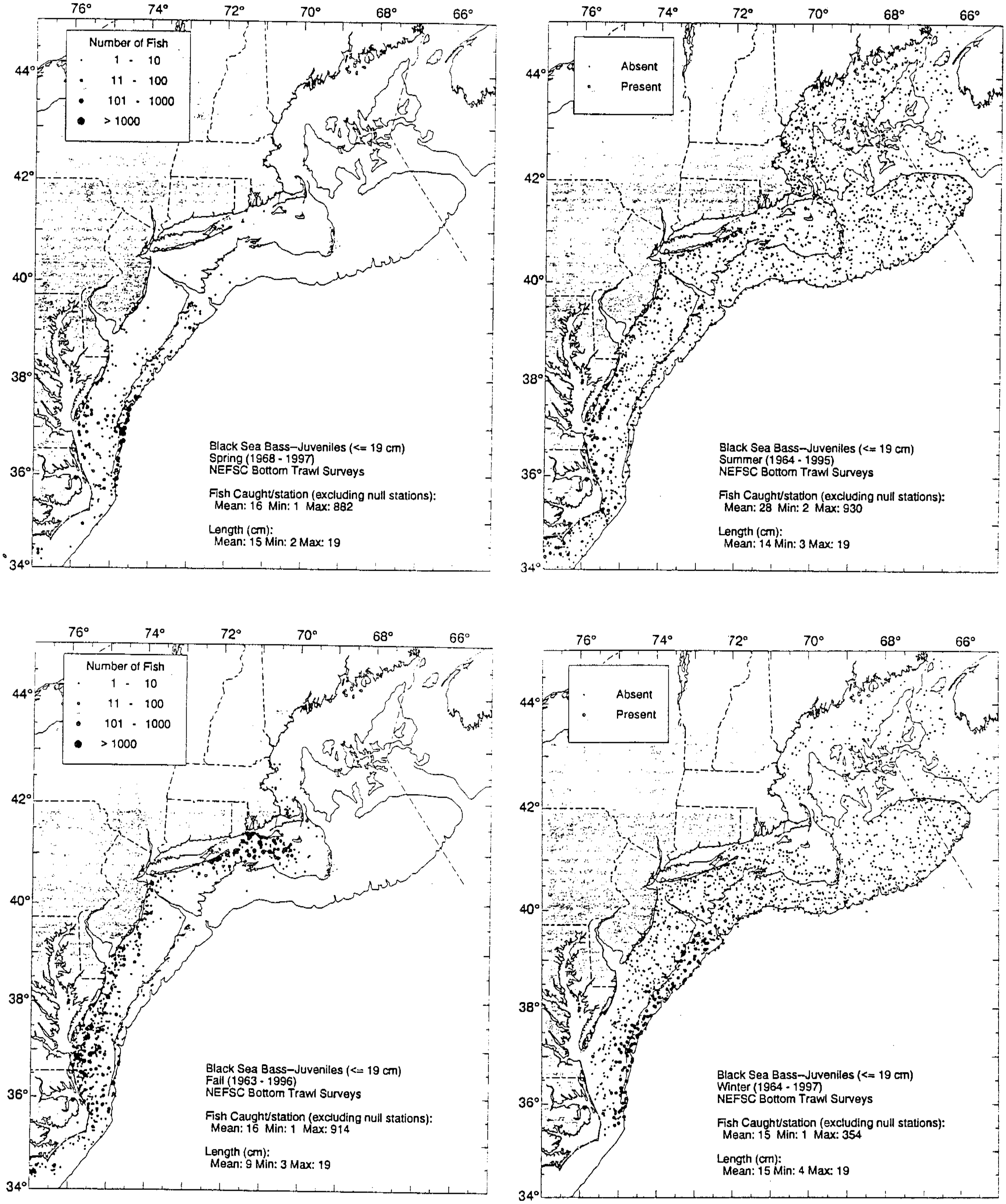
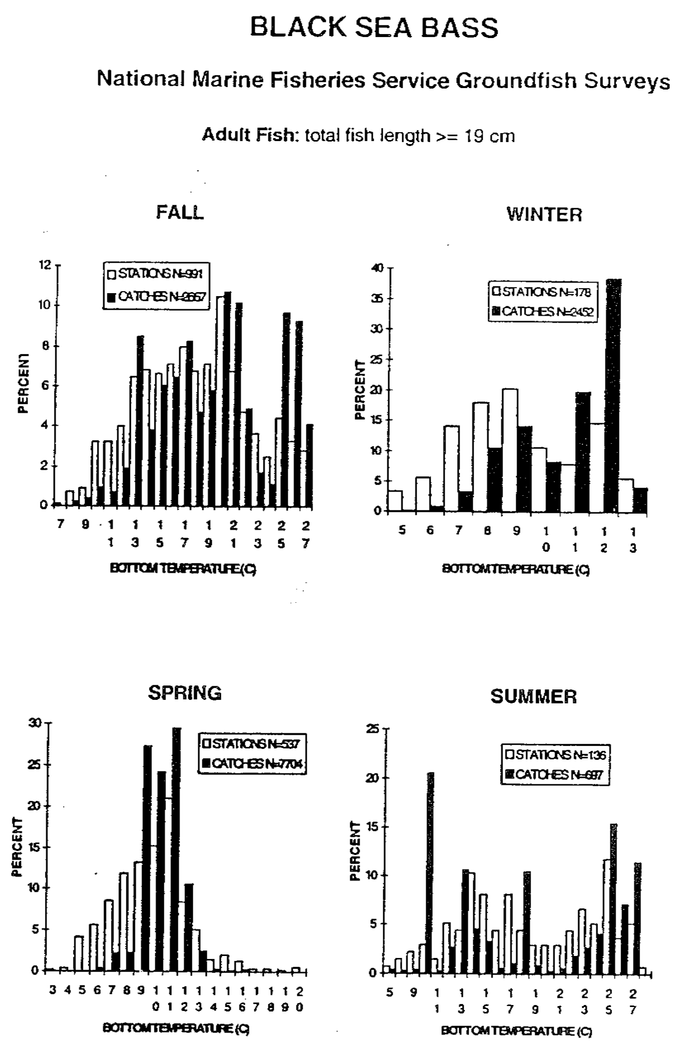


Figure 33a-d. Seasonal distribution and relative abundance of juvenile black sea bass in the northeast, based on NEFSC bottom trawl surveys since 1963.

Source: Steimle *et al.* 1998b.



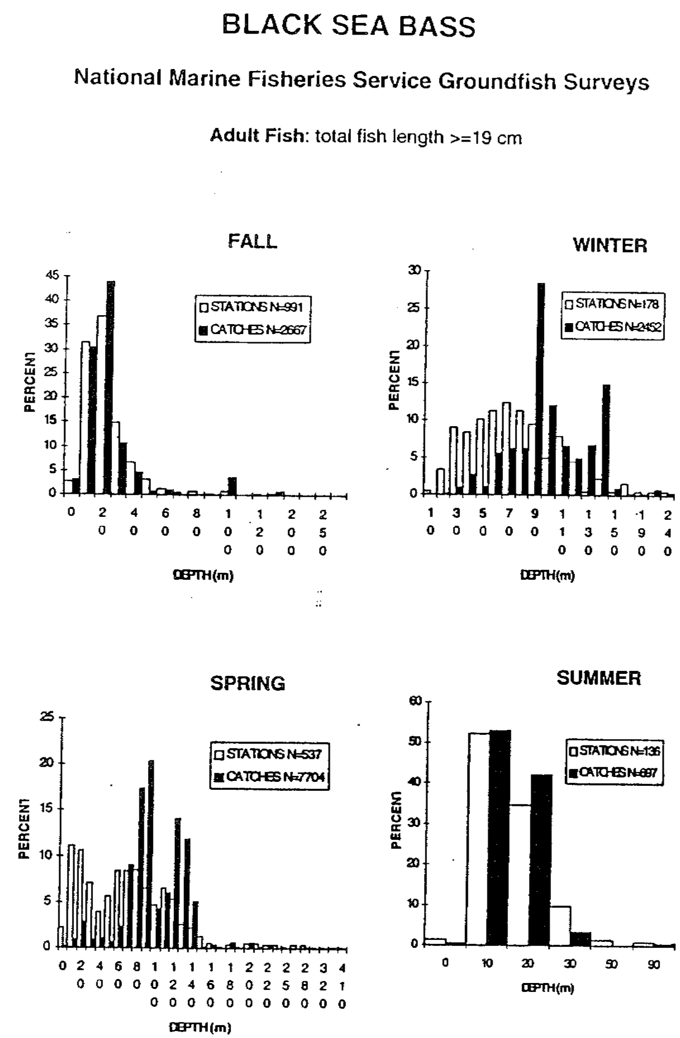


Figure 34a-b. Relative abundance of adult black sea bass associated with bottom water (a) temperatures and (b)water depth , by season, since 1963, based on NEFSC bottom trawl surveys.

Source: Steimle *et al.* 1998b.

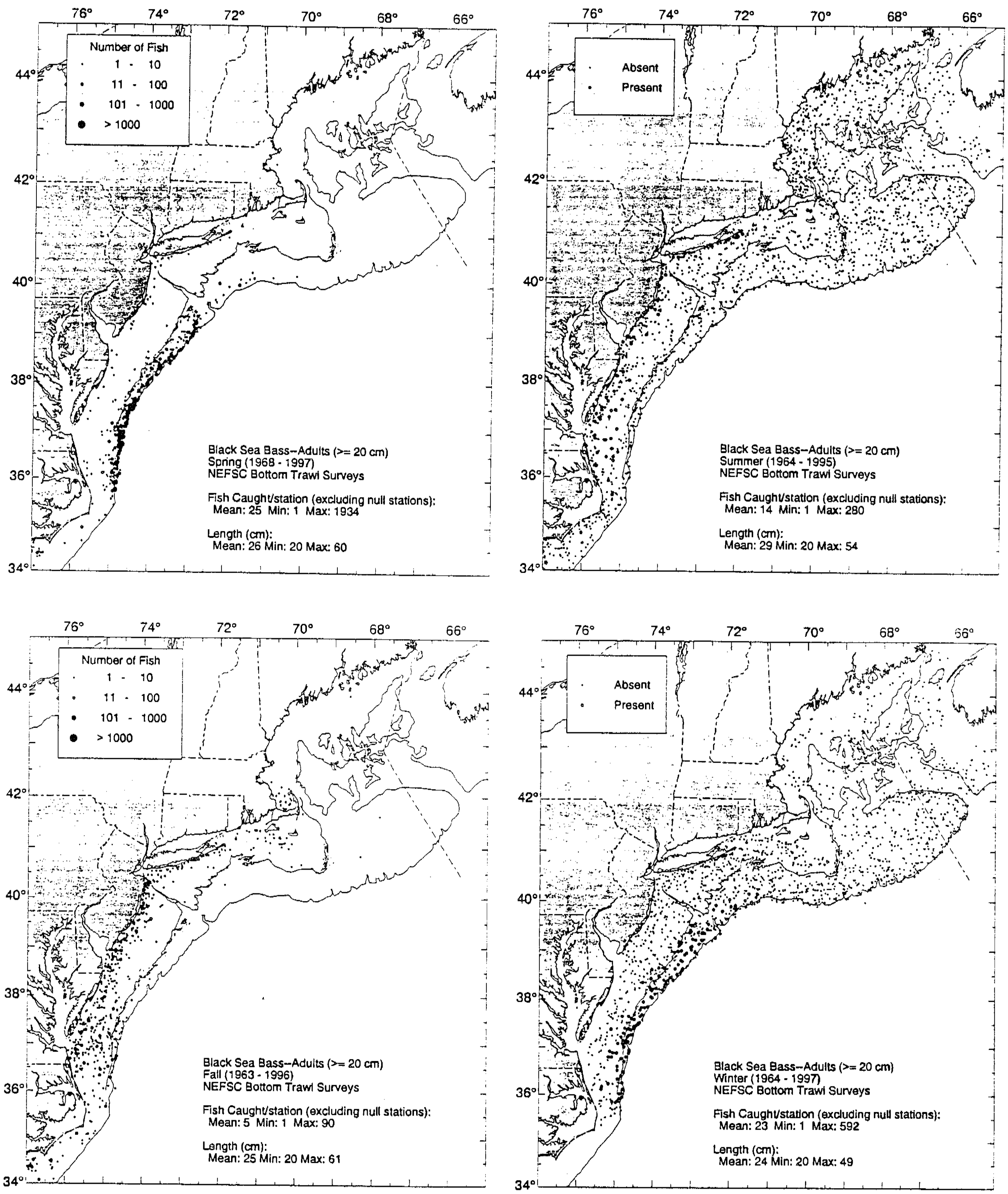


Figure 35a-d. Seasonal distribution and relative abundance of adult black sea bass in the northeast based on NEFSC bottom trawl surveys, (a) spring, (b) summer, (c) fall, (d) winter. (Note: winter and summer data is reported only as presence/absence because of variability in area coverage or gear used during this time series.)

Source: Steimle *et al.* 1998b.

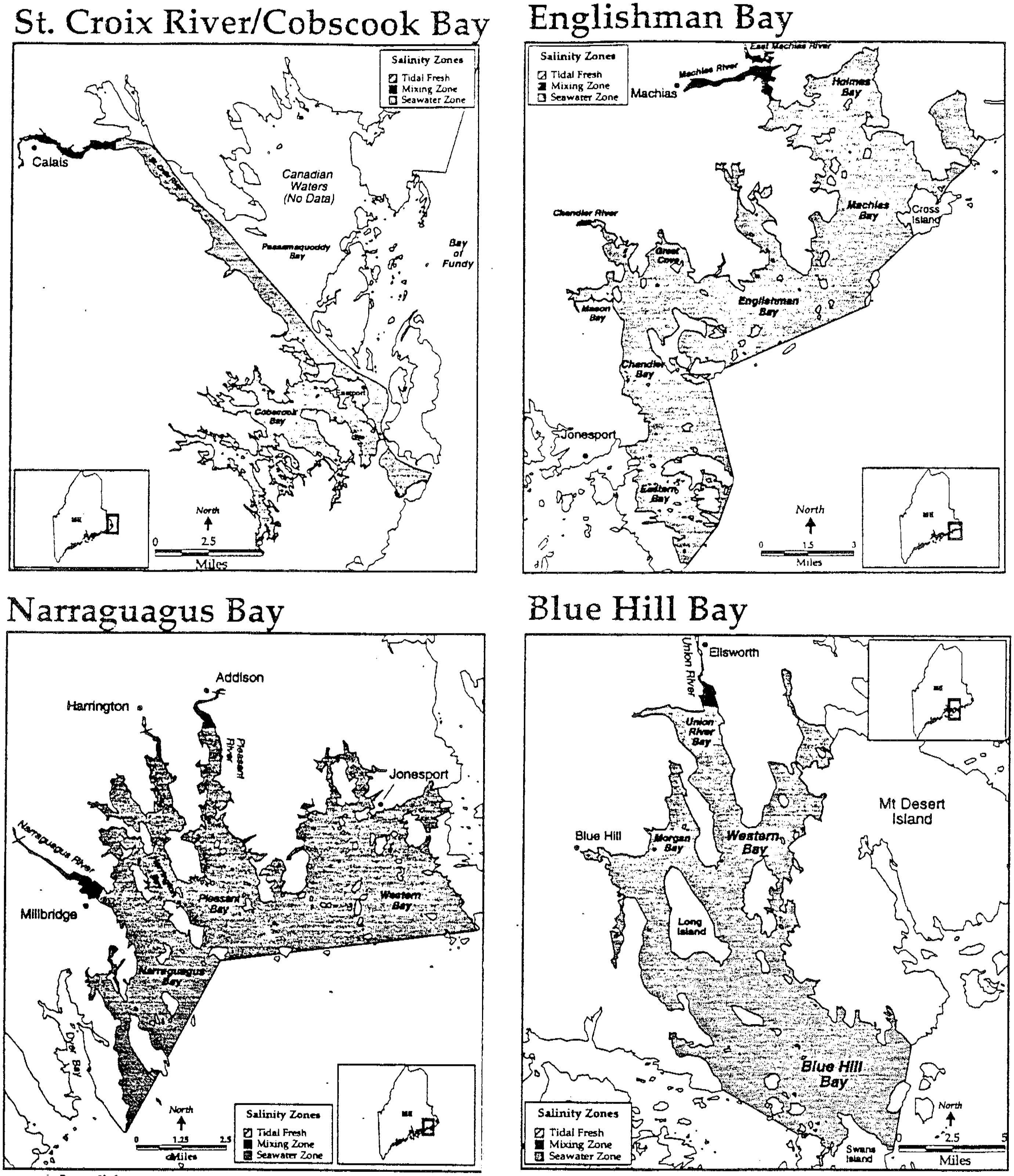


Figure 36a. Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data). Source: NOAA 1997a.

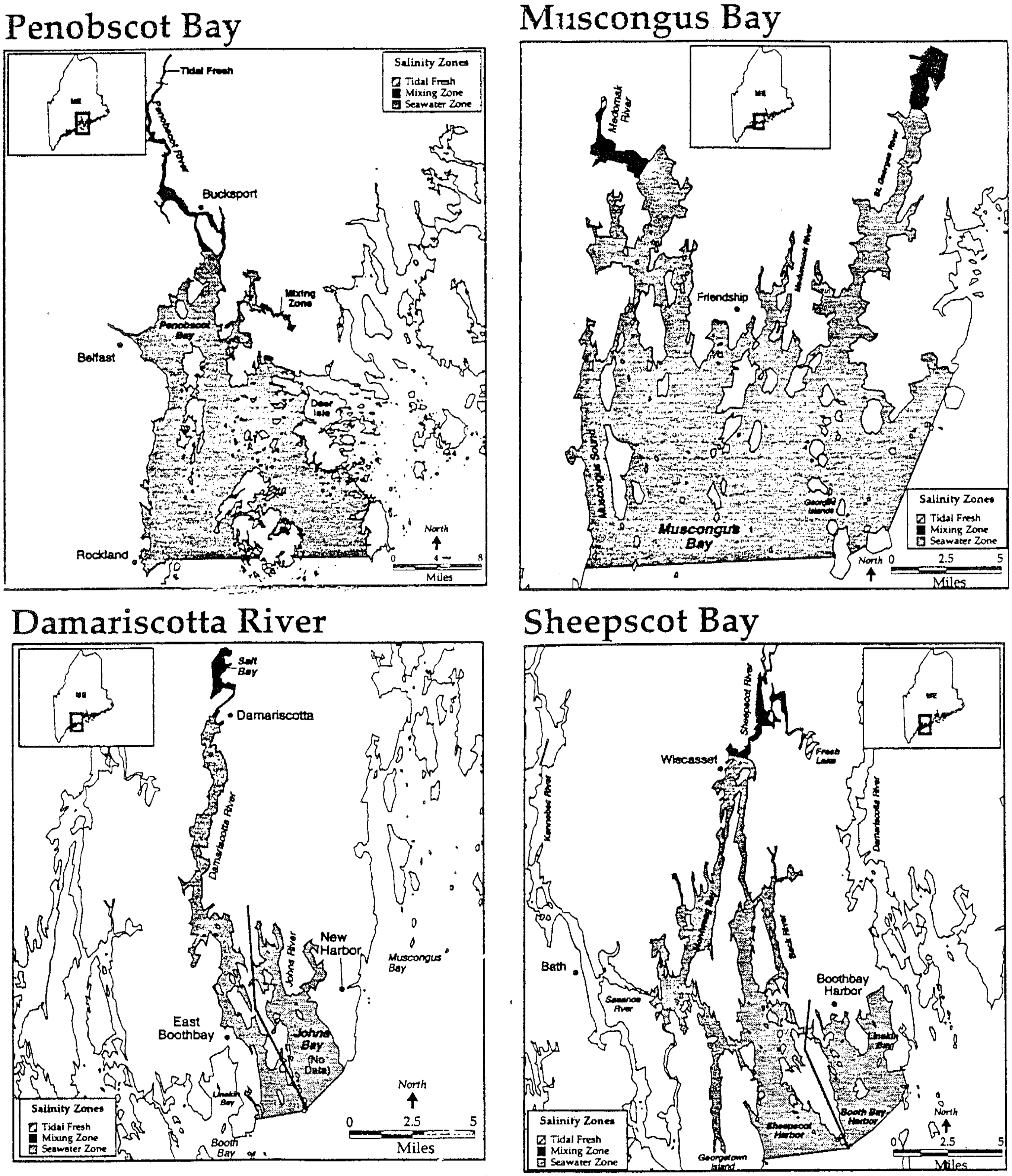


Figure 36a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

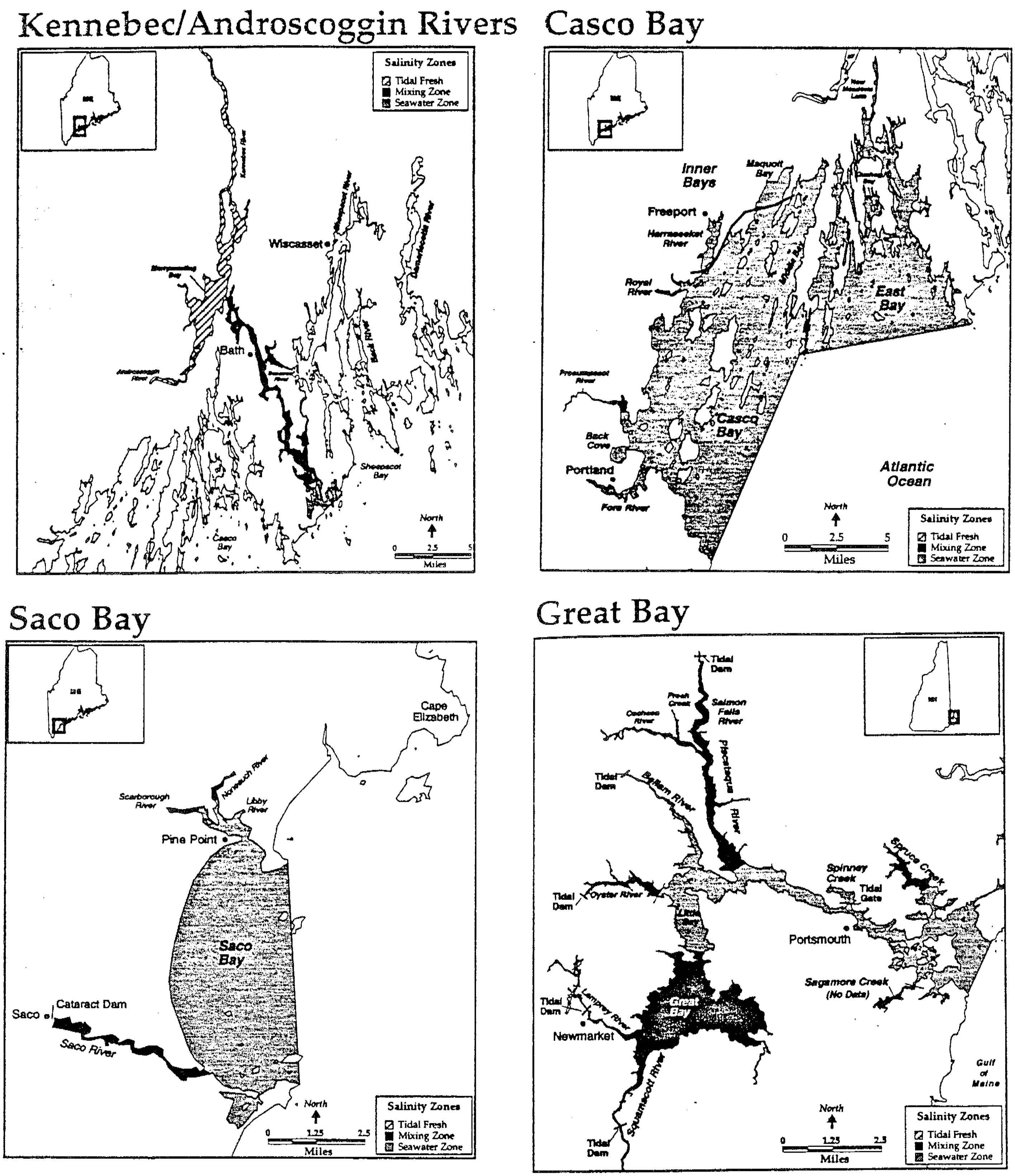
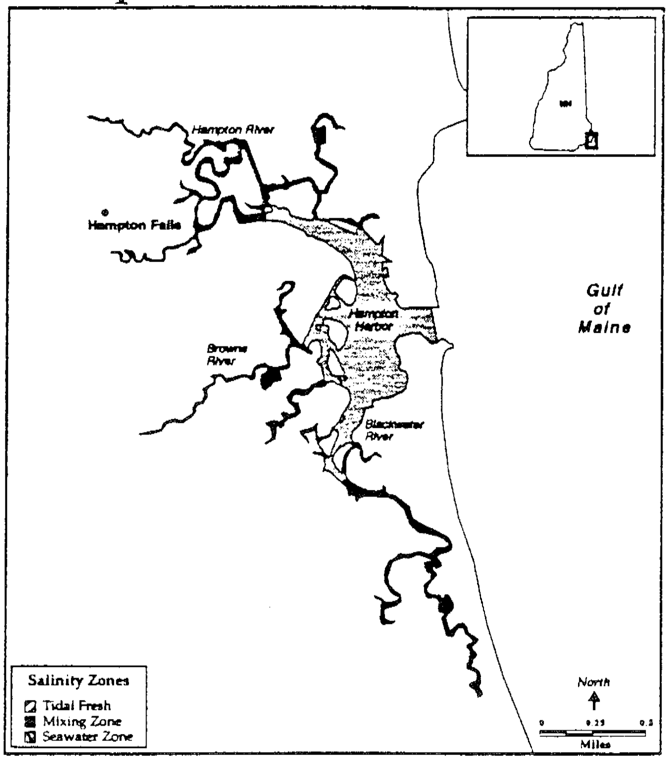
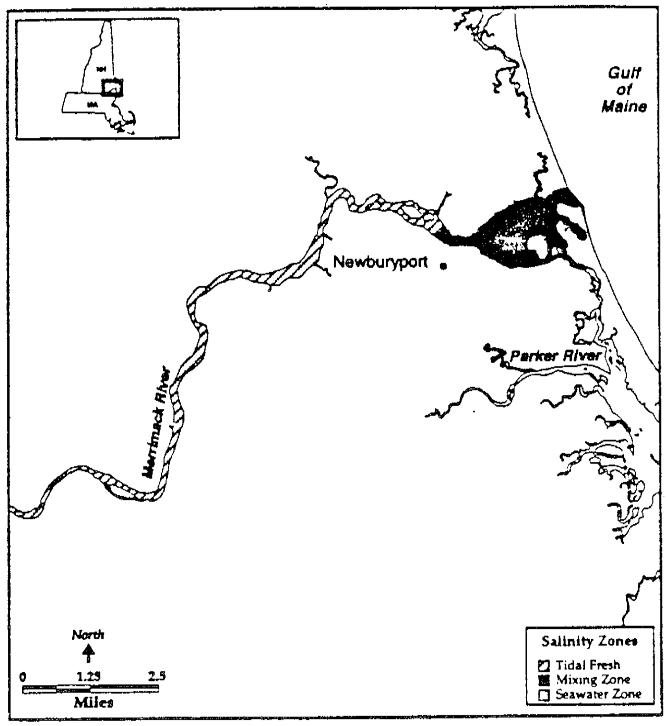


Figure 36a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

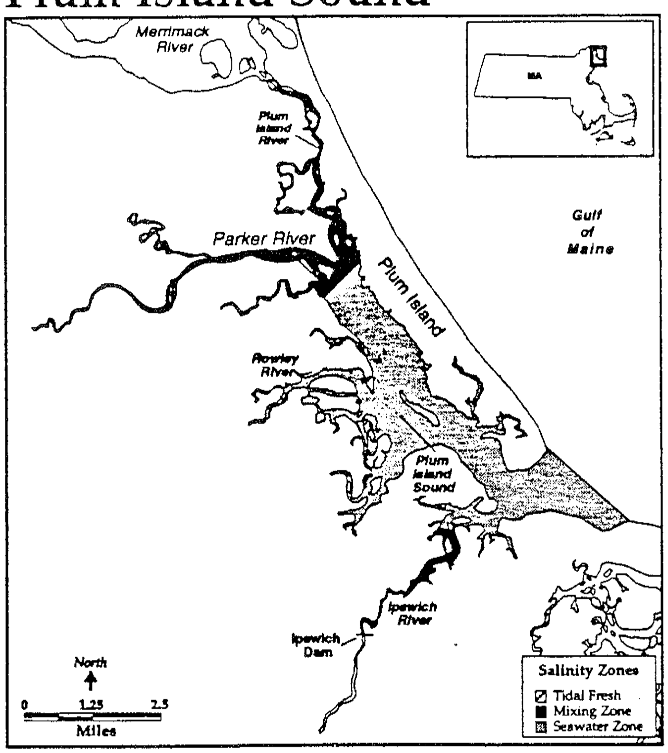
Hampton Harbor



Merrimack River



Plum Island Sound



Massachusetts Bay

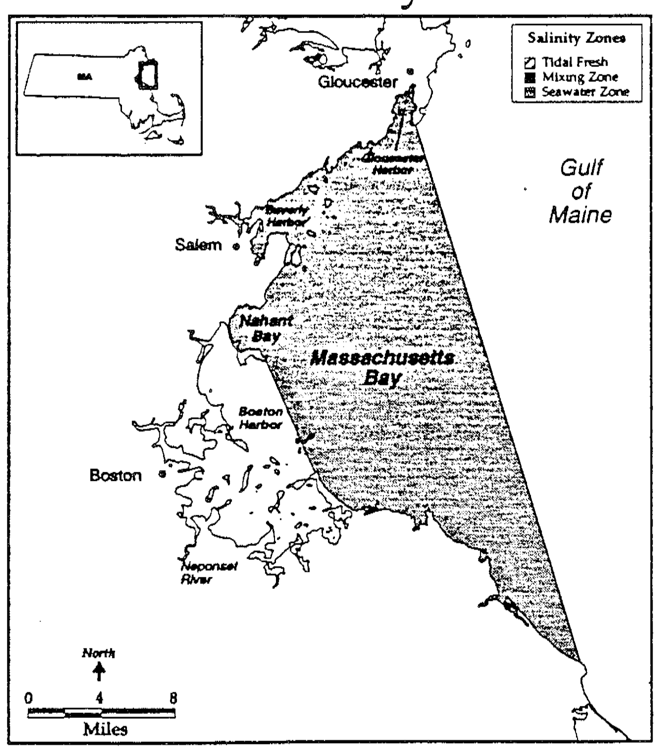
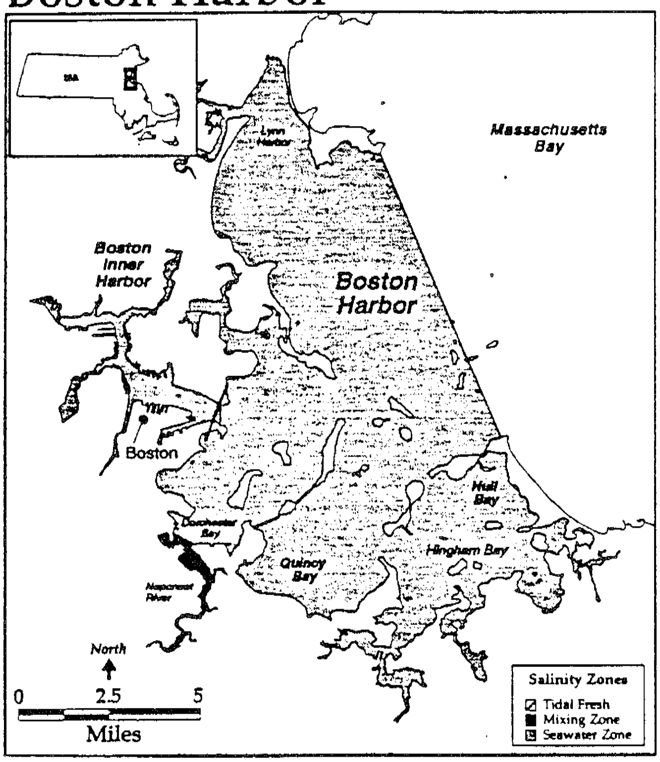


Figure 36a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

Boston Harbor



Cape Cod Bay

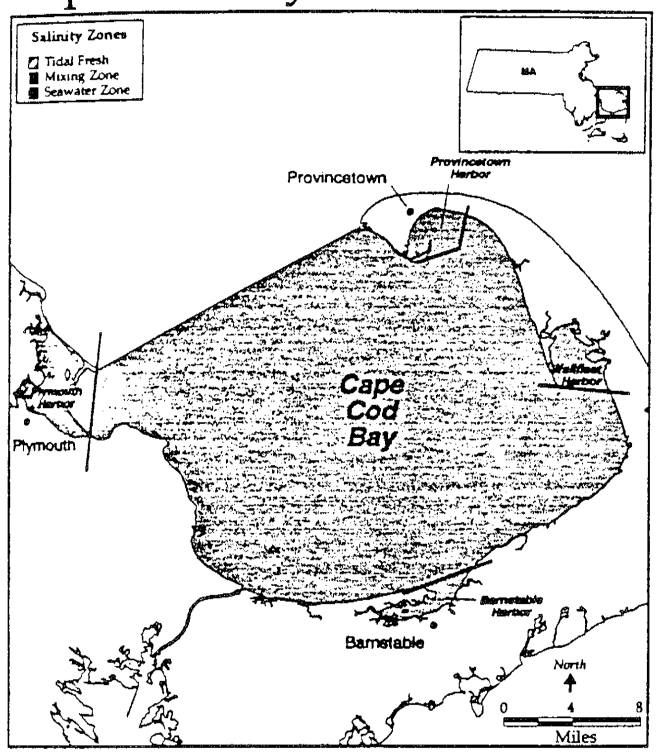
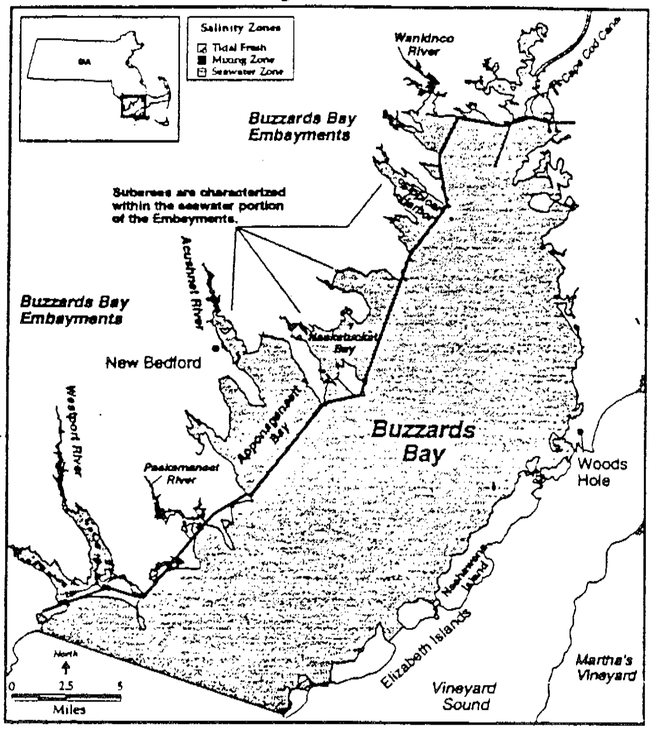
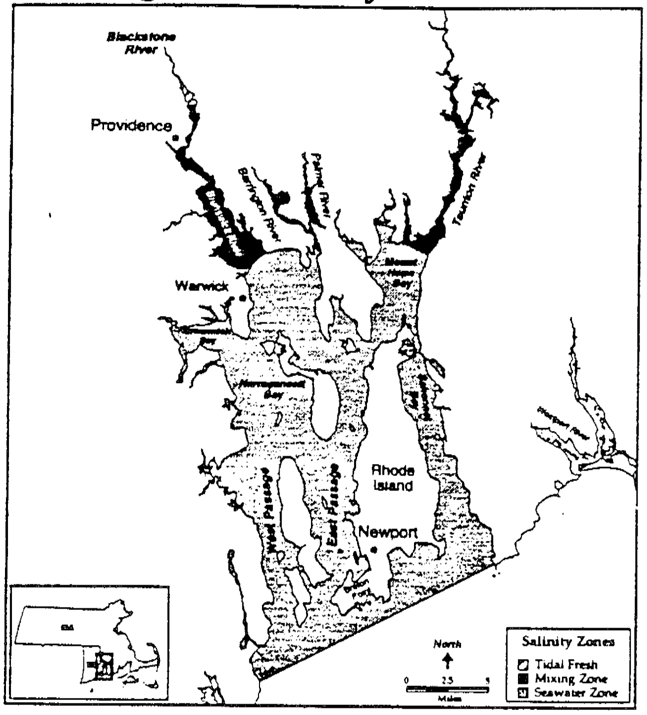


Figure 36a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

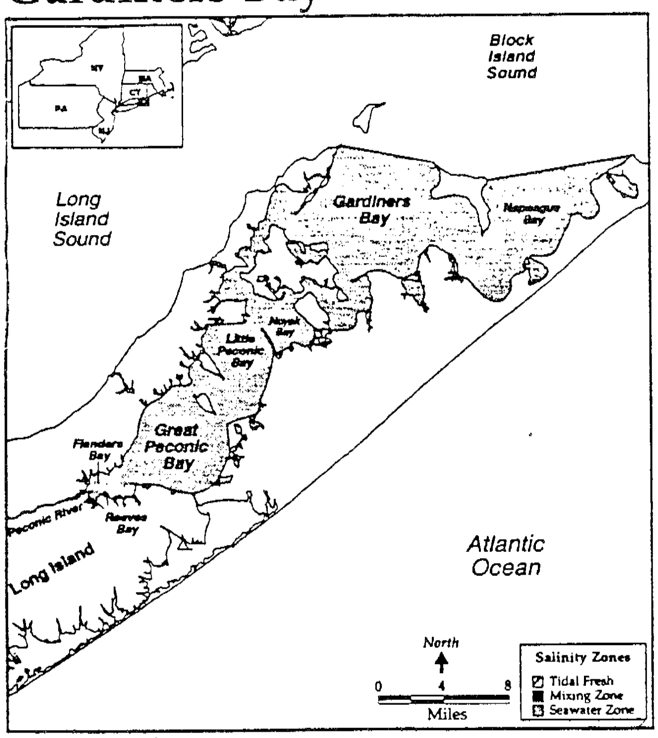
Buzzards Bay



Narragansett Bay



Gardiners Bay



Long Island Sound

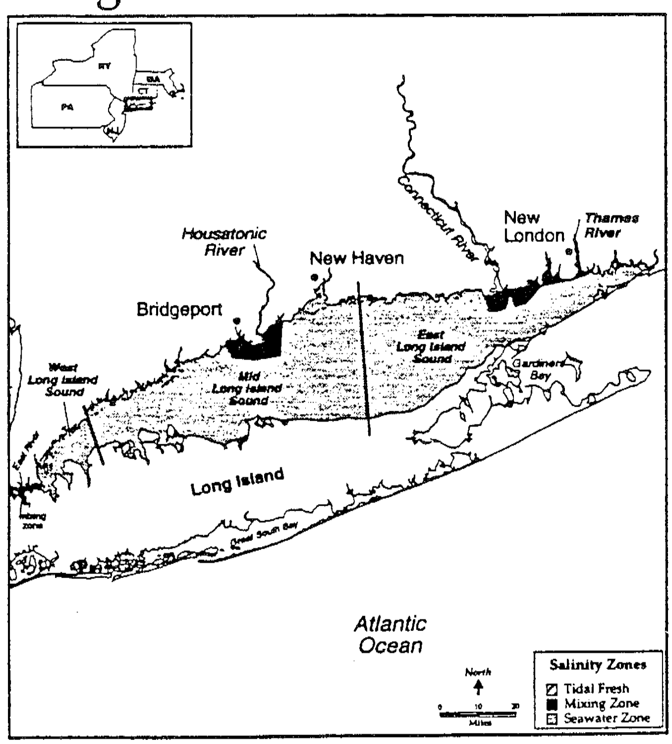
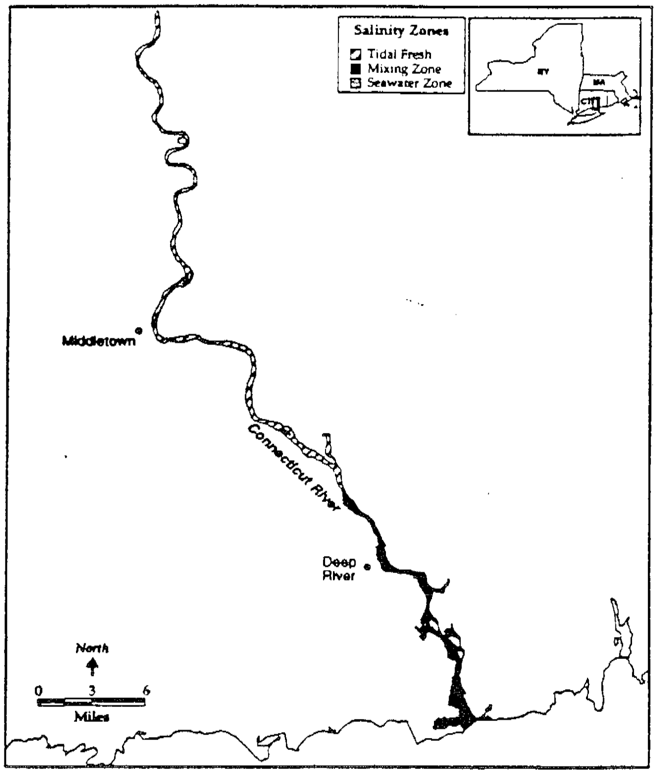
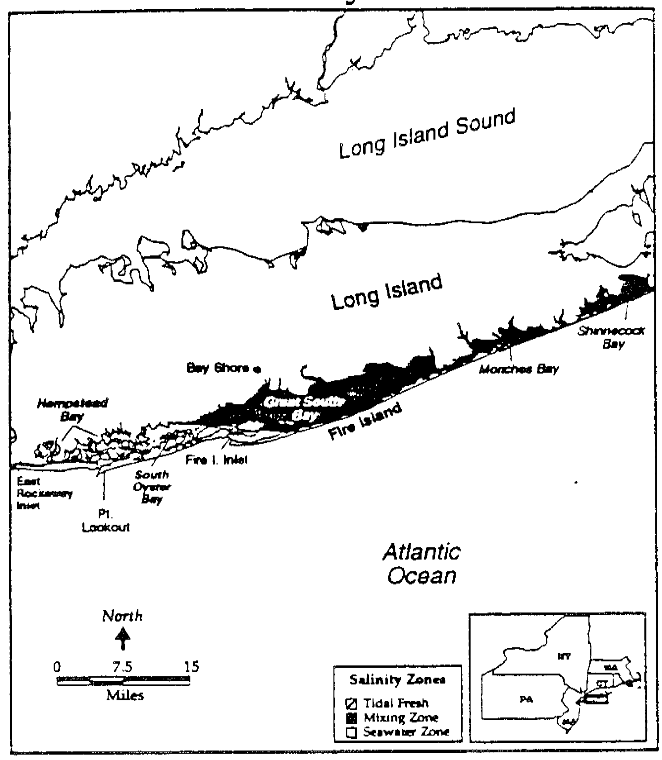


Figure 36b. Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data). Source: NOAA 1997b.

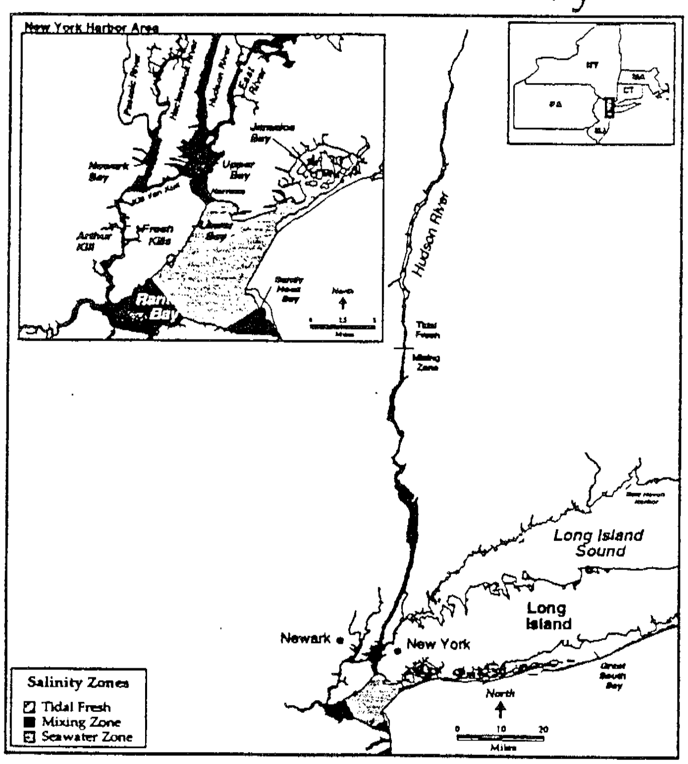
Connecticut River



Great South Bay



Hudson River/Raritan Bay



Barnegat Bay

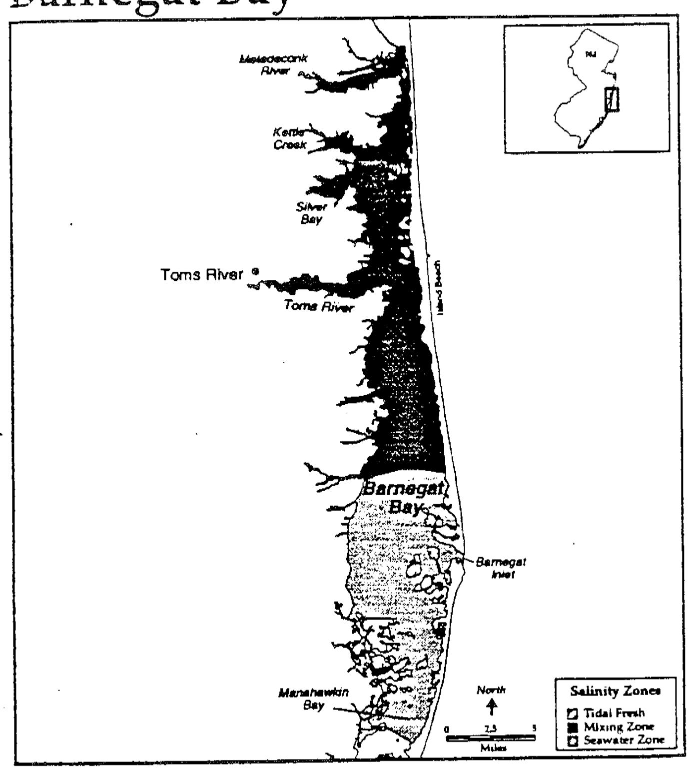


Figure 36b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

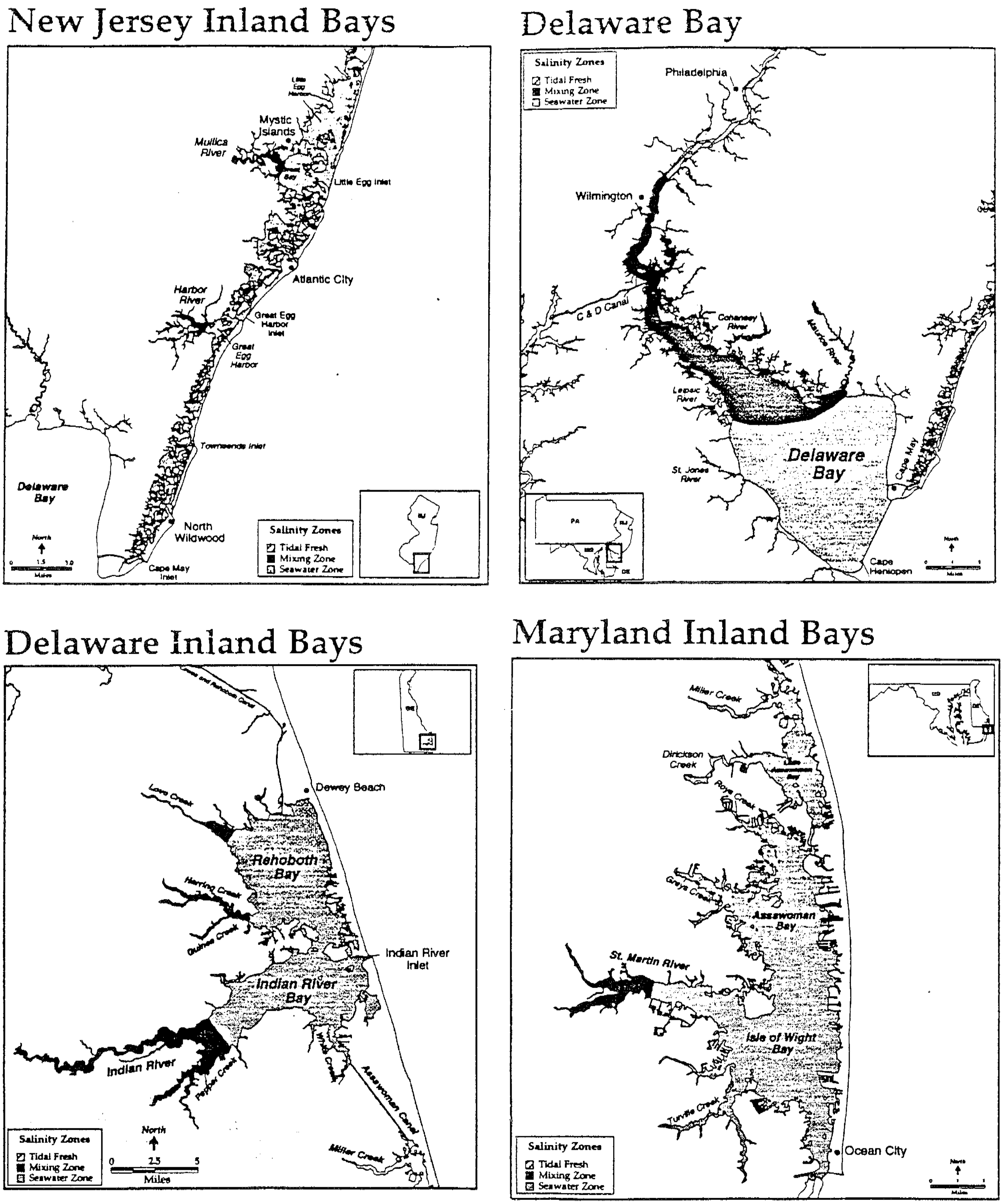
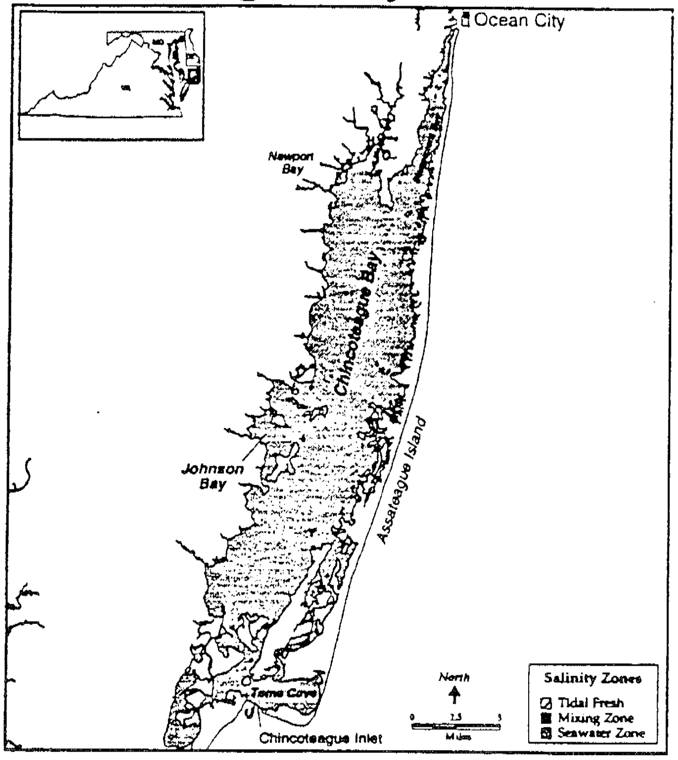
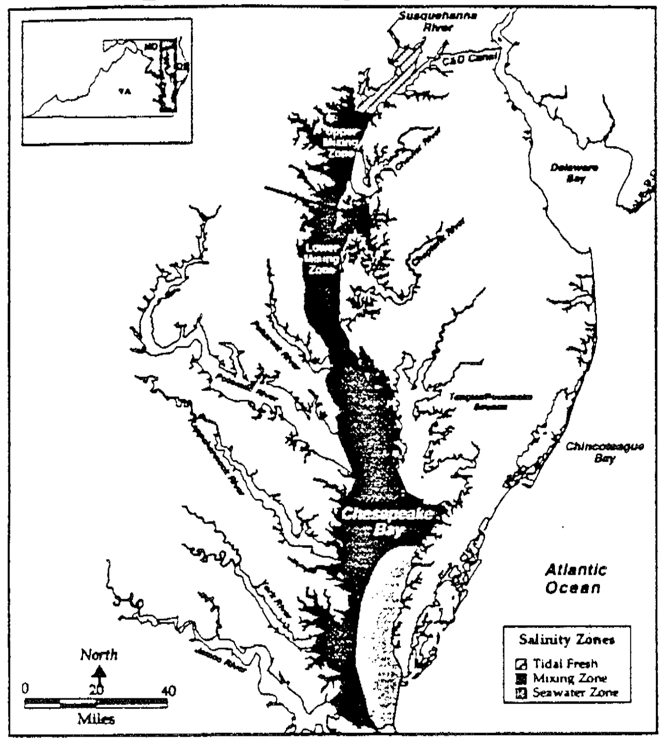


Figure 36b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

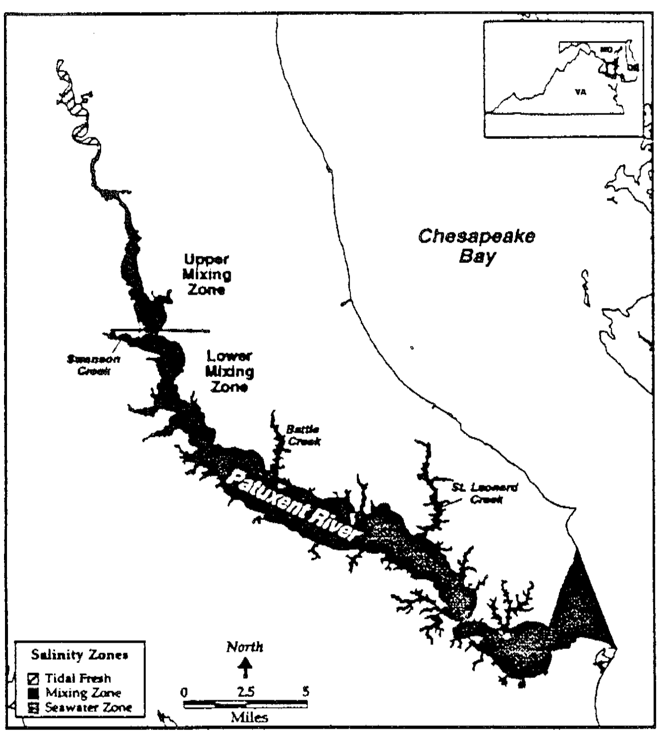
Chincoteague Bay



Chesapeake Bay (Mainstem)



Patuxent River



Potomac River

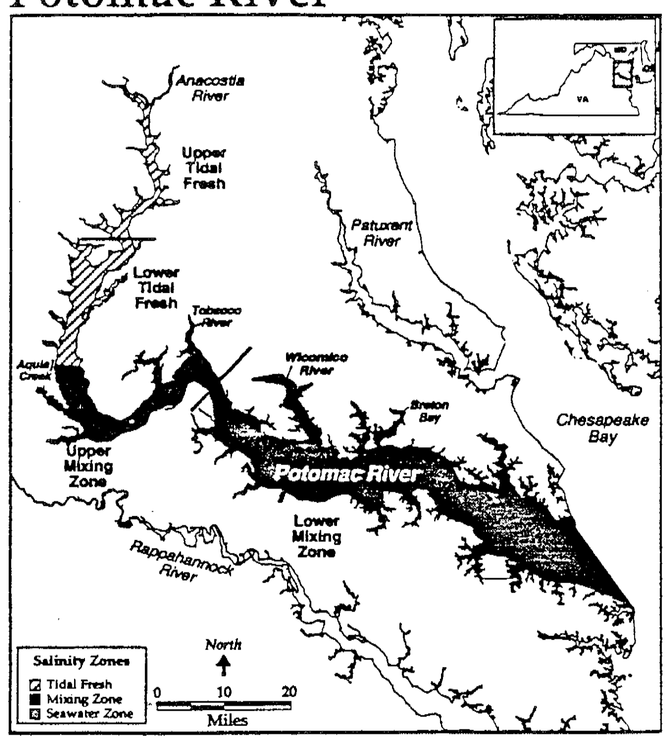


Figure 36b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

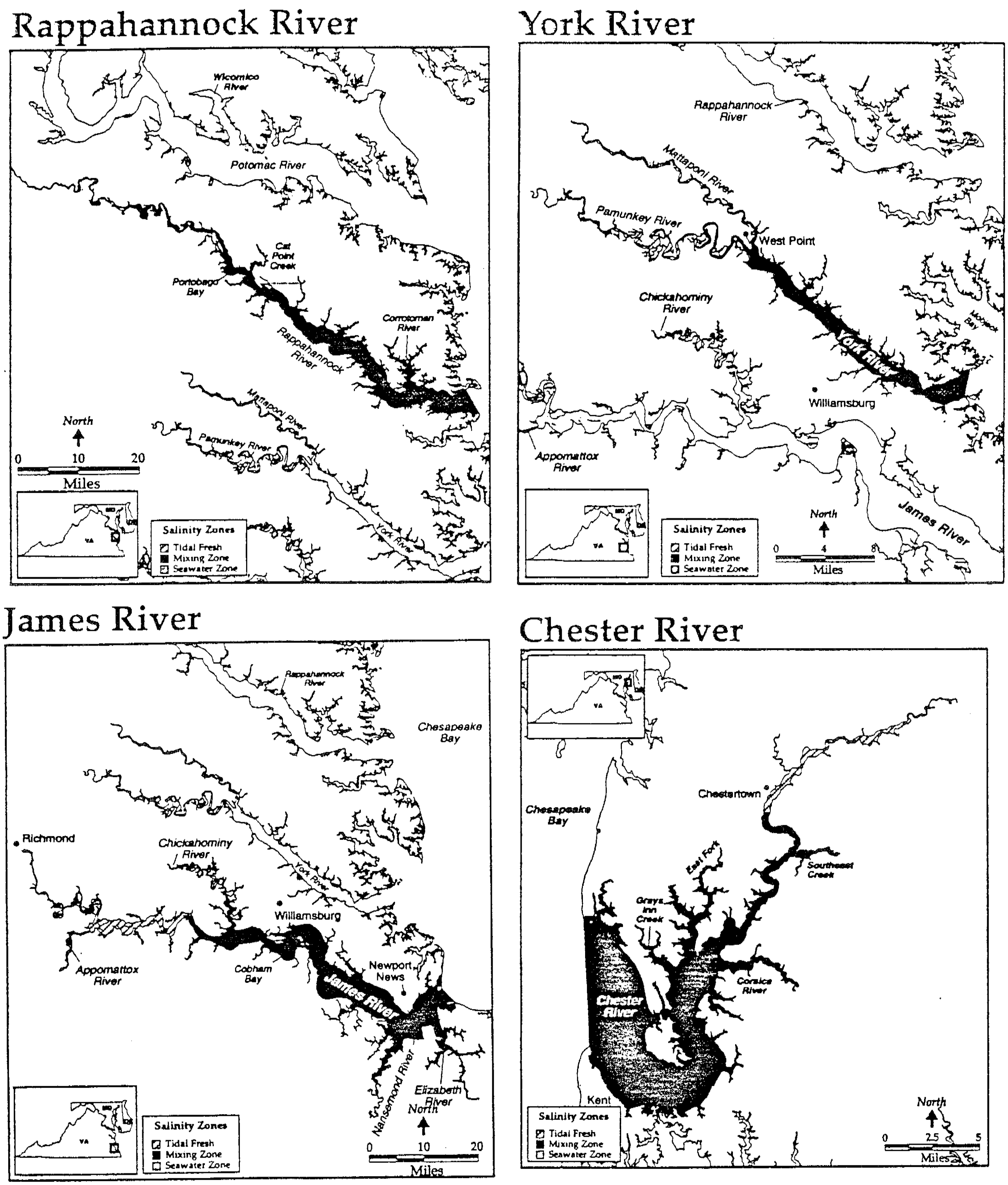
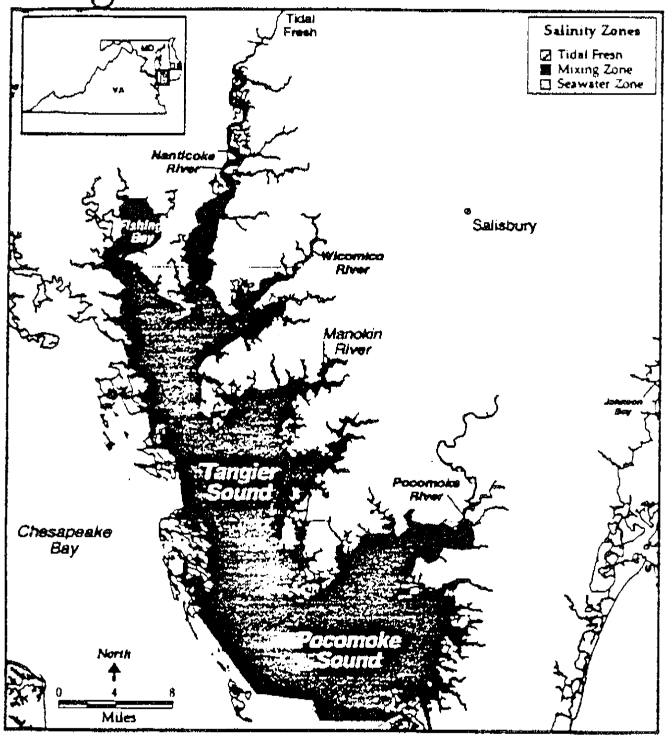


Figure 36b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

Tangier/Pocomoke Sounds



Choptank River

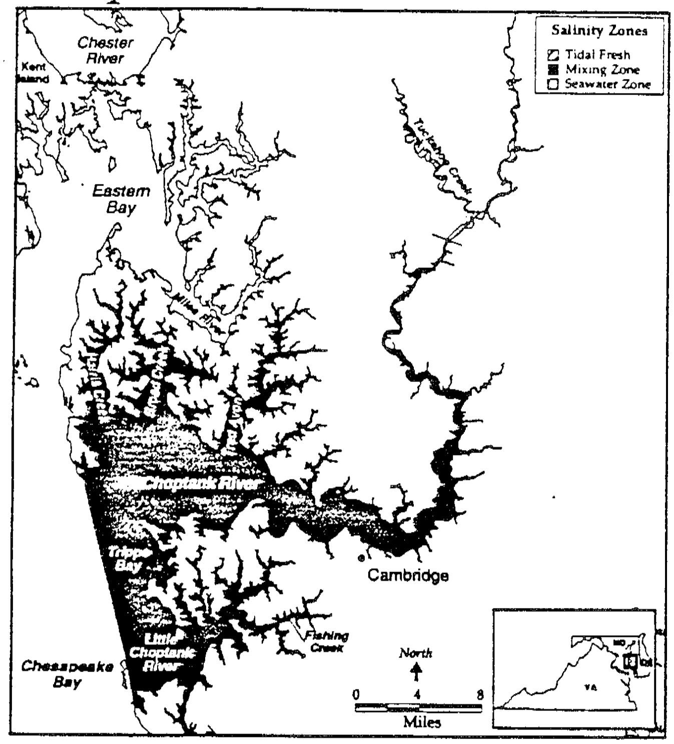


Figure 36b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

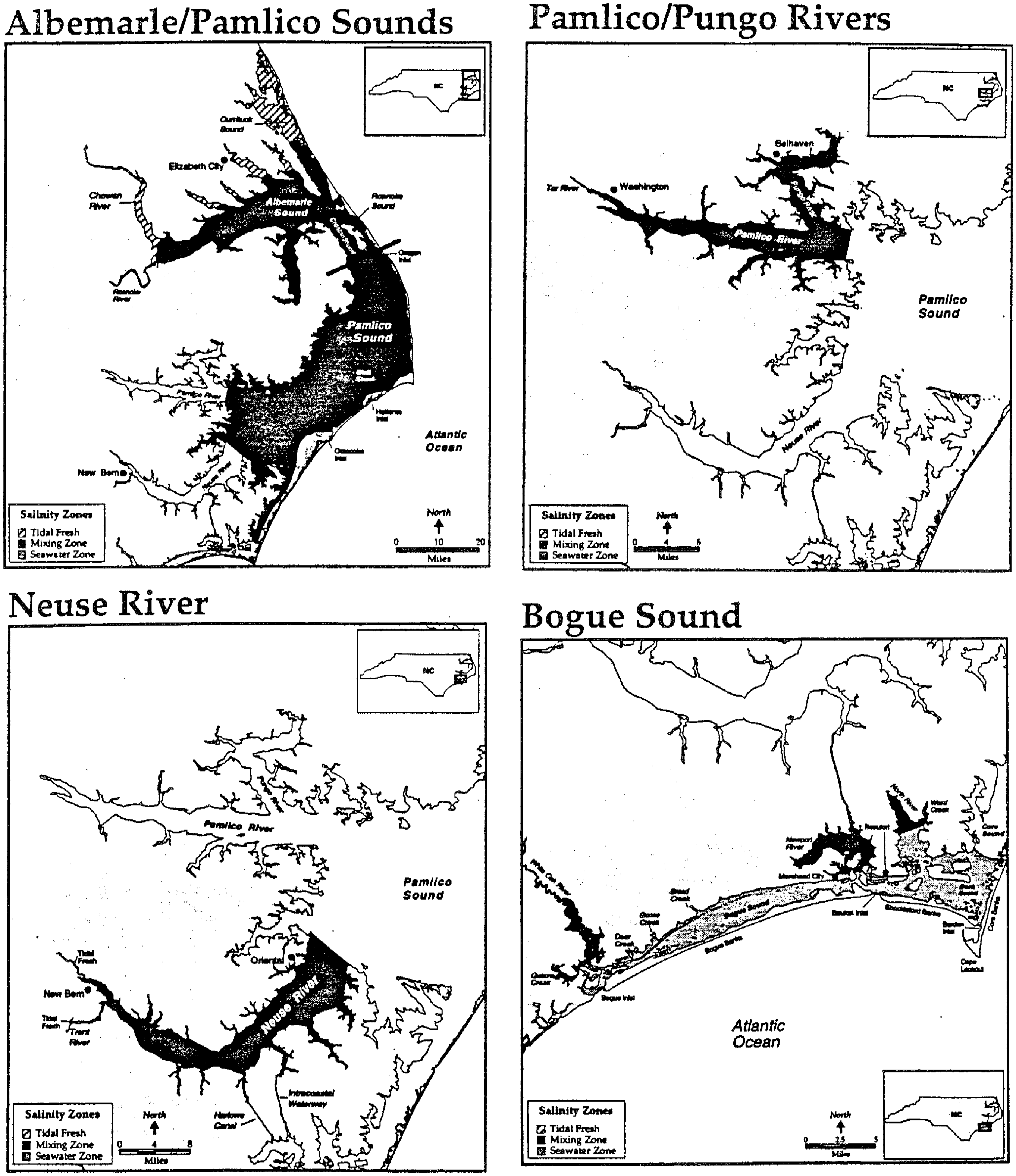
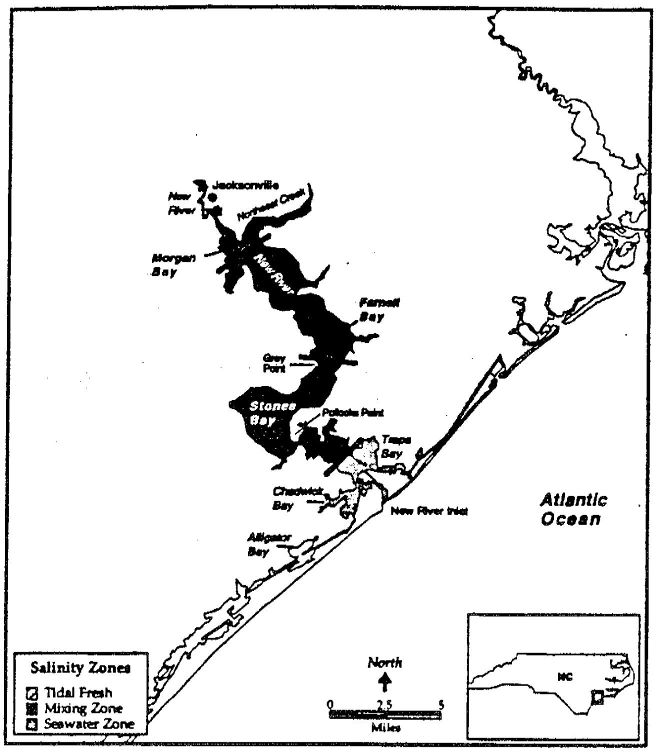
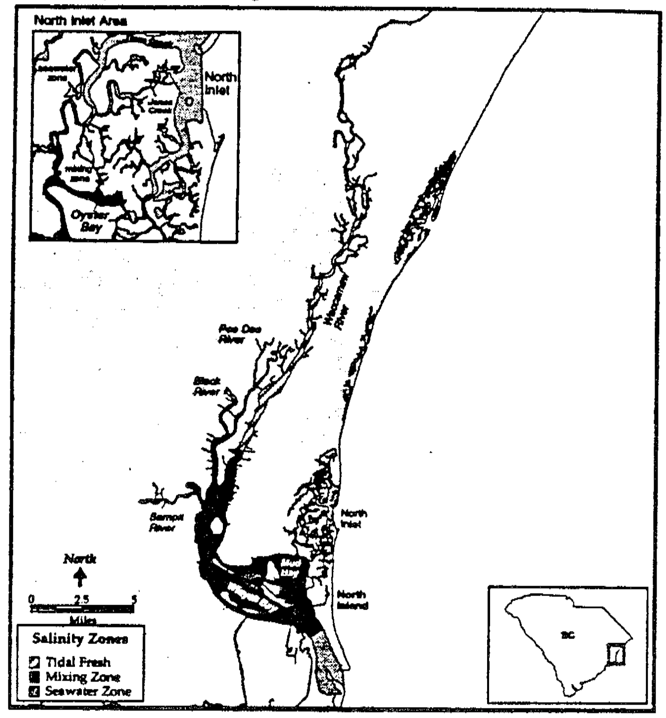


Figure 36c. Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data). Source: NOAA 1996.

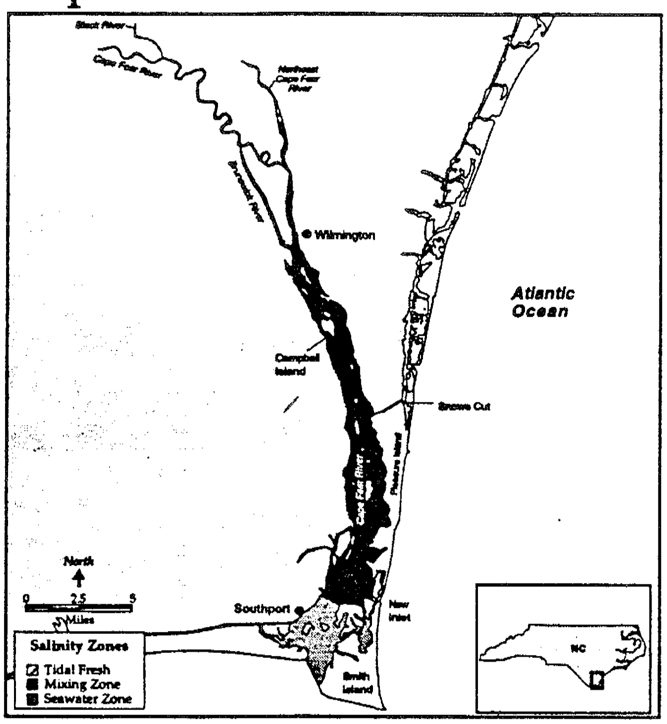
New River



Winyah Bay



Cape Fear River



North/South Santee Rivers

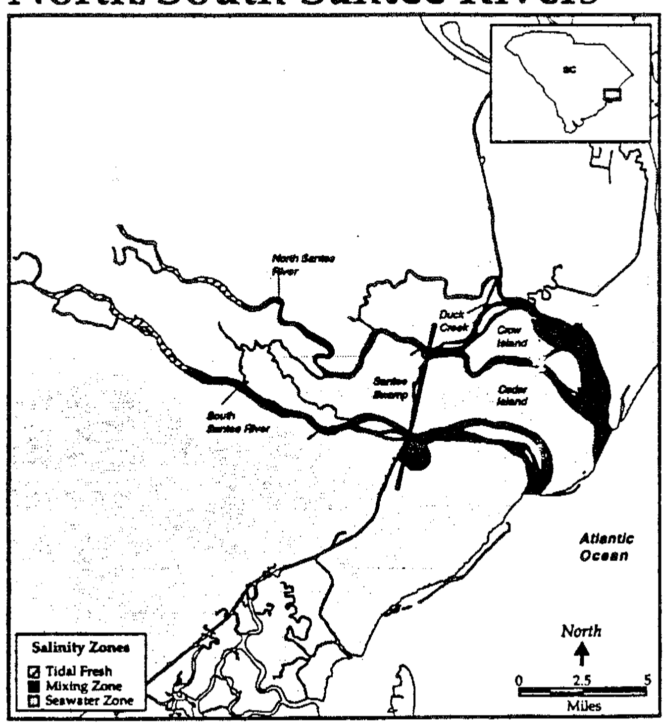


Figure 36c (continued). Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1996.

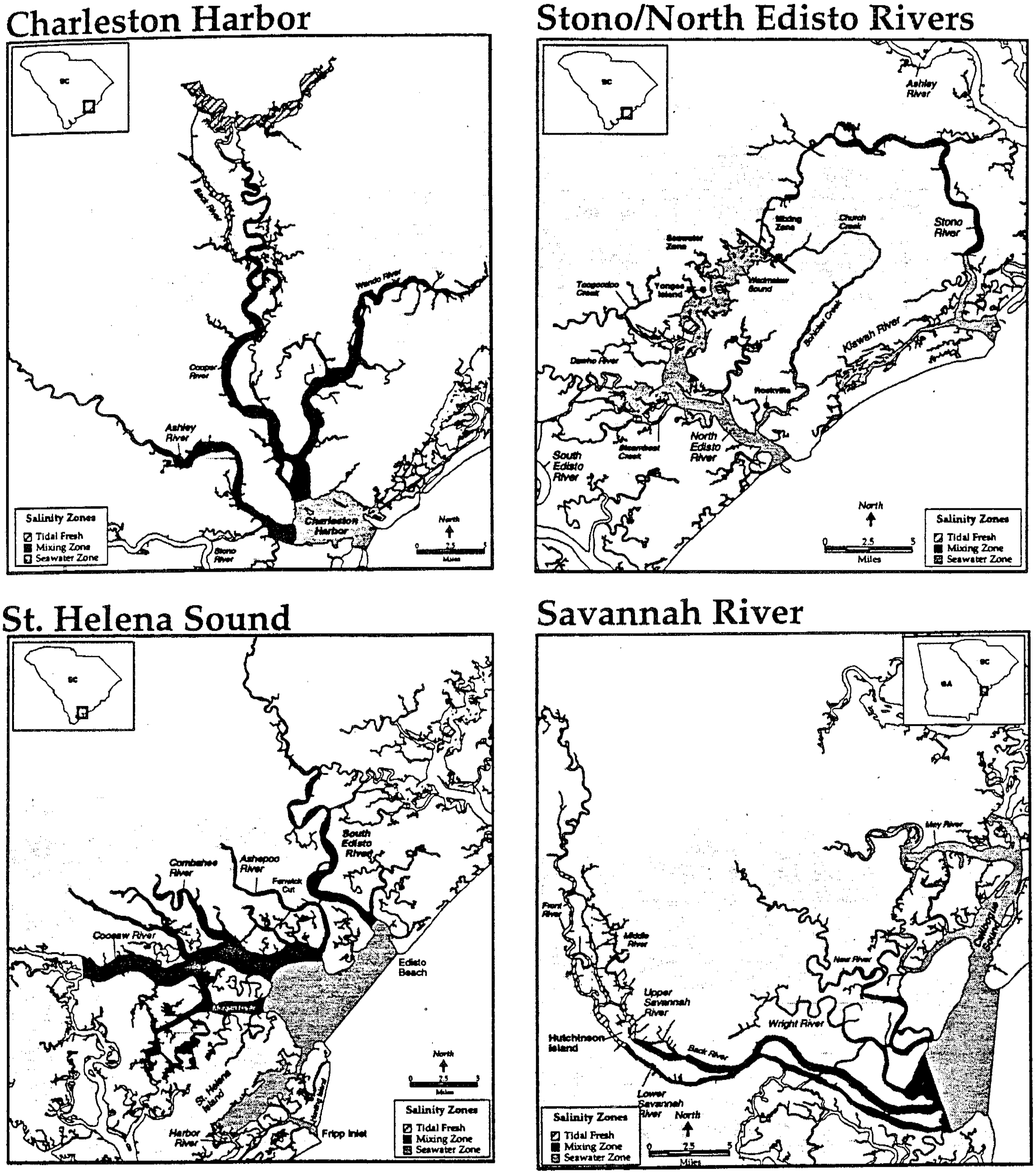
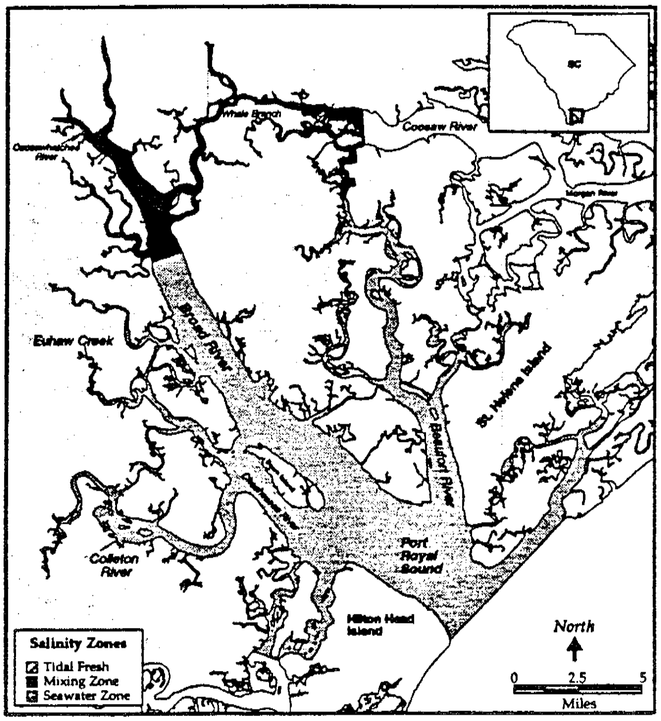
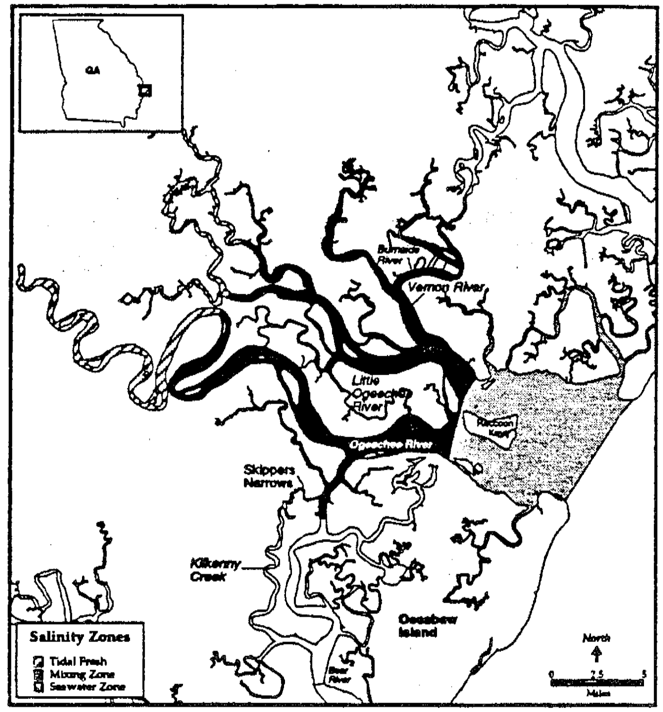


Figure 36c (continued). Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1996.

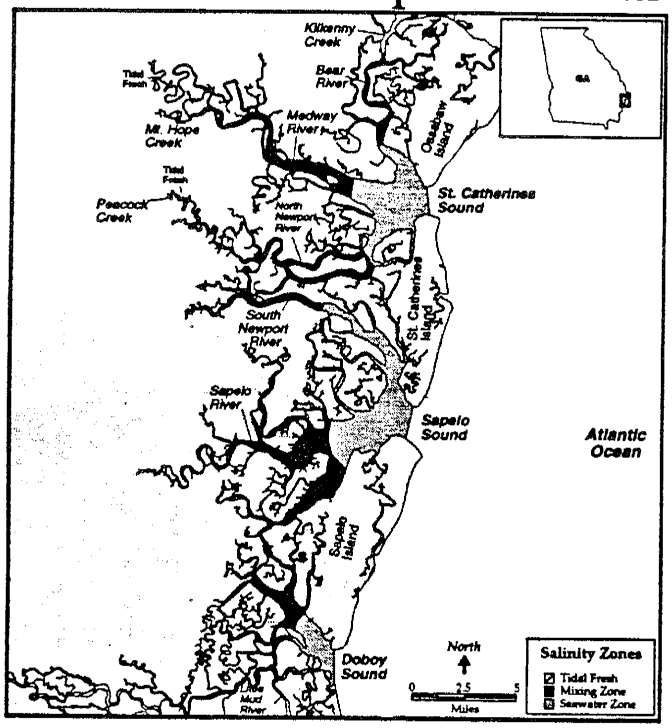
Broad River



Ossabaw Sound



St. Catherines/Sapelo Sounds



Altamaha River

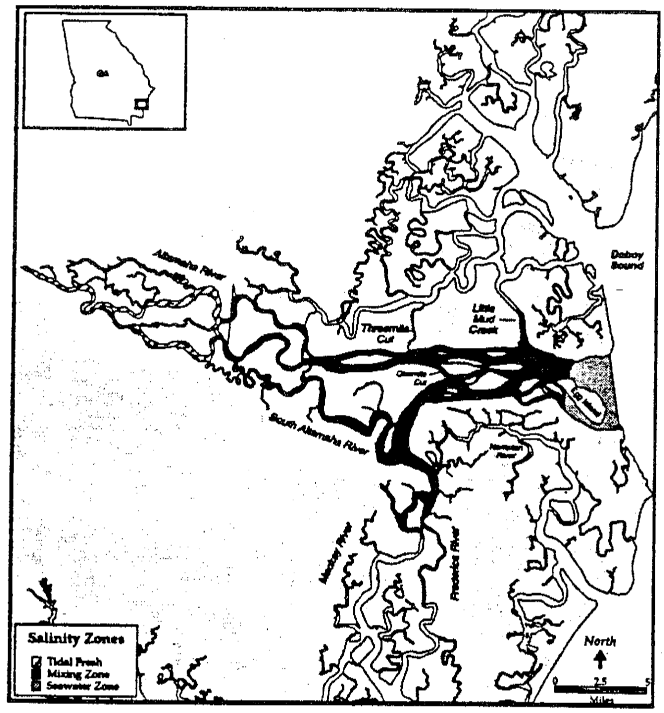
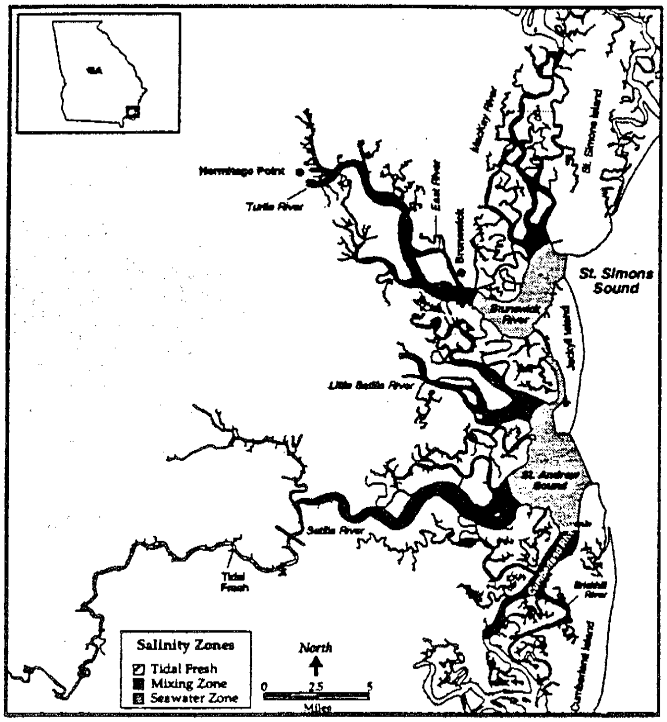
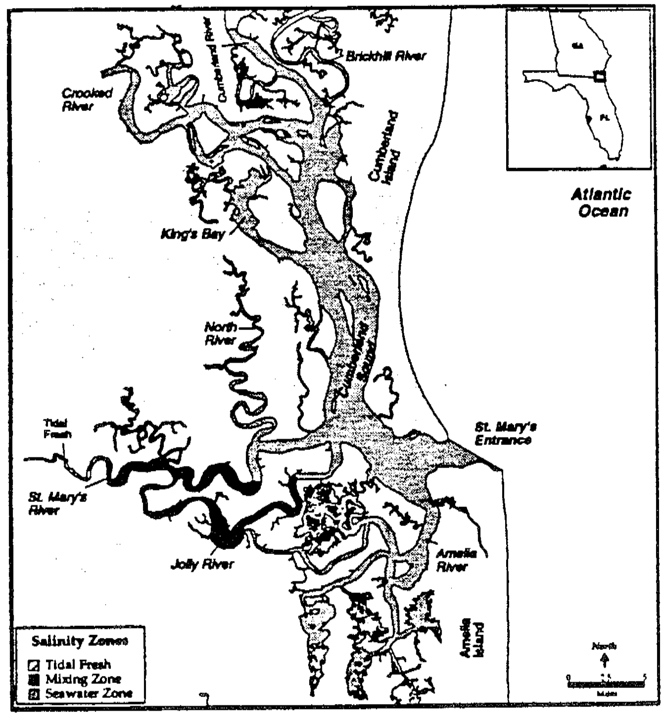


Figure 36c (continued). Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1996.

St. Andrew/St. Simons Sounds



St. Marys River/Cumberland Sound



St. Johns River

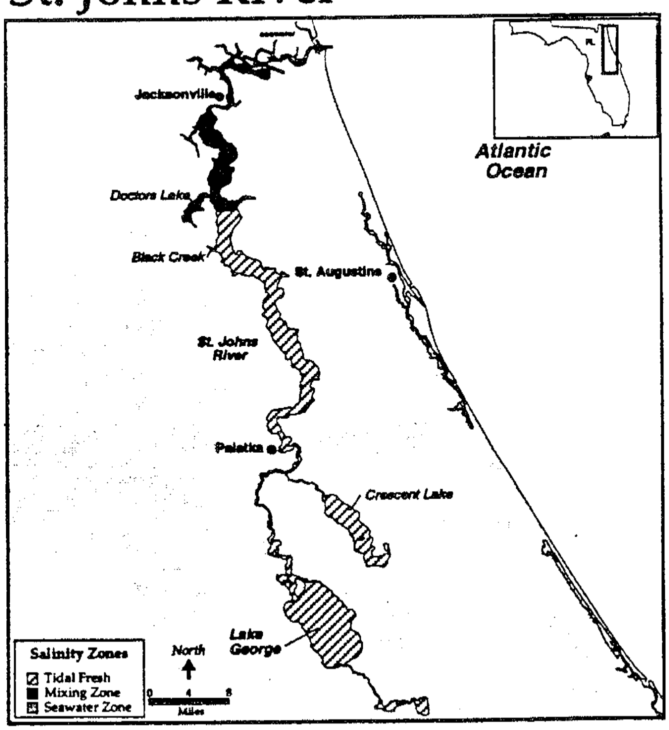
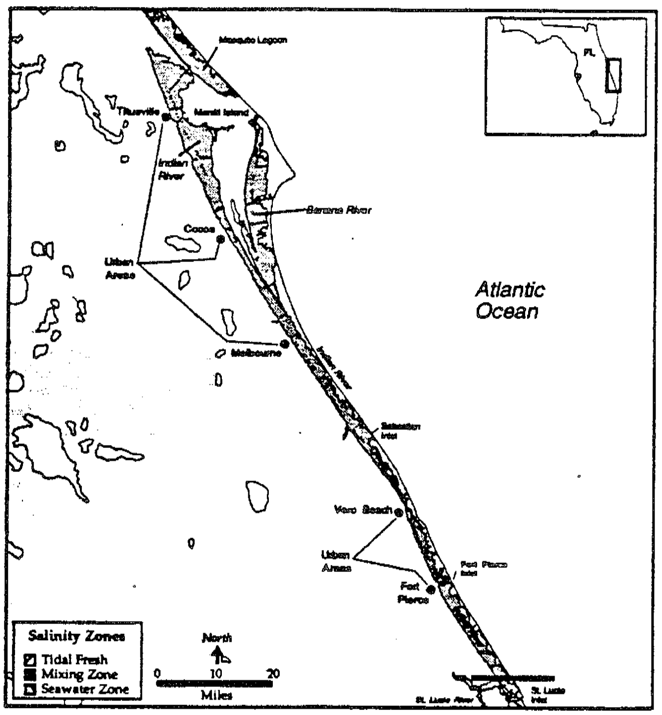


Figure 36c (continued). Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1996.

Indian River



Biscayne Bay

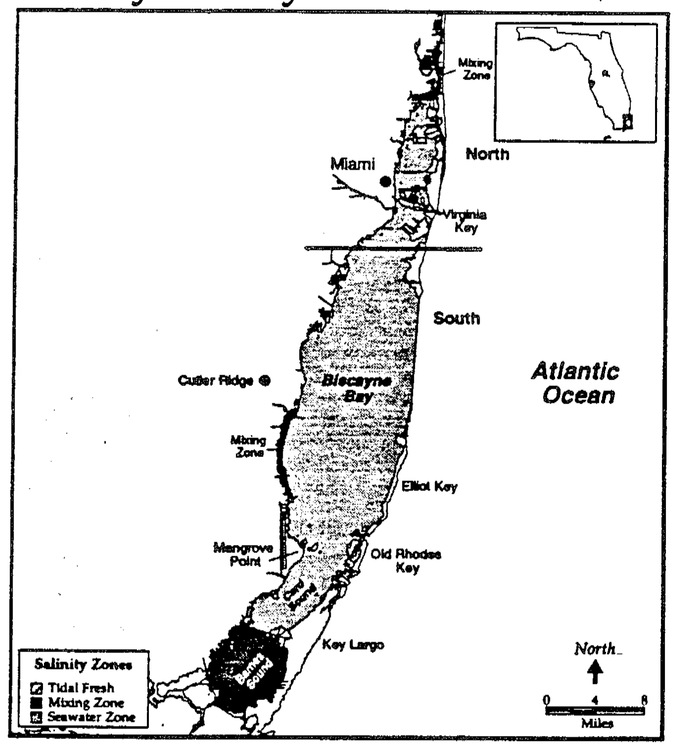


Figure 36c (continued). Salinity zone maps for the South Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1996.

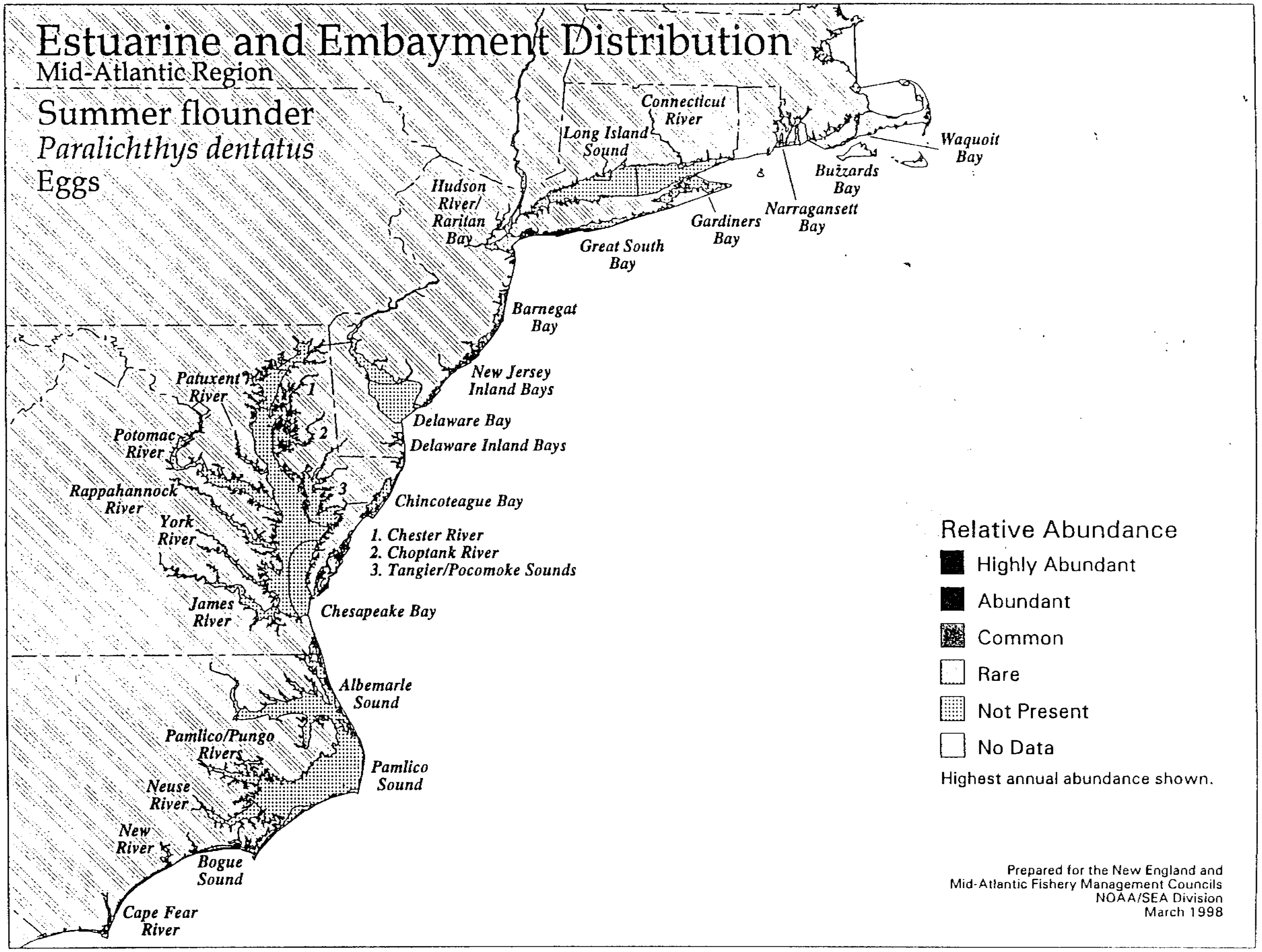


Figure 37a. **Relative of abundance and distribution of summer flounder eggs in Mid- and South Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, common, or rare are designated as essential fish habitat. Source: ELMR data.**

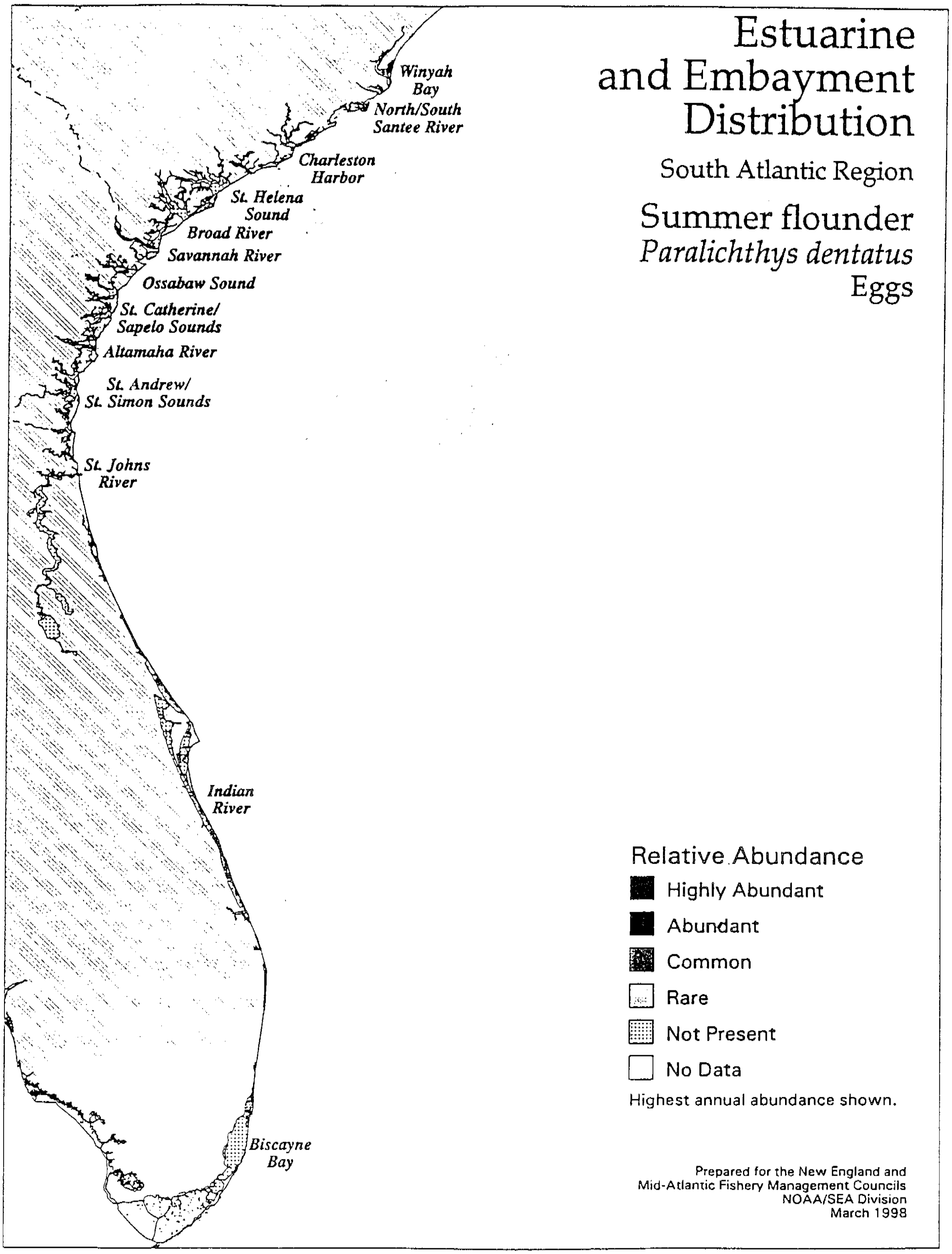


Figure 37a(continued). Relative of abundance and distribution of summer flounder eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, common, or rare are designated as essential fish habitat.
Source: ELMR data.

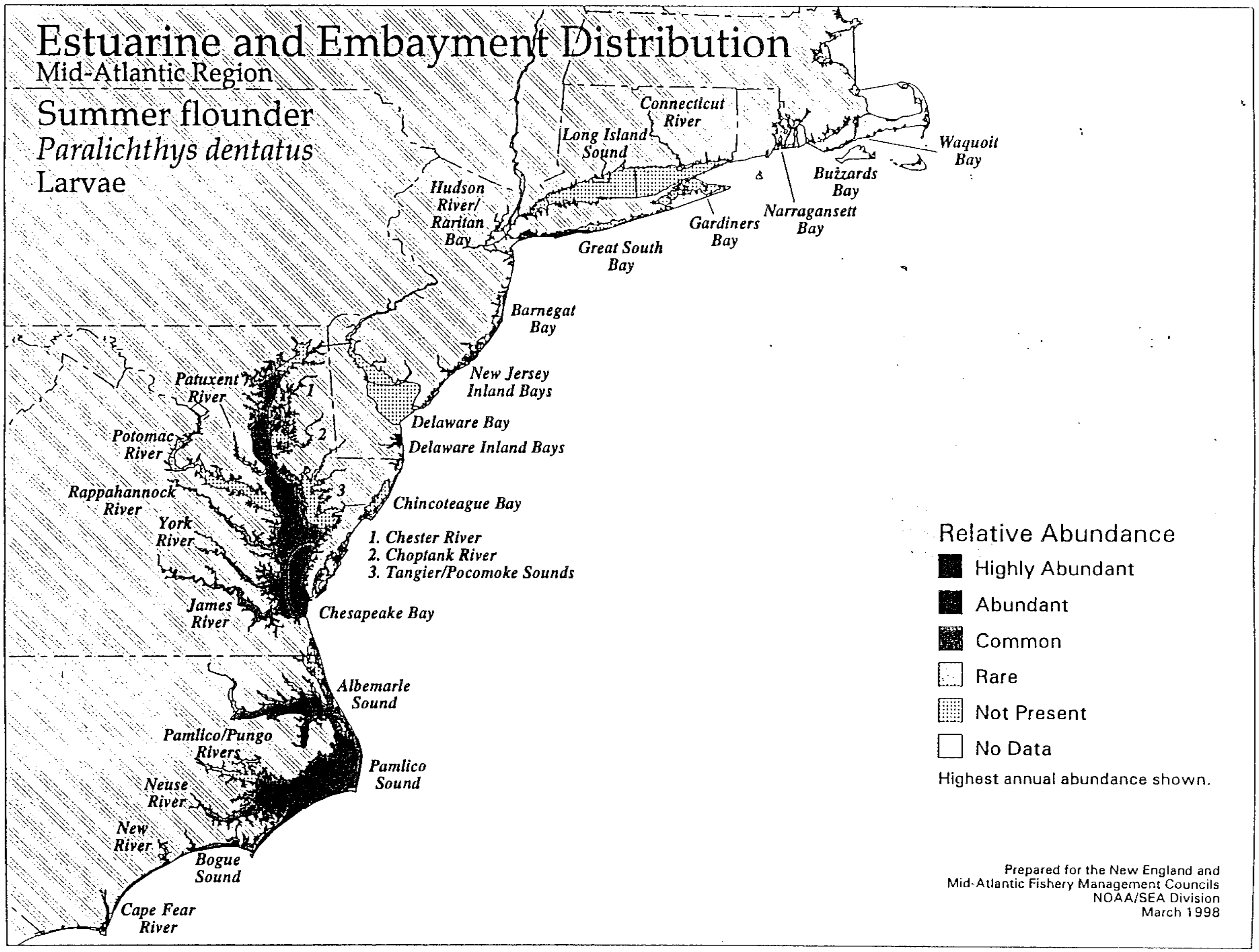


Figure 37b. Relative of abundance and distribution of summer flounder larvae in Mid- and South Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, common or rare are designated as essential fish habitat. Source: ELMR data.

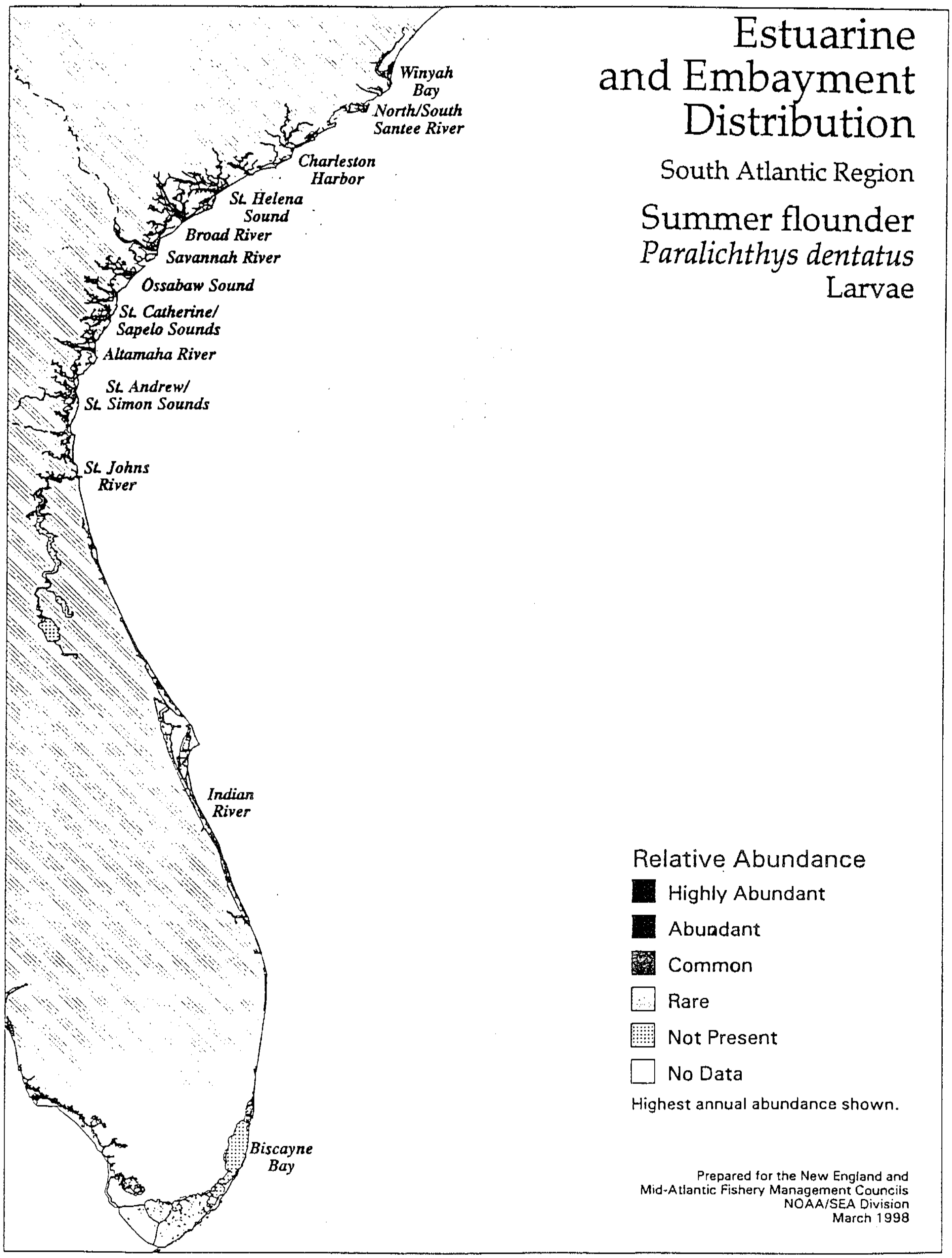


Figure 37b. Relative of abundance and distribution of summer flounder larvae in Mid- and South Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, common, or rare are designated as essential fish habitat.
Source: ELMR data.

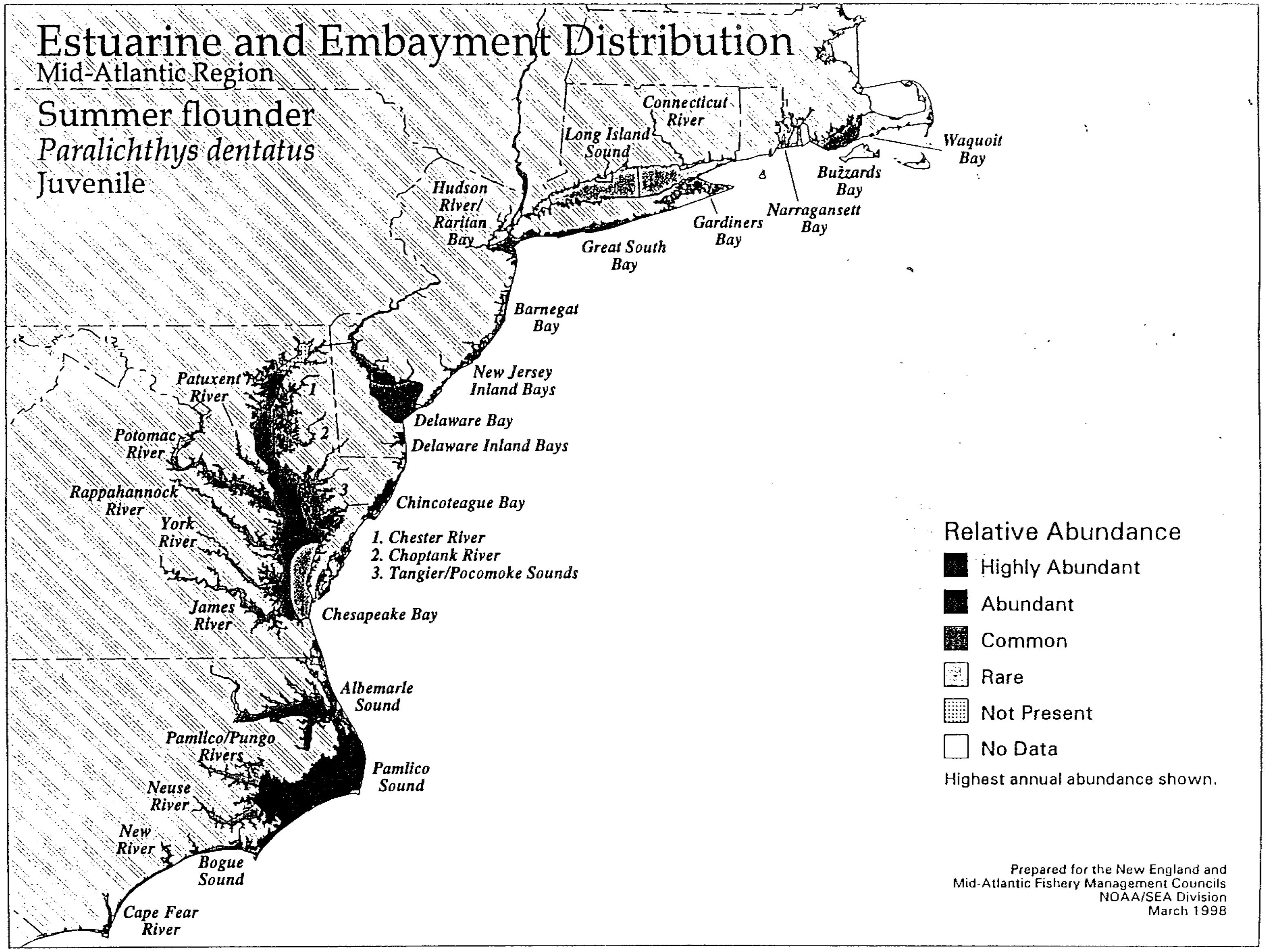


Figure 37c. Relative of abundance and distribution of juvenile summer flounder in Mid- and South Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

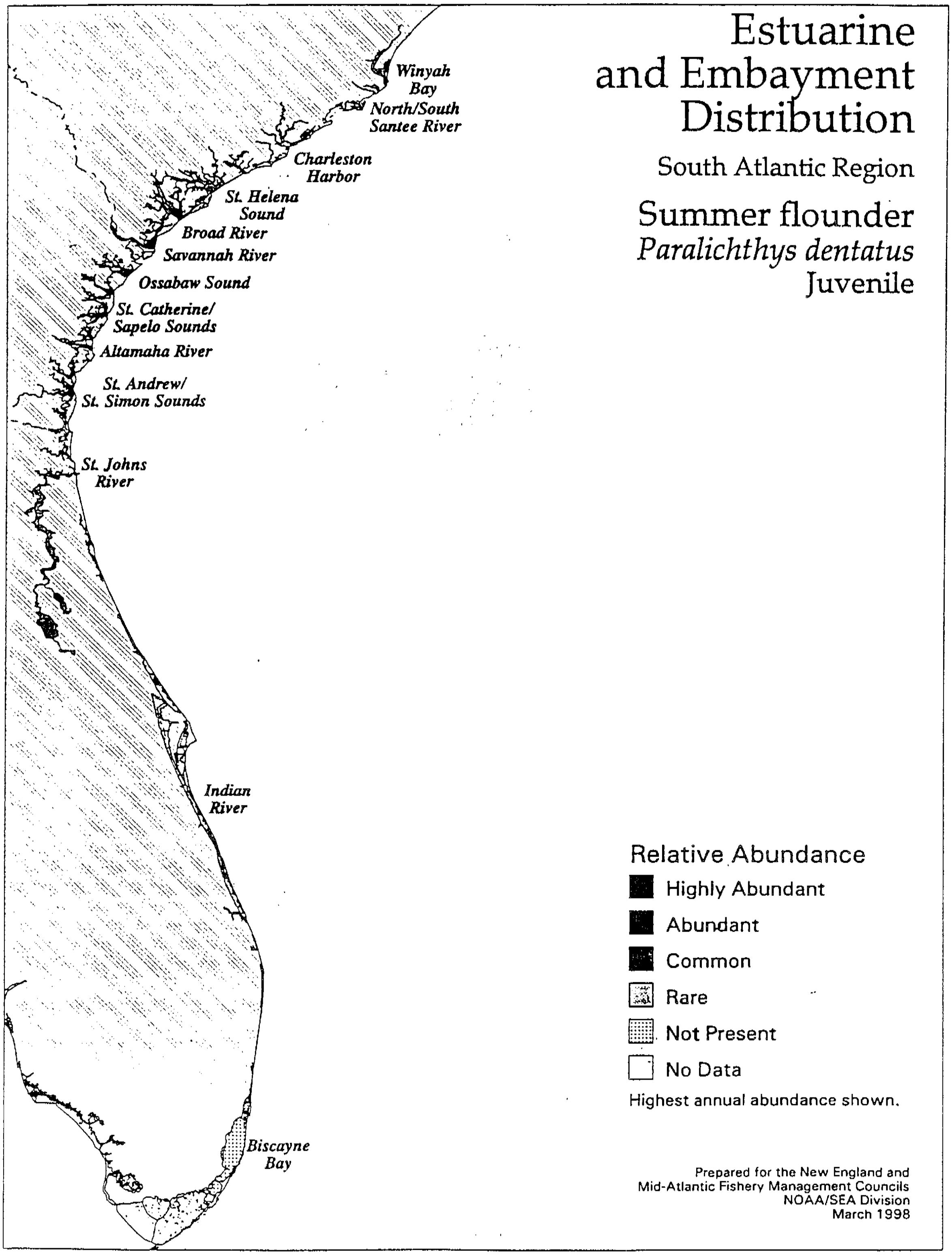


Figure 37c(continued). Relative of abundance and distribution of juvenile summer flounder in Mid- and South Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

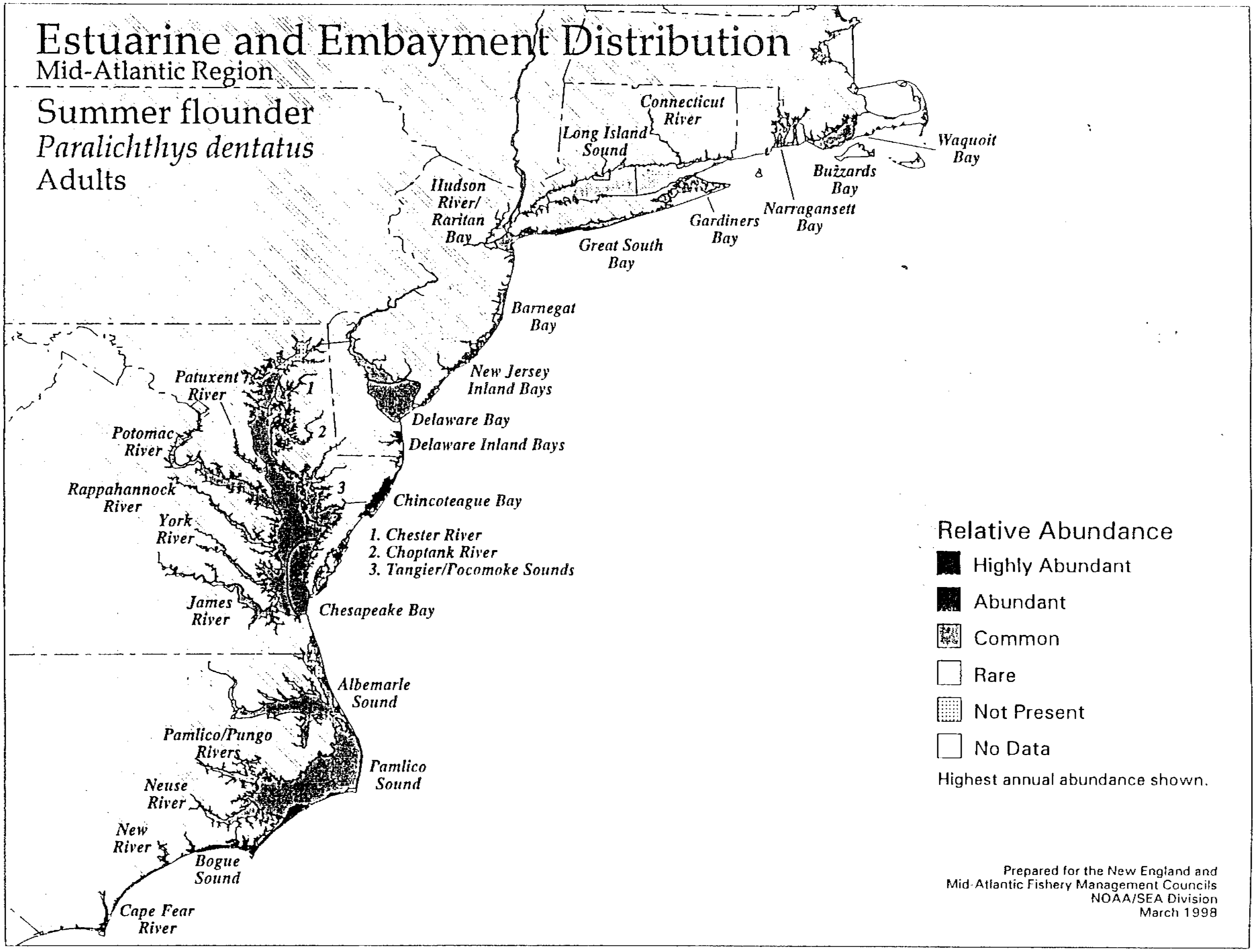


Figure 37d. Relative of abundance and distribution of adult summer flounder in Mid- and South Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

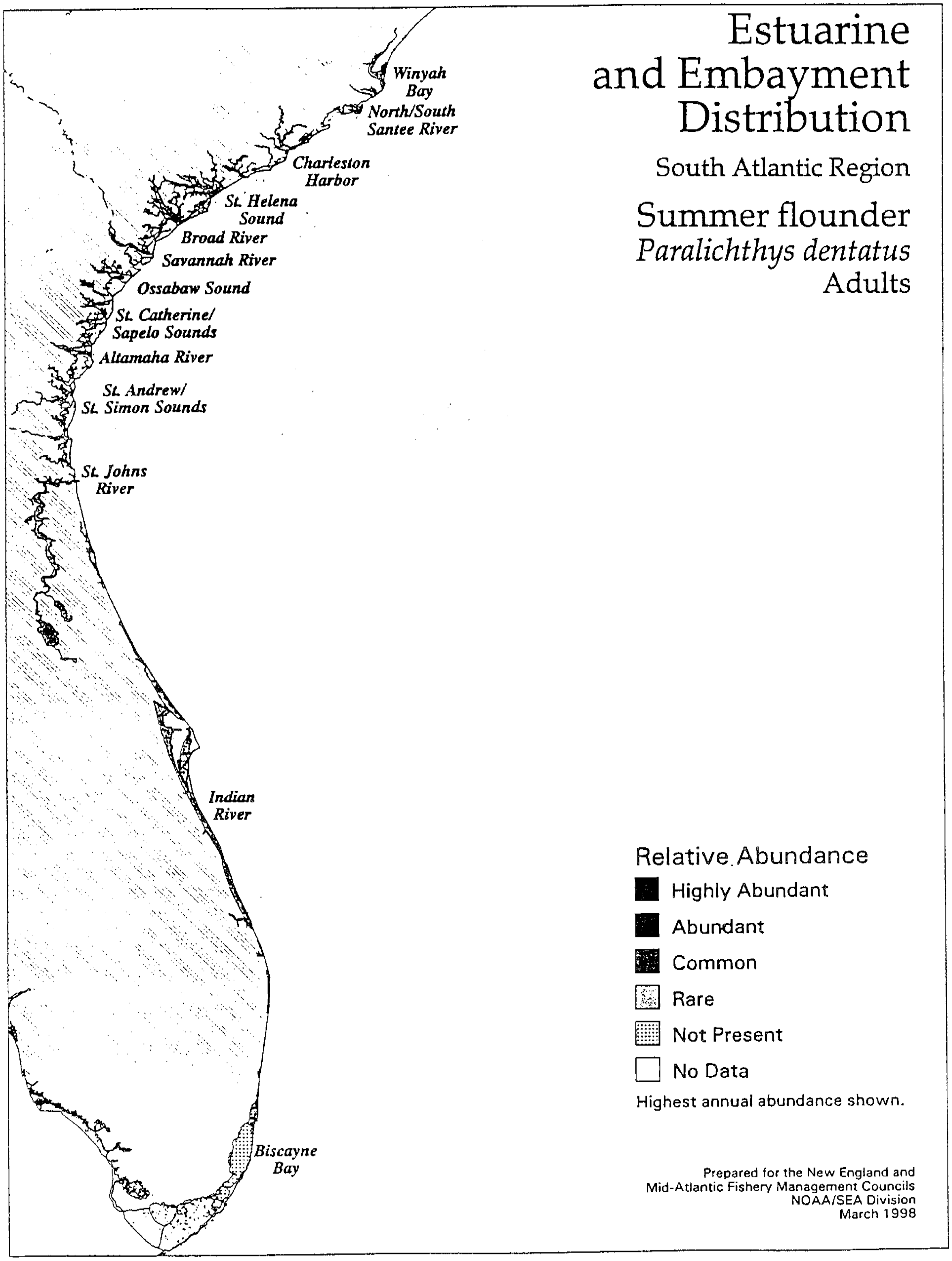


Figure 37d(continued). Relative of abundance and distribution of adult summer flounder in Mid- and South Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

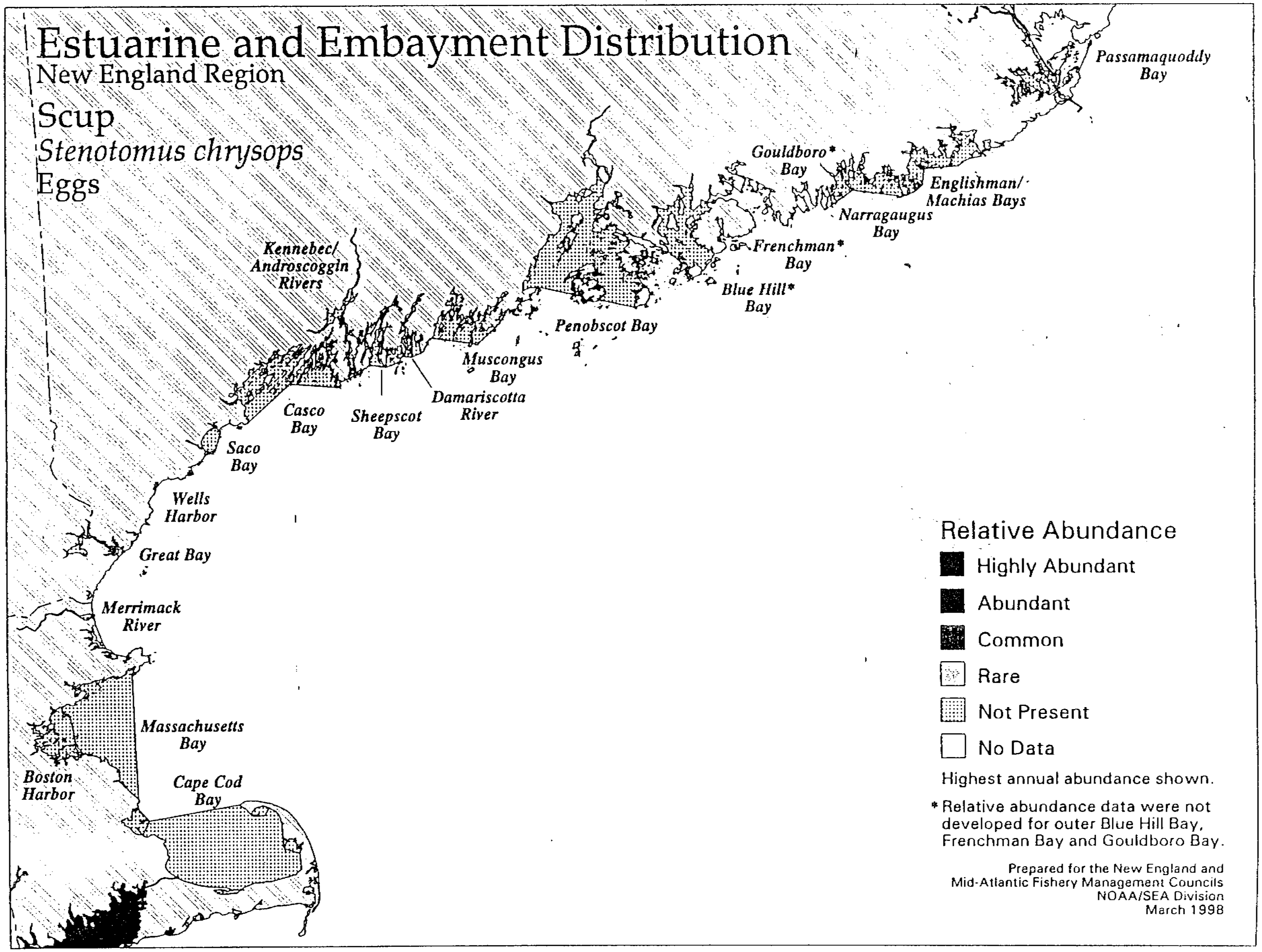


Figure 38a. Relative of abundance and distribution of scup eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

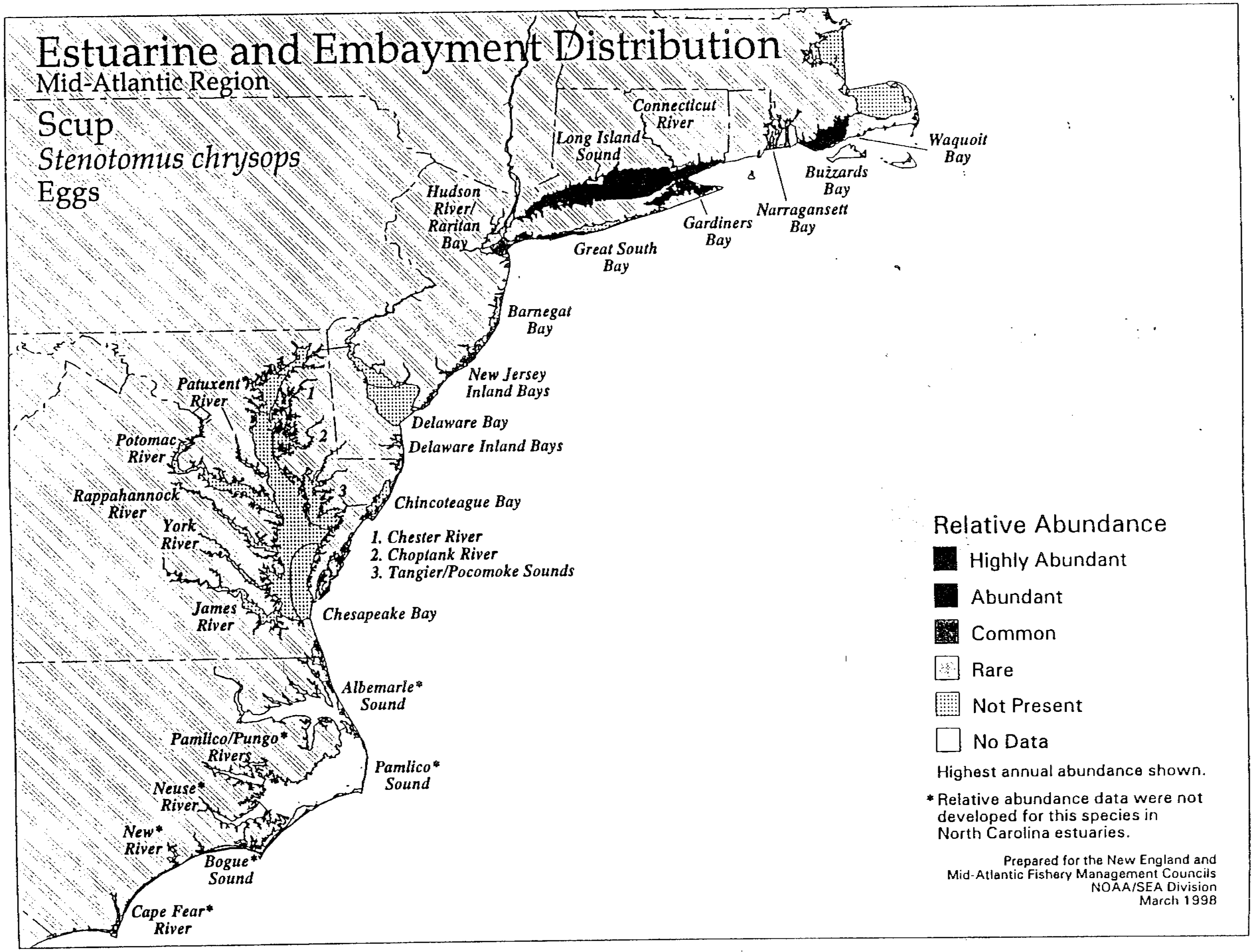


Figure 38a(continued). Relative of abundance and distribution of scup eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

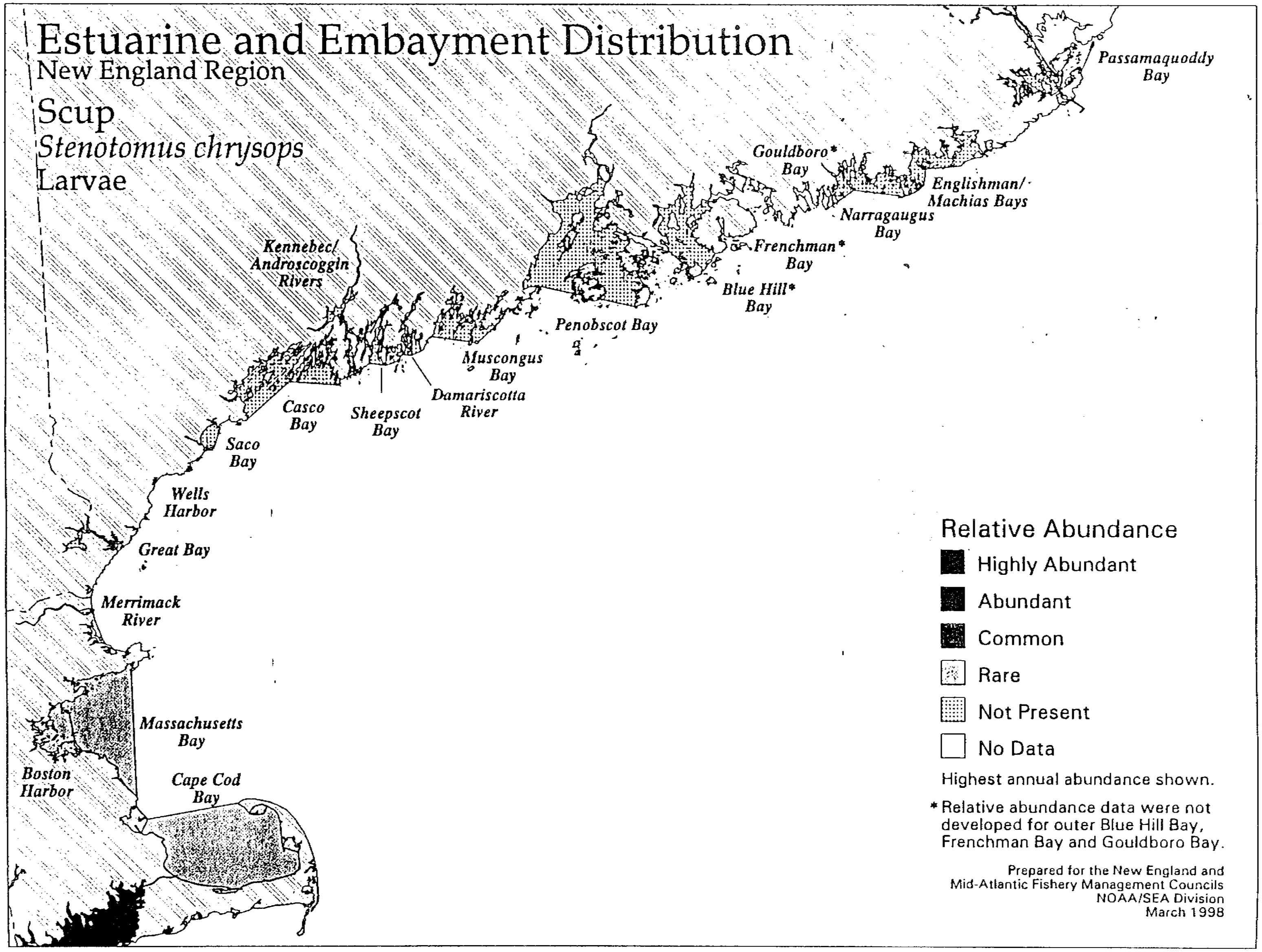


Figure 38b. Relative of abundance and distribution of scup larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

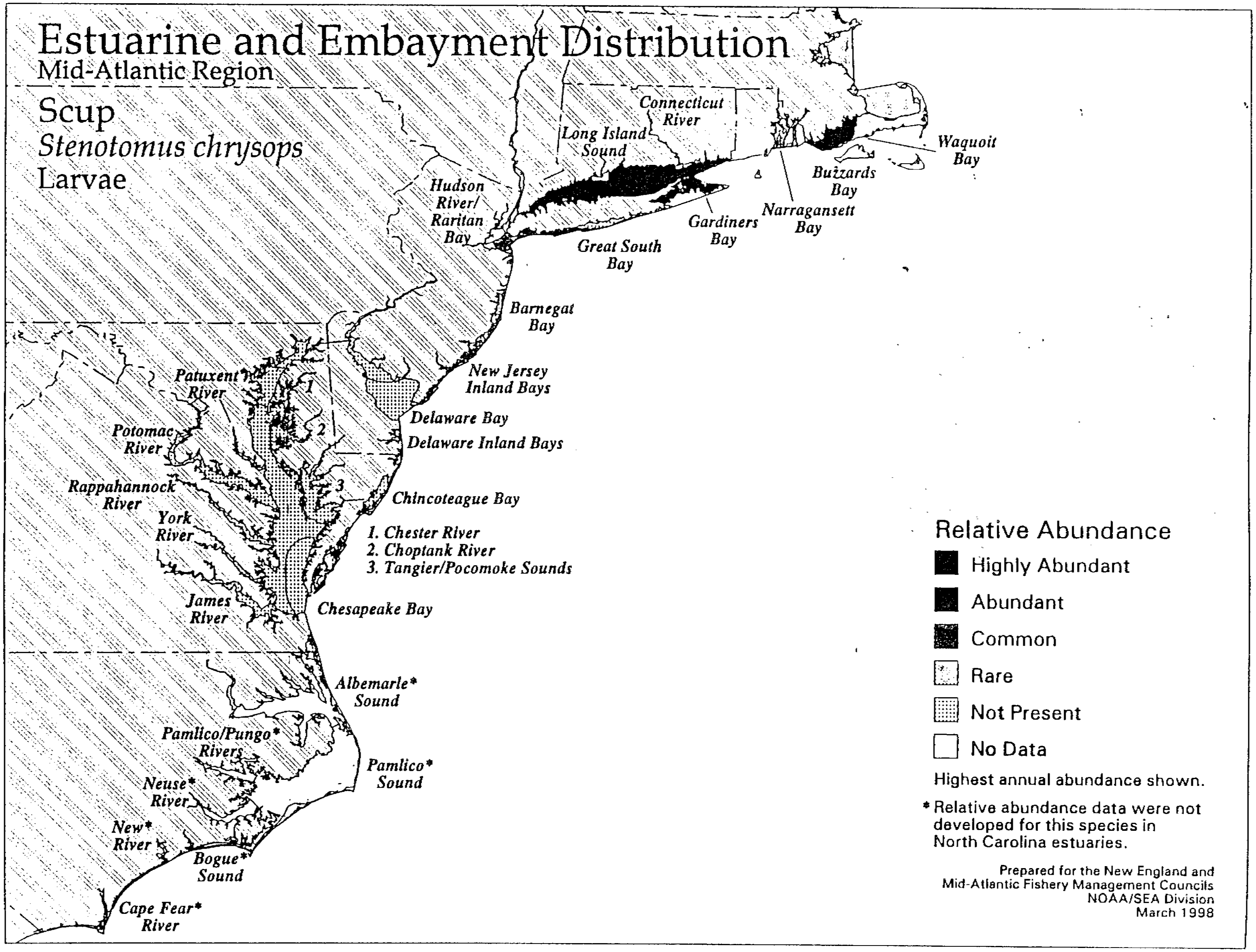


Figure 38b(continued). Relative of abundance and distribution of scup larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

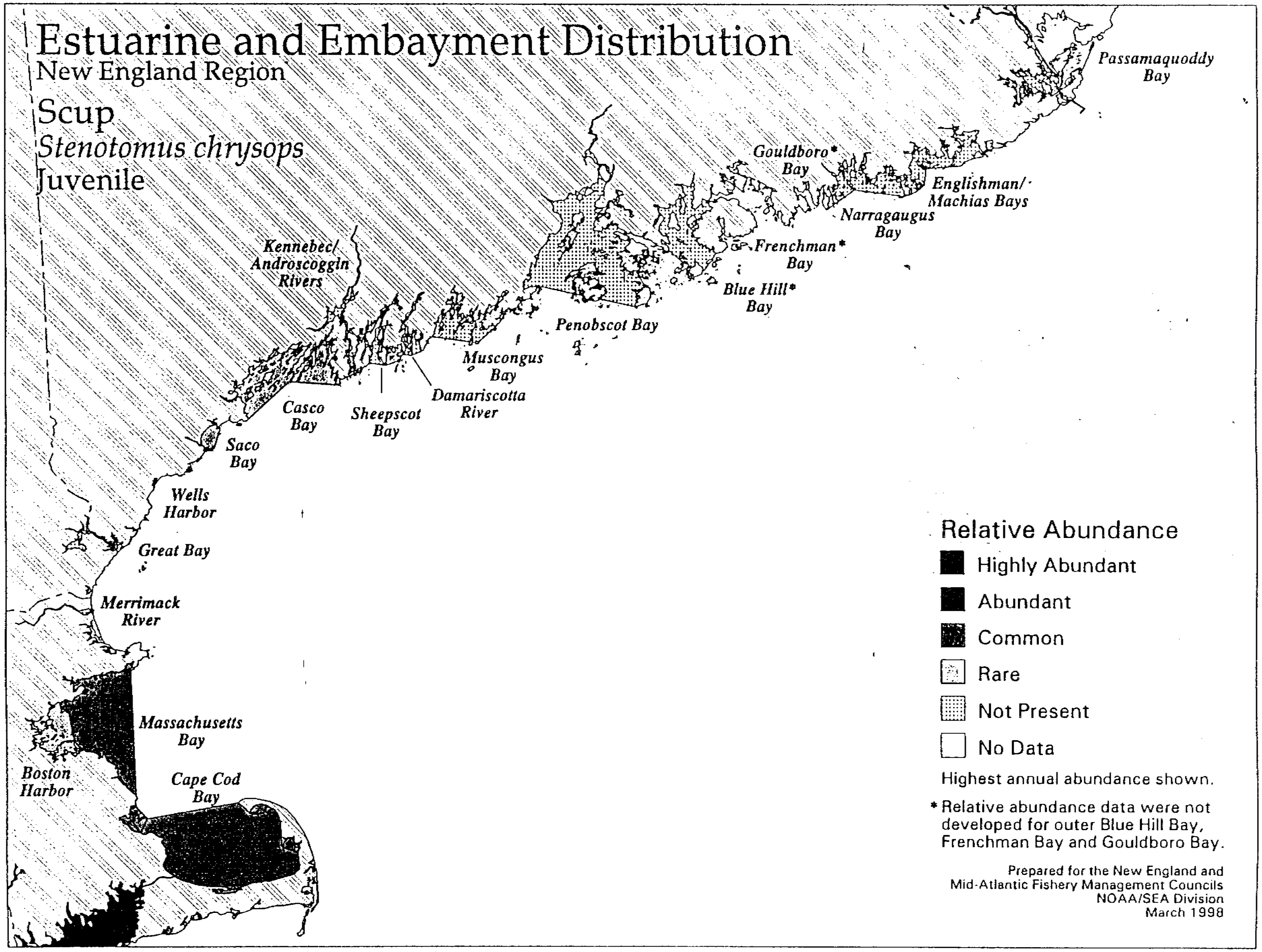


Figure 38c. Relative of abundance and distribution of juvenile scup in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

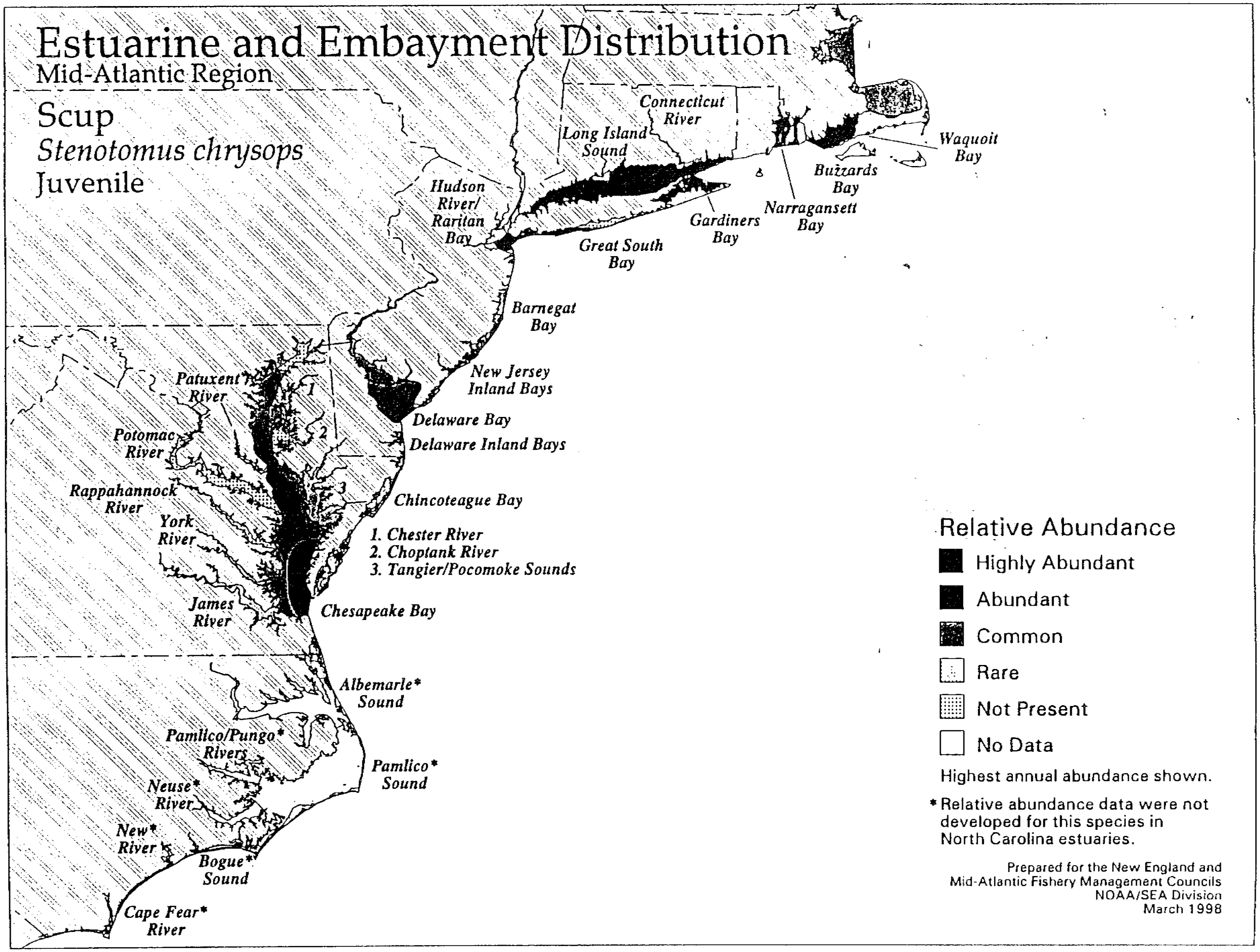


Figure 38c(continued). Relative of abundance and distribution of juvenile scup in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as hgihly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

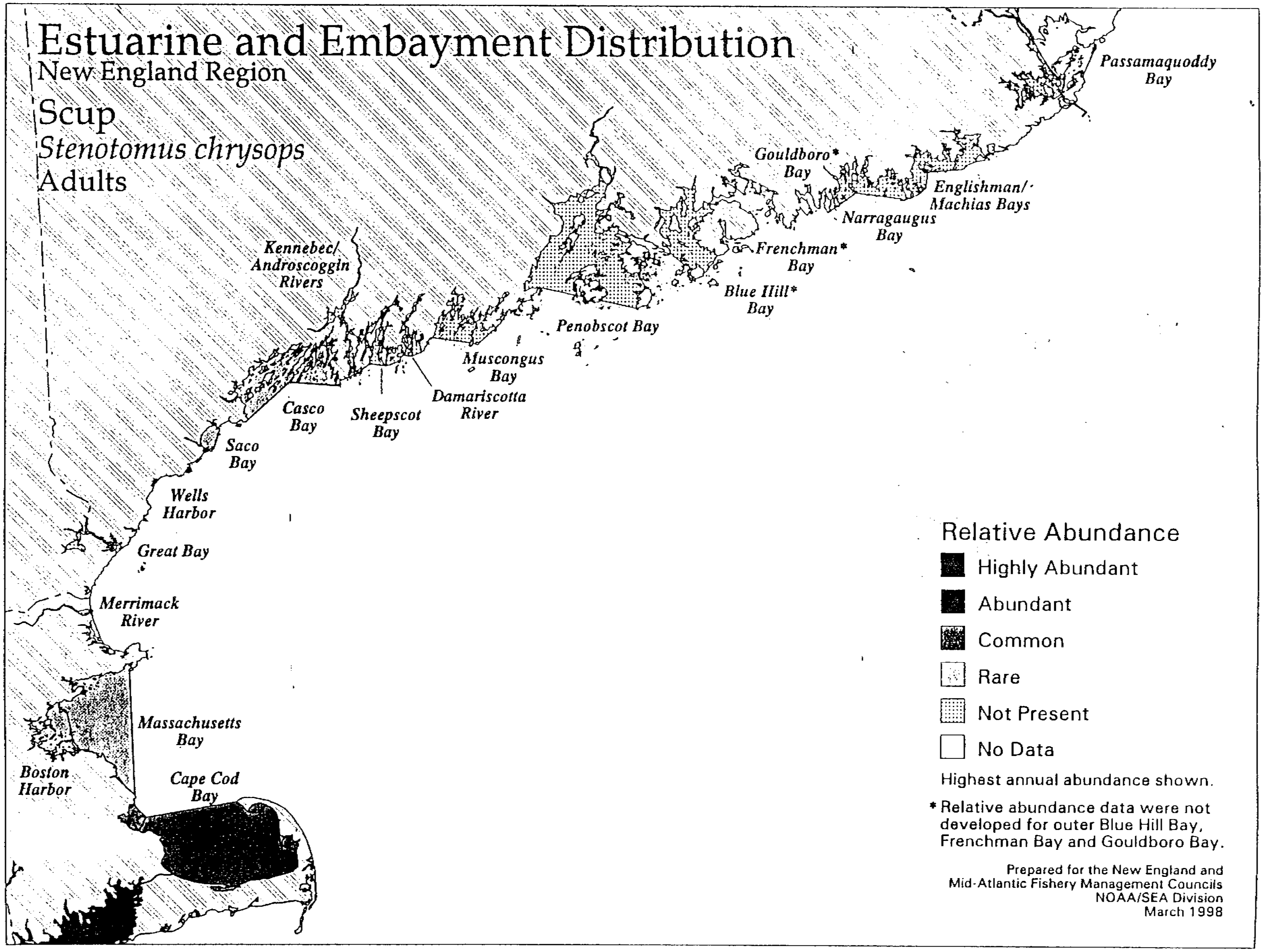


Figure 38d. Relative of abundance and distribution of adult scup in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

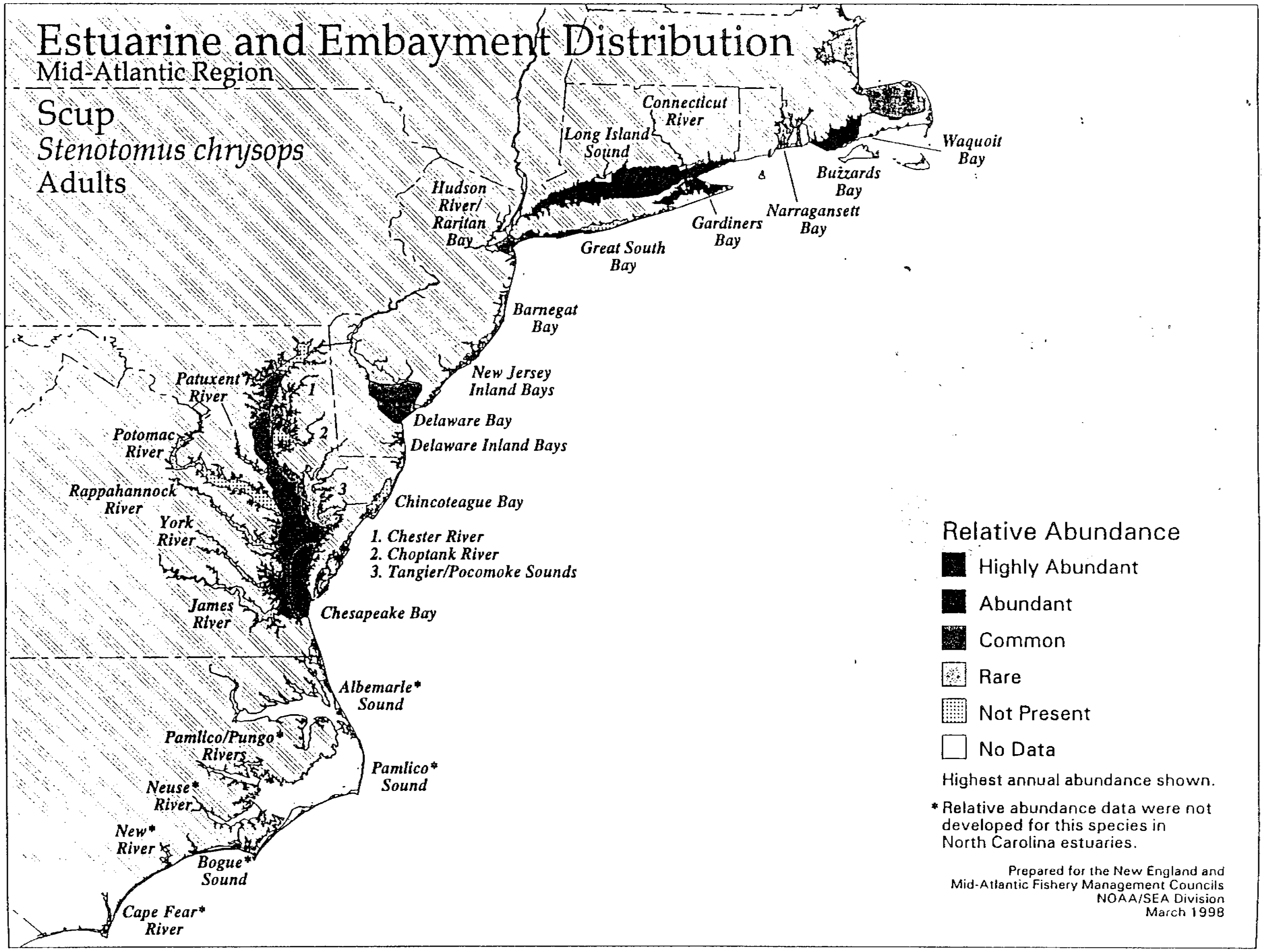


Figure 38d(continued). Relative of abundance and distribution of adult scup in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

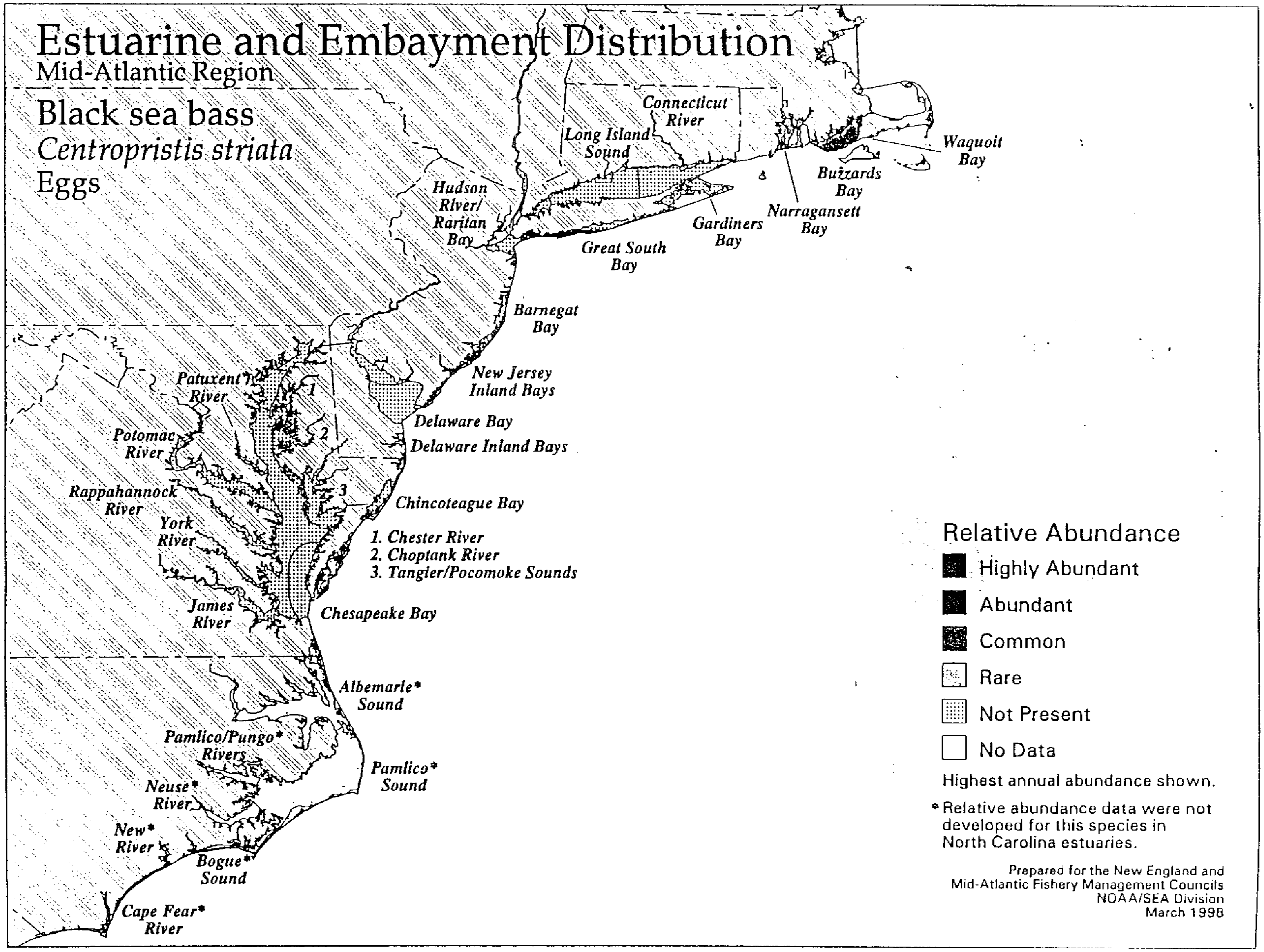


Figure 39a. Relative of abundance and distribution of black sea bass eggs in Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

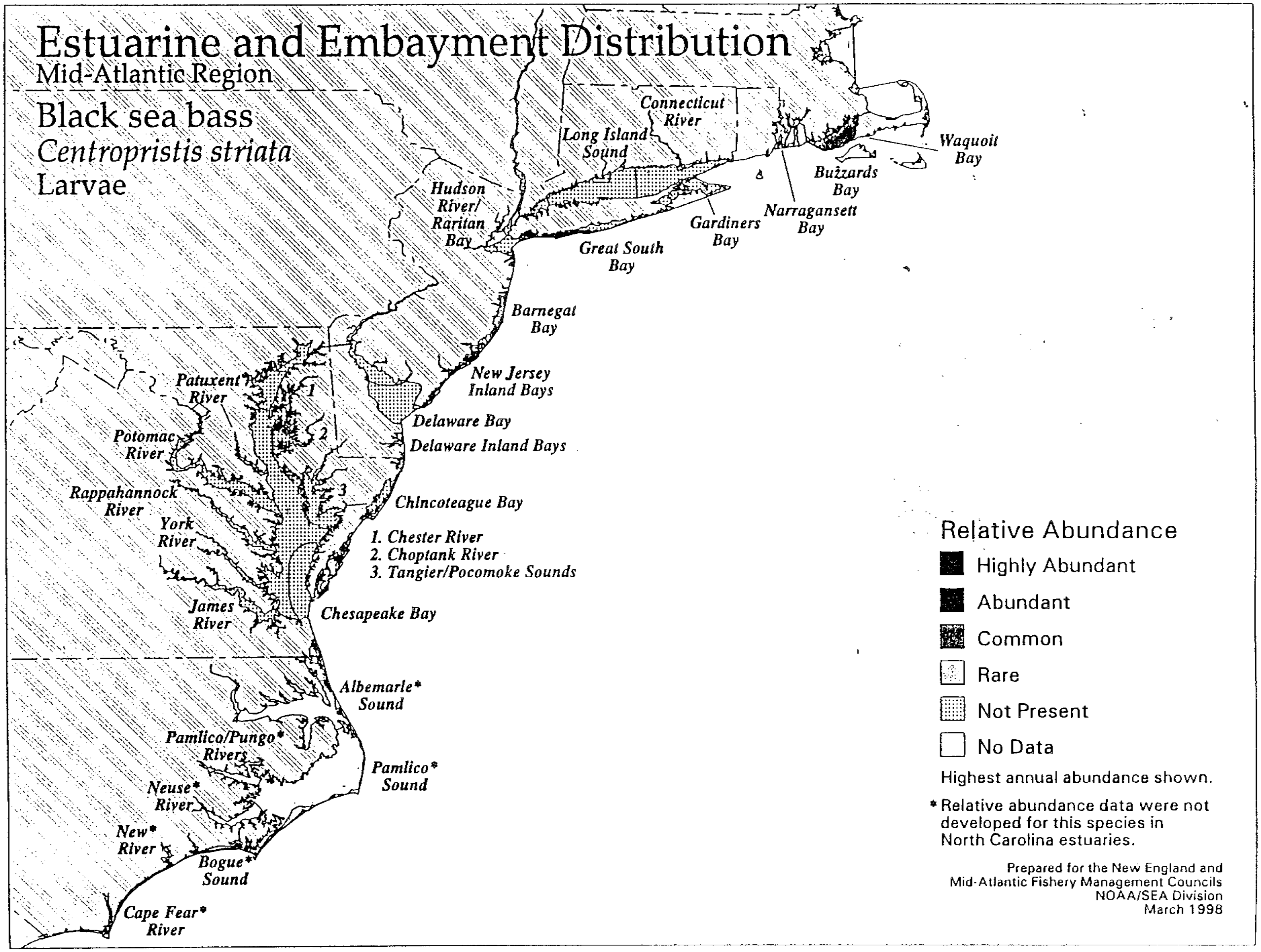


Figure 39b. Relative of abundance and distribution of black sea bass larvae in Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

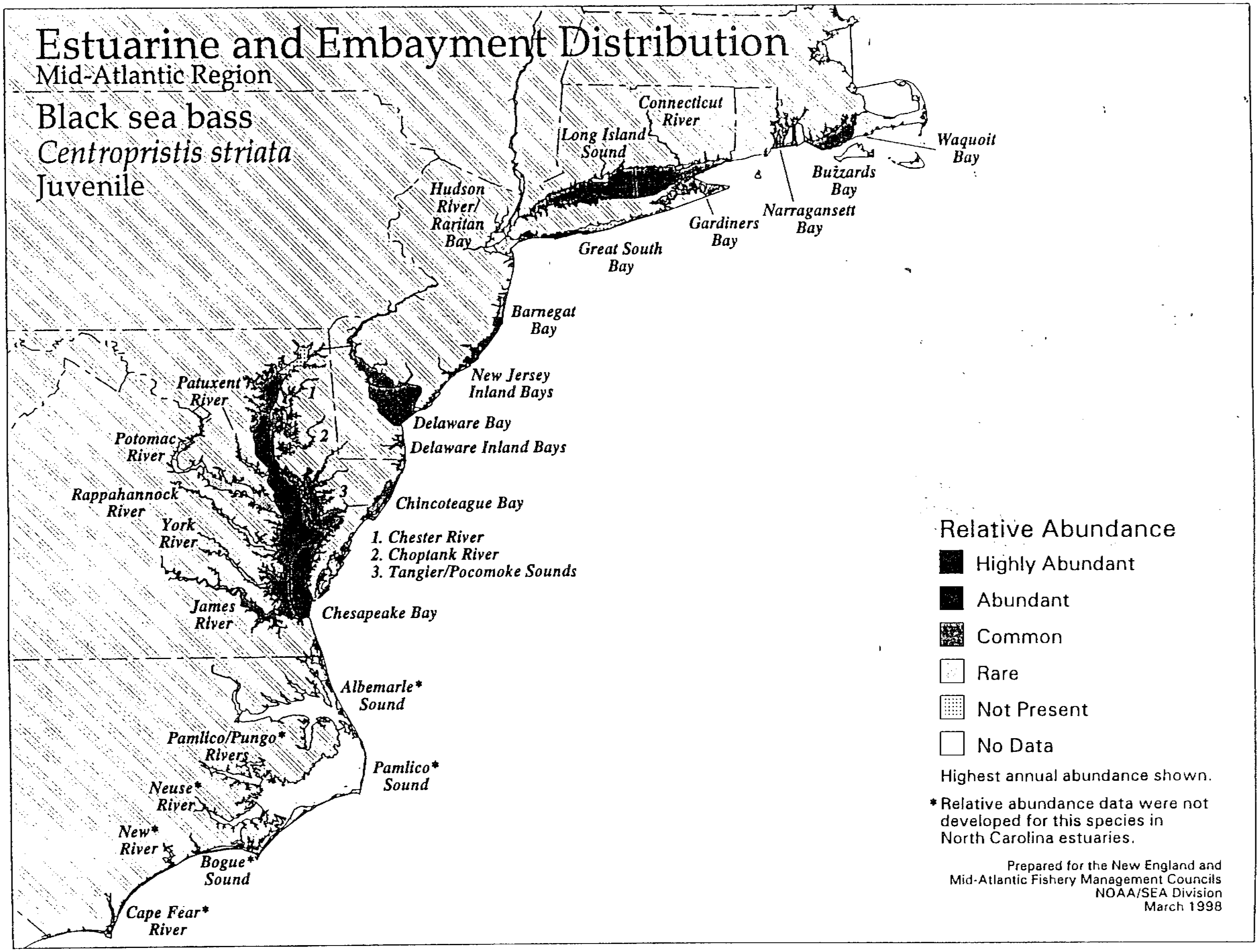


Figure 39c. Relative of abundance and distribution of black sea bass in Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

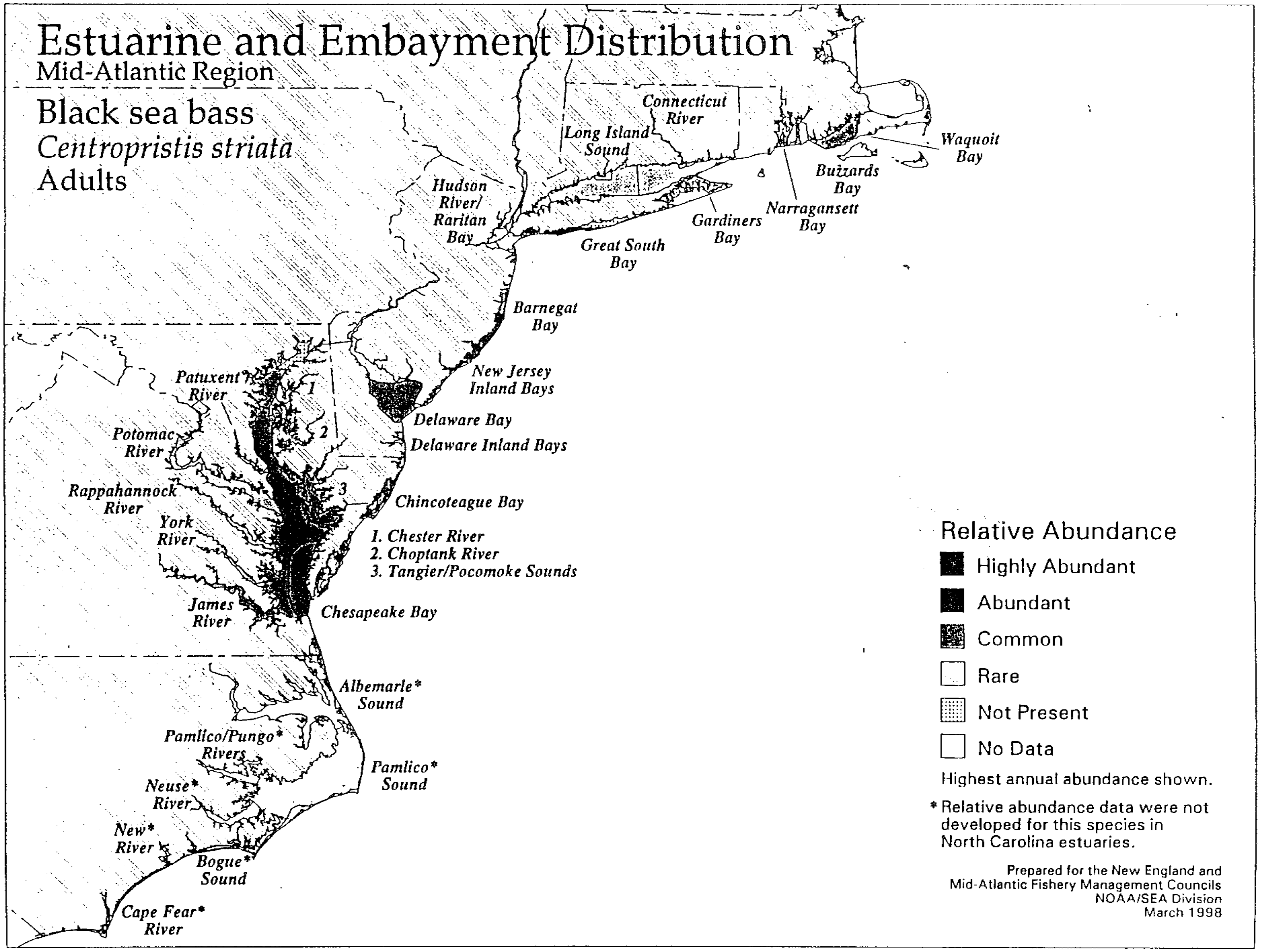
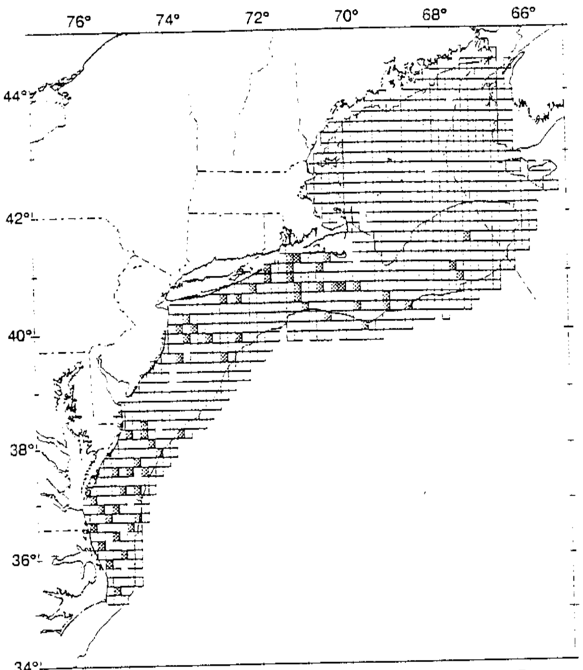
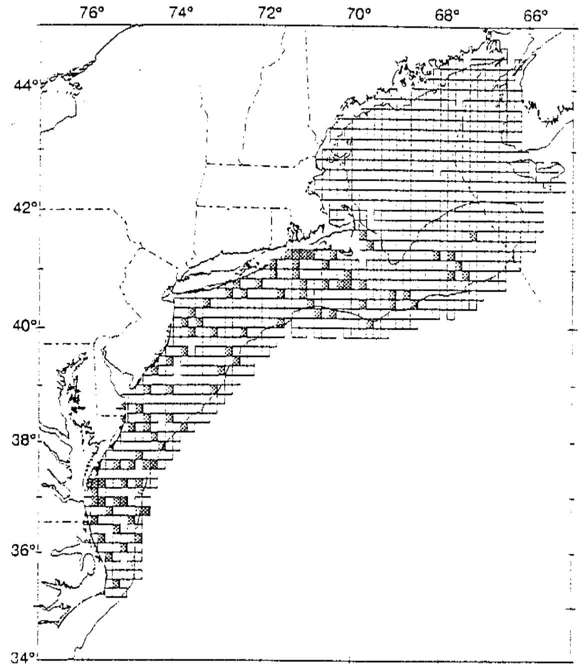


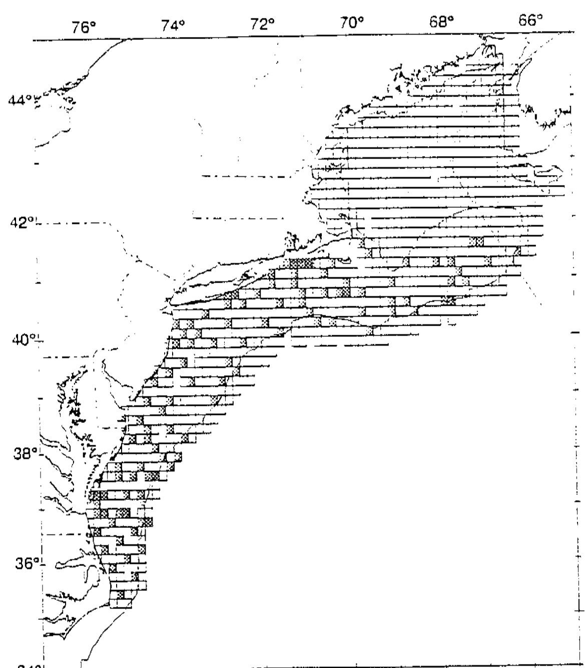
Figure 39d. Relative of abundance and distribution of adult black sea bass in Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.



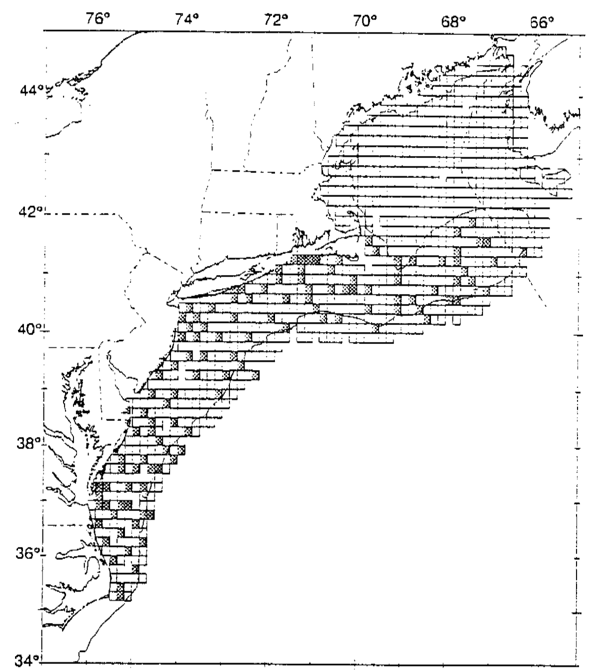
Summer Flounder -- Eggs -- Area Using Mean Natural Log -- 50 Percent
Months (1, 4, 5, 9, 10, 11, 12)



Summer Flounder -- Eggs -- Area Using Mean Natural Log -- 75 Percent
Months (1, 4, 5, 9, 10, 11, 12)



Summer Flounder -- Eggs -- Area Using Mean Natural Log -- 90 Percent
Months (1, 4, 5, 9, 10, 11, 12)



Summer Flounder -- Eggs -- Area Using Mean Natural Log -- 100 Percent
Months (1, 4, 5, 9, 10, 11, 12)

Figure 40a. Four options for designating EFH for summer flounder eggs under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the MARMAP survey.
Source: Cross pers. comm.

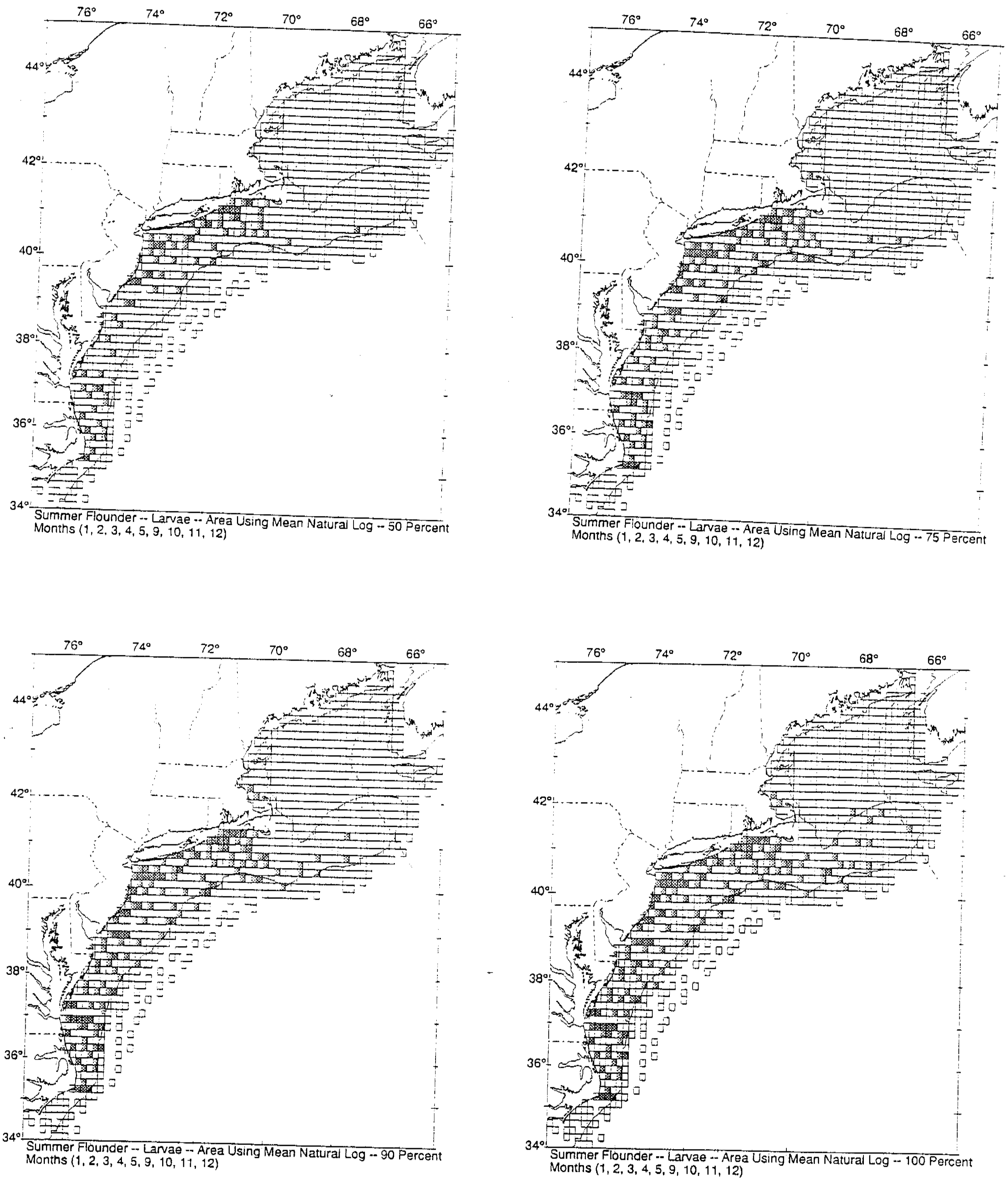
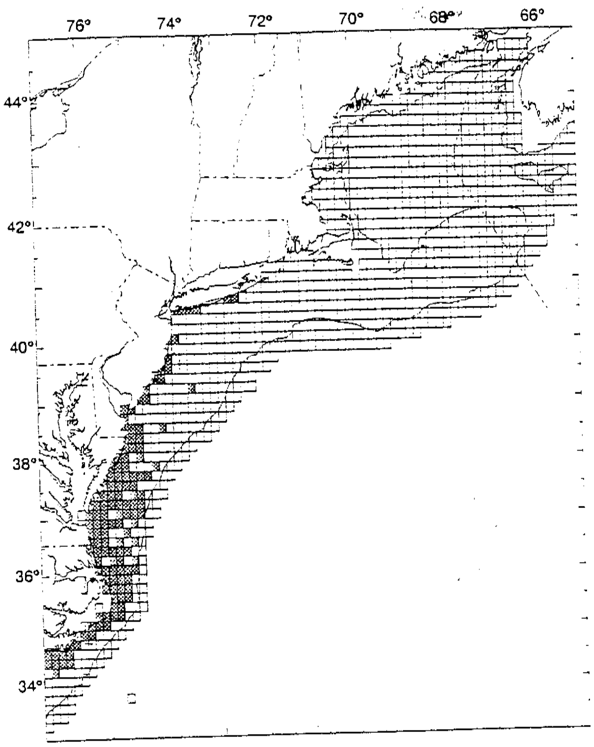
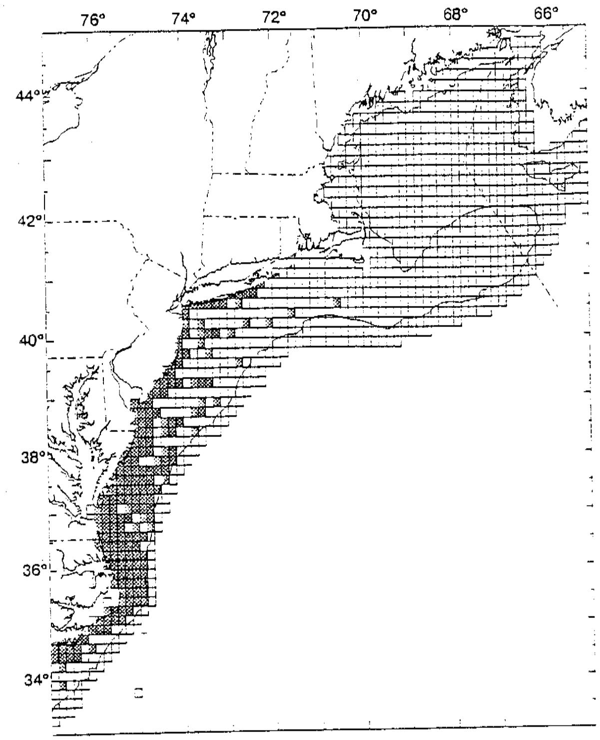


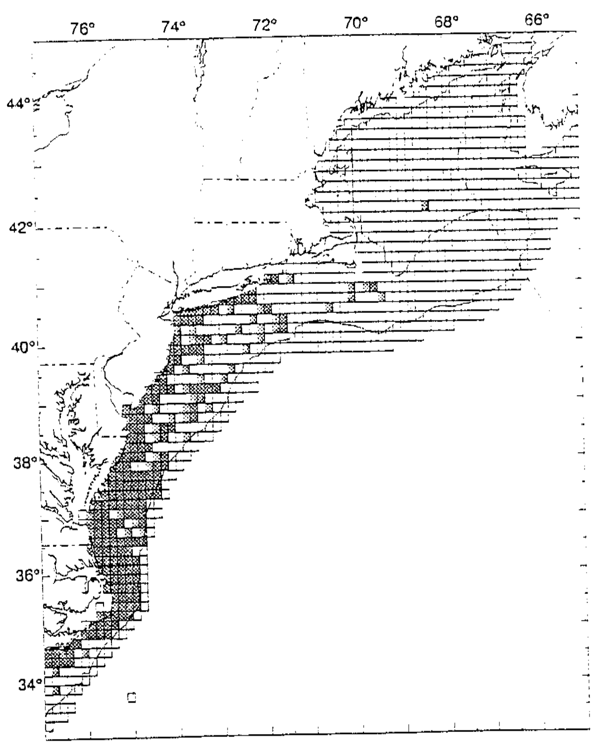
Figure 40b. Four options for designating EFH for summer flounder larvae under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the MARMAP survey.
Source: Cross pers. comm.



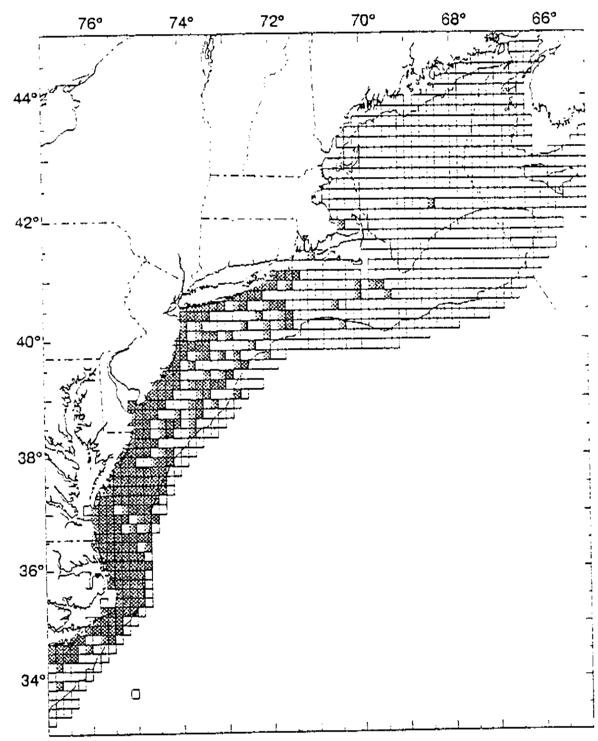
Summer Flounder – Juveniles (Spring and Fall) -- Area Using Mean Natural Log – 50 Percent



Summer Flounder – Juveniles (Spring and Fall) -- Area Using Mean Natural Log – 75 Percent

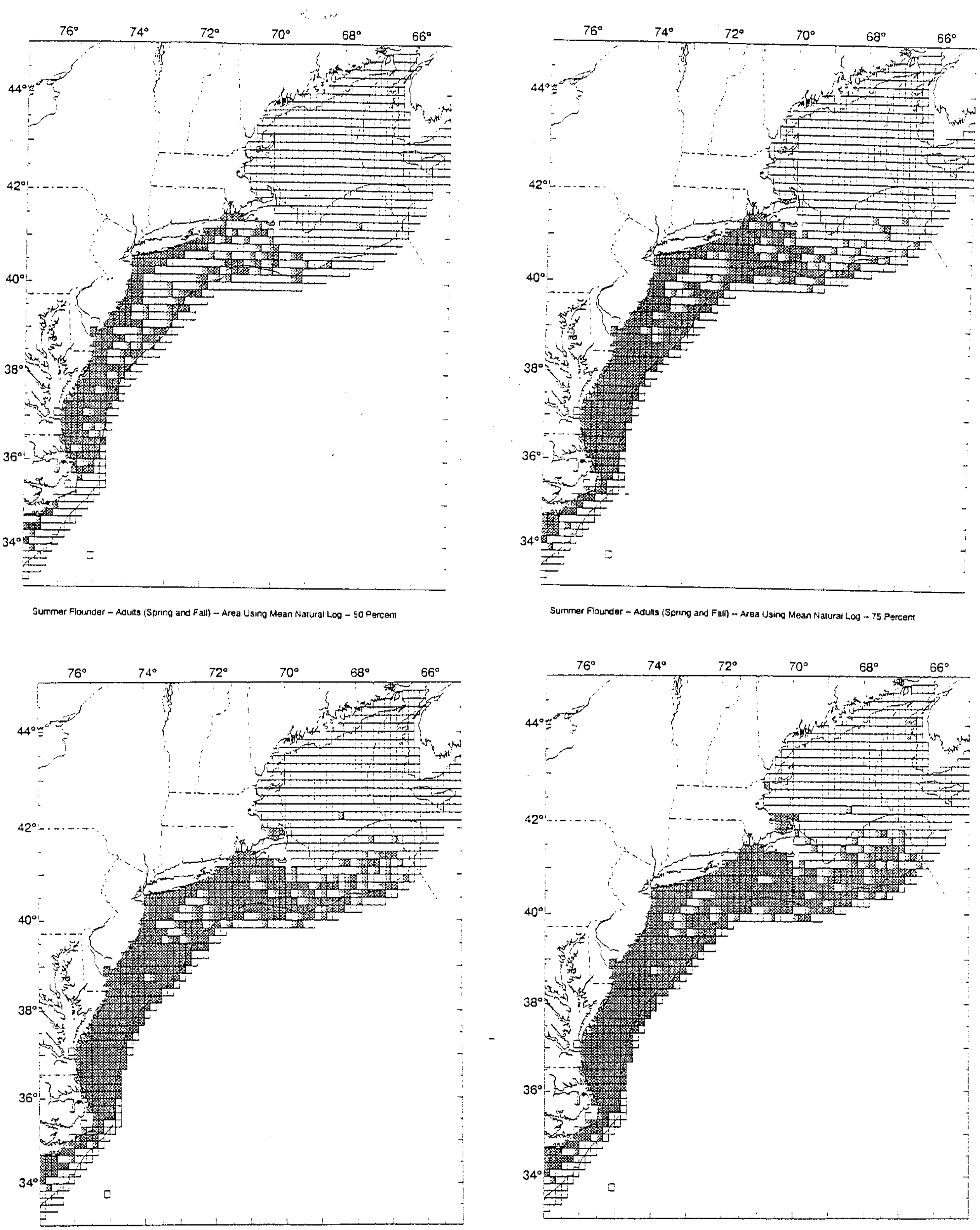


Summer Flounder – Juveniles (Spring and Fall) -- Area Using Mean Natural Log – 90 Percent



Summer Flounder – Juveniles (Spring and Fall) – Area Using Mean Natural Log – 100 Percent

Figure 40c. Four options for designating EFH for juvenile summer flounder under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.



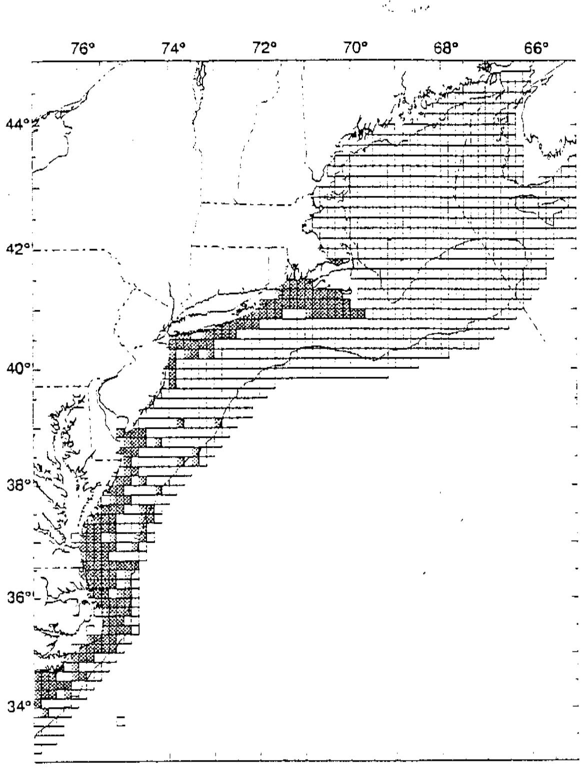
Summer Flounder – Adults (Spring and Fall) – Area Using Mean Natural Log – 50 Percent

Summer Flounder – Adults (Spring and Fall) – Area Using Mean Natural Log – 75 Percent

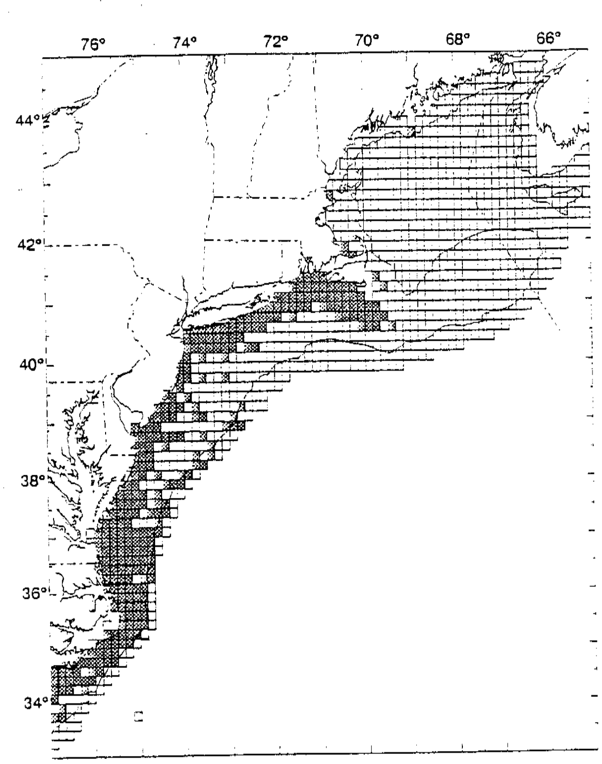
Summer Flounder – Adults (Spring and Fall) – Area Using Mean Natural Log – 90 Percent

Summer Flounder – Adults (Spring and Fall) – Area Using Mean Natural Log – 100 Percent

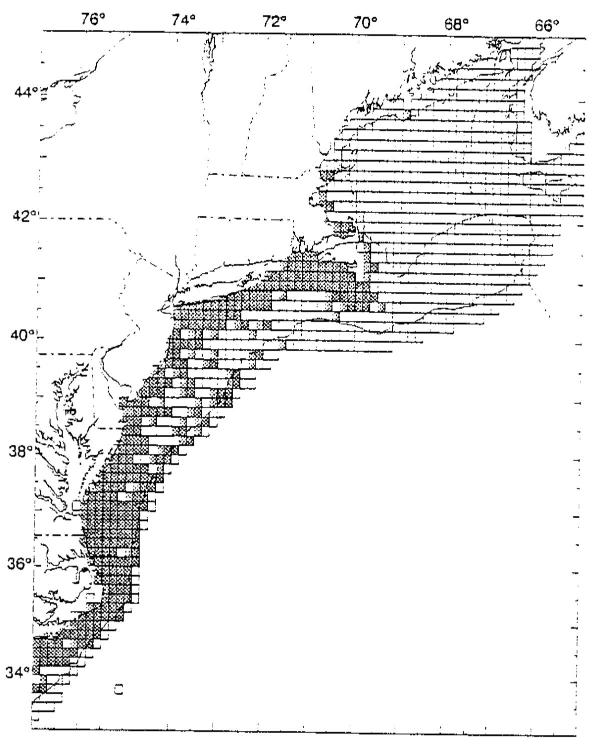
Figure 40d. Four options for designating EFH for adult summer flounder under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.



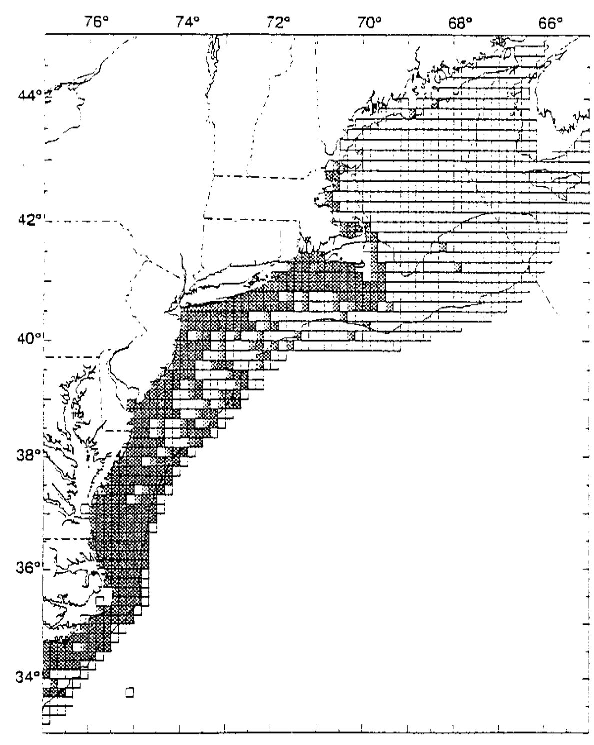
Scup -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 50 Percent



Scup -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 75 Percent

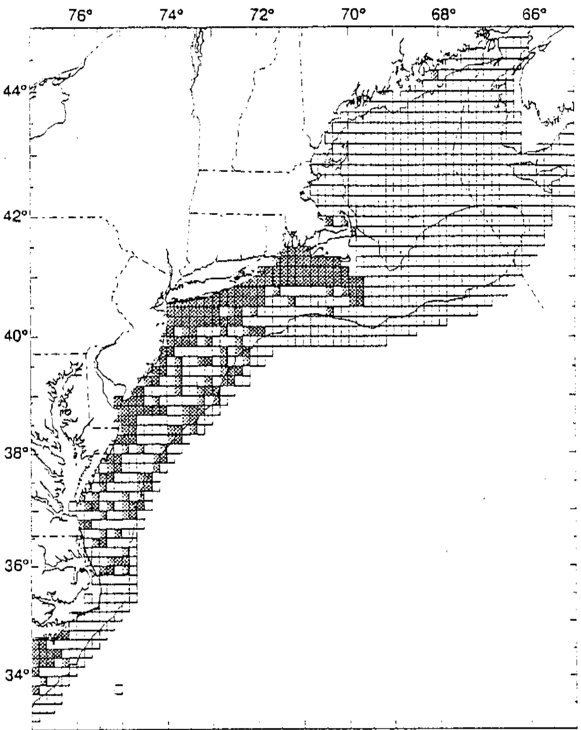


Scup -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

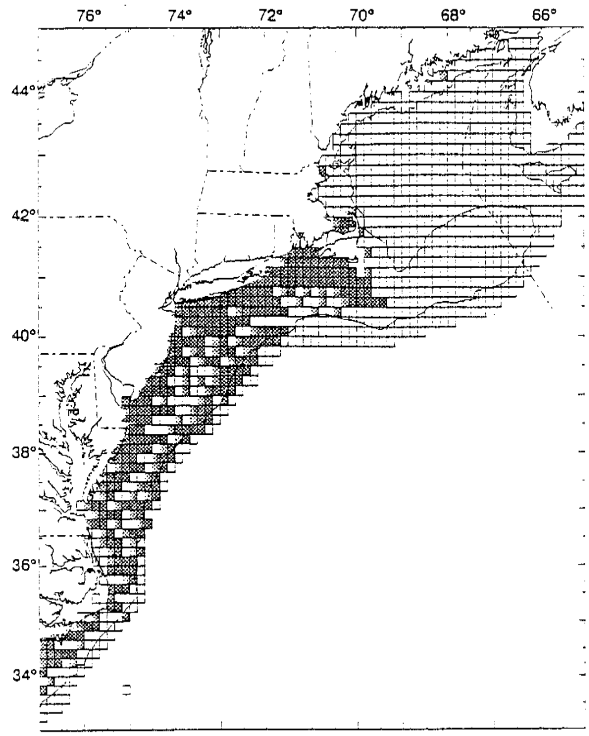


Scup -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 100 Percent

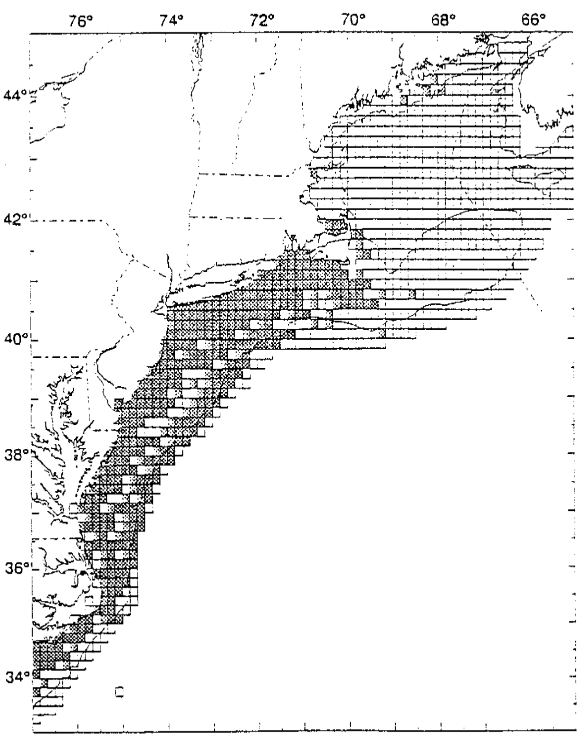
Figure 41a. Four options for designating EFH for juvenile scup under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.



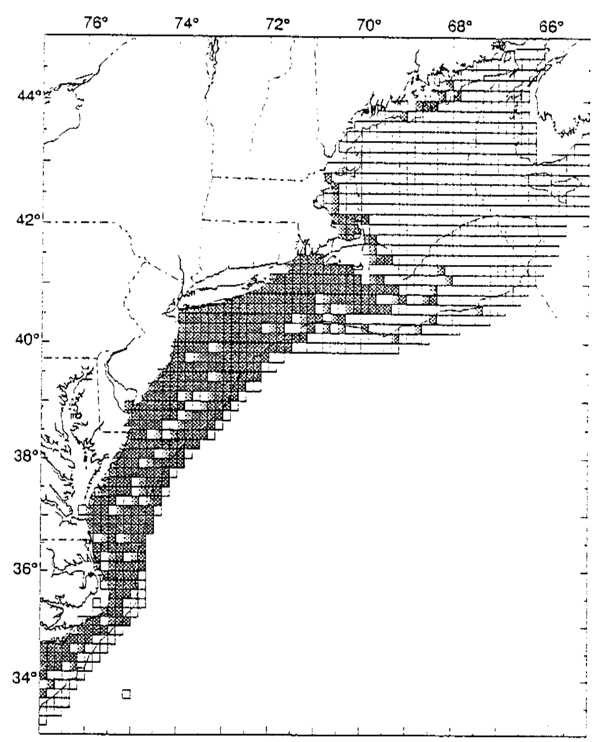
Scup -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 50 Percent



Scup -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 75 Percent



Scup -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent



Scup -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 100 Percent

Figure 41b. Four options for designating EFH for adult scup under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.

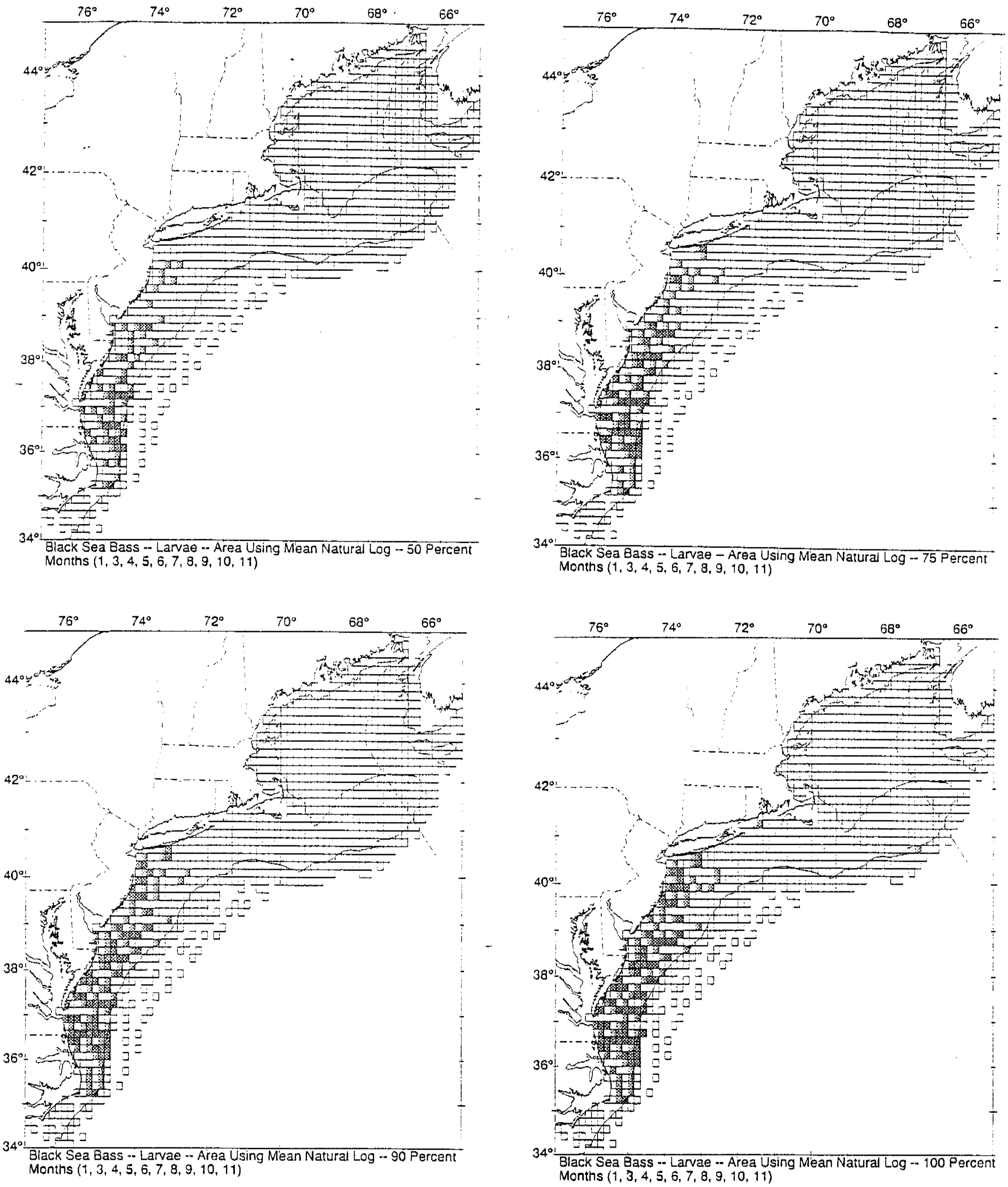
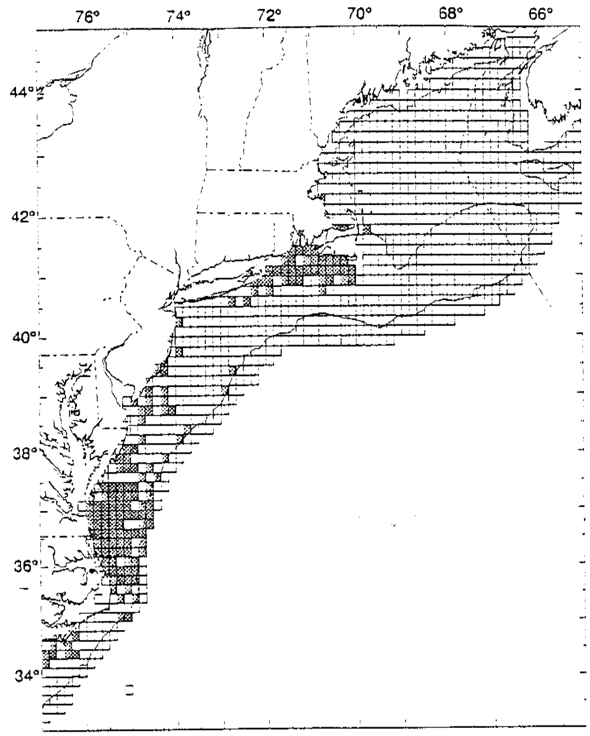
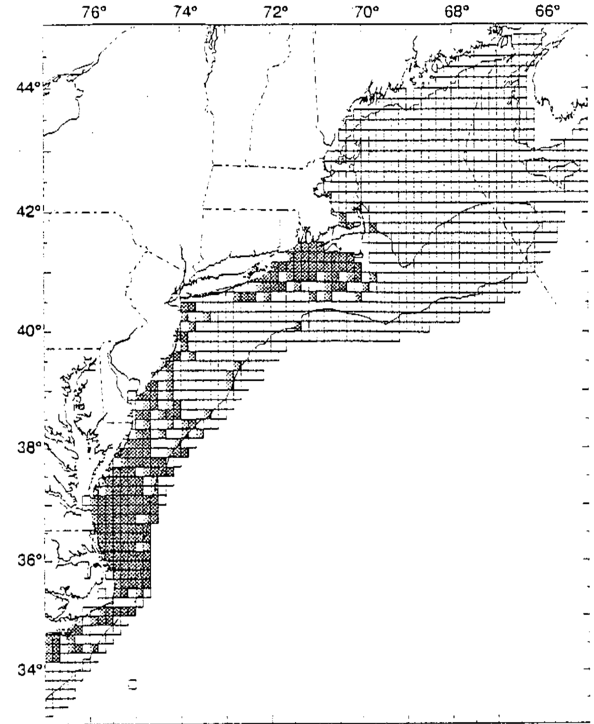


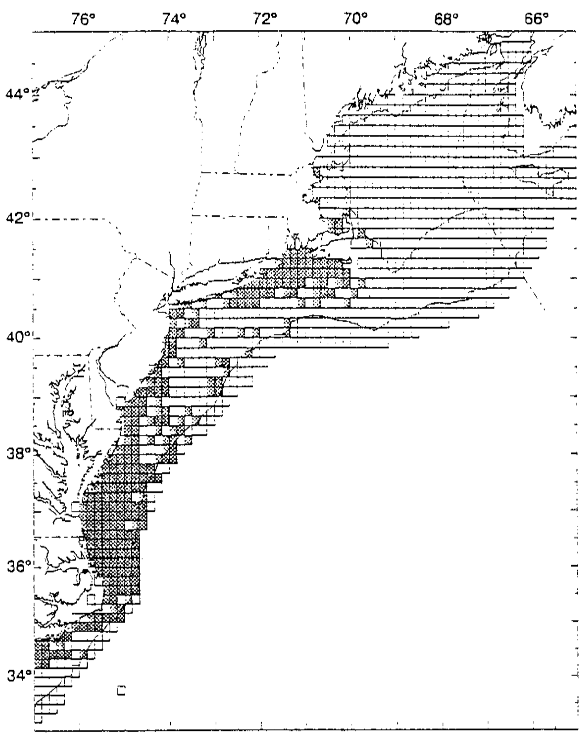
Figure 42a. Four options for designating EFH for black sea bass larvae under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the MARMAP survey.
Source: Cross pers. comm.



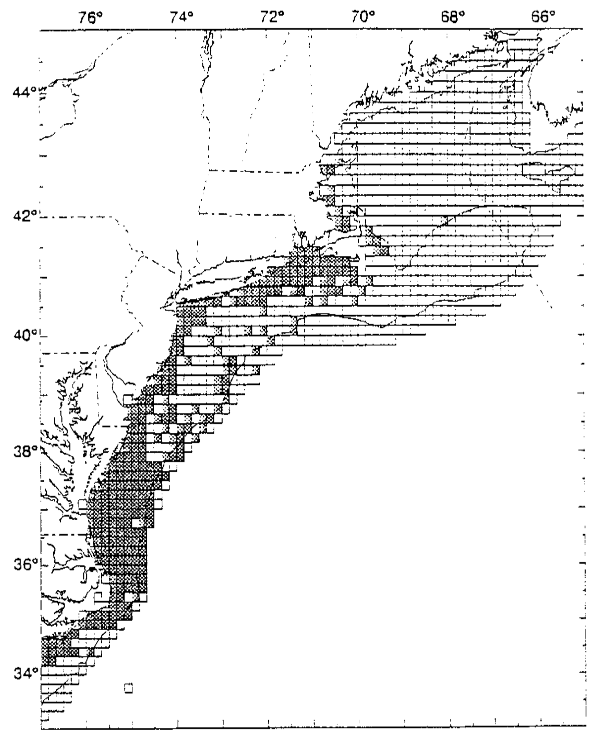
Black Sea Bass -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 50 Percent



Black Sea Bass -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 75 Percent



Black Sea Bass -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent



Black Sea Bass -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 100 Percent

Figure 42b. Four options for designating EFH for juvenile black sea bass under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.

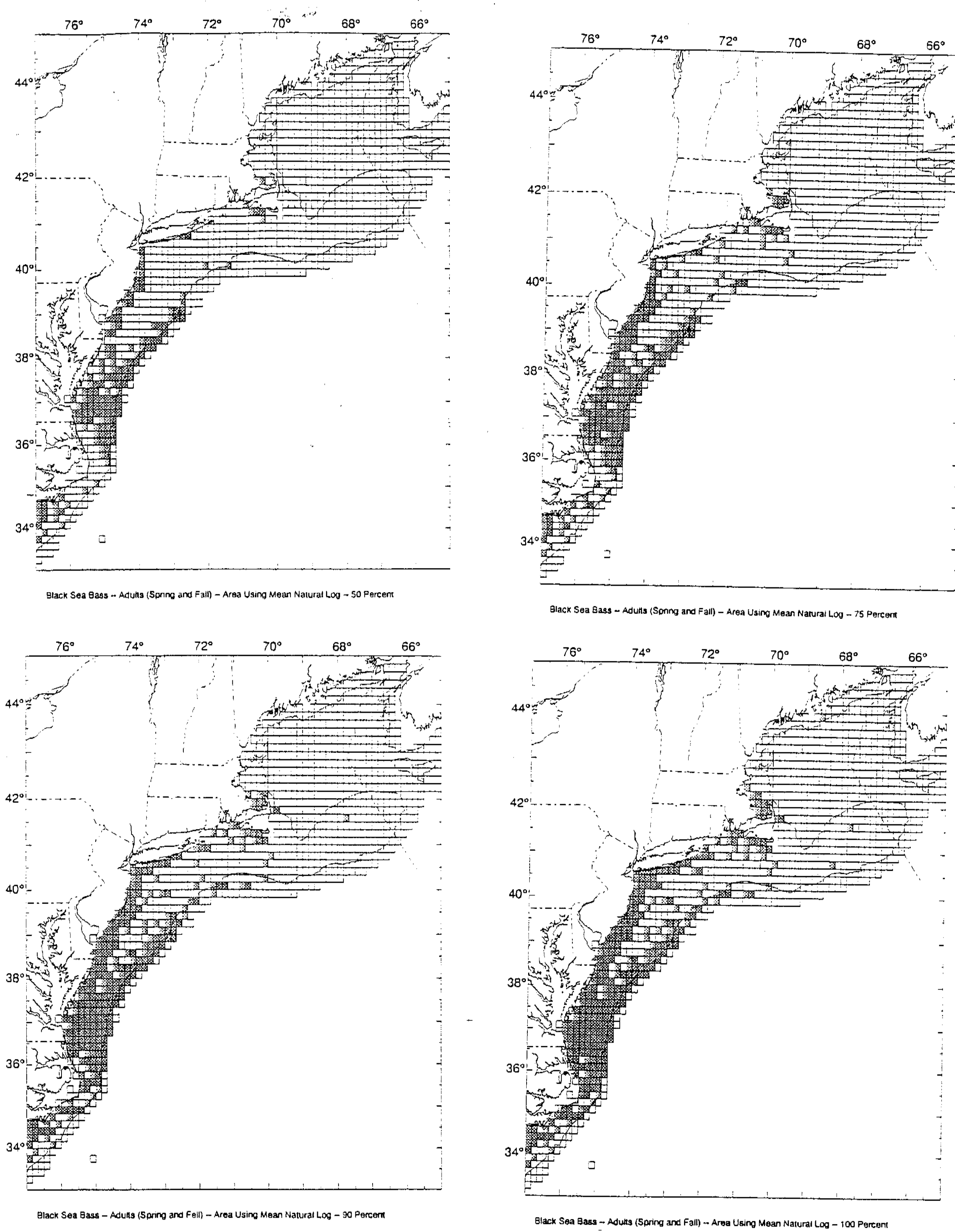


Figure 42c. Four options for designating EFH for adult black sea bass under Alternative 5, the preferred alternative: 1) the top 50% of the area; 2) the top 75% of the area; 3) the top 90% of the area; 4) and the top100% of the area, in the NEFSC trawl survey.
Source: Cross pers. comm.

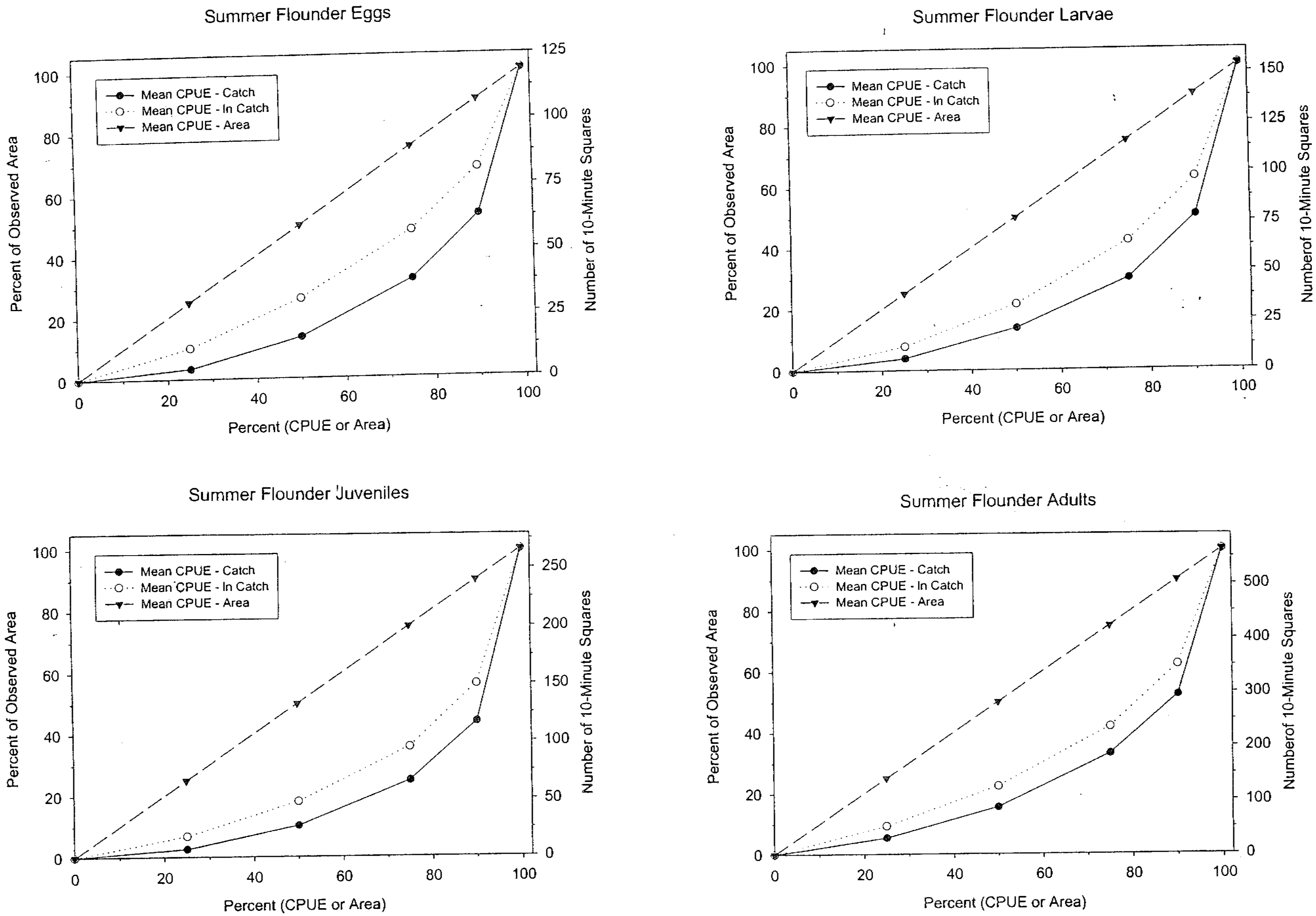
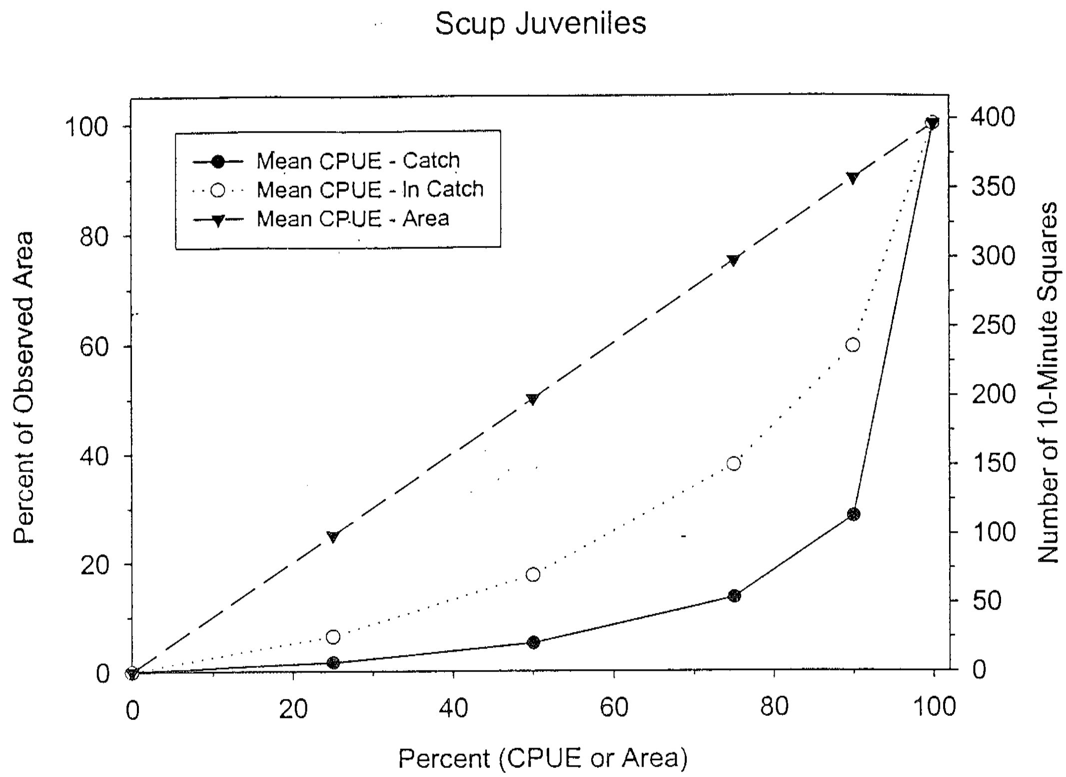


Figure 43a-d. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for summer flounder - (a) eggs, (b) larvae, (c) juveniles, and (d) adults.
Source: Cross pers. comm.



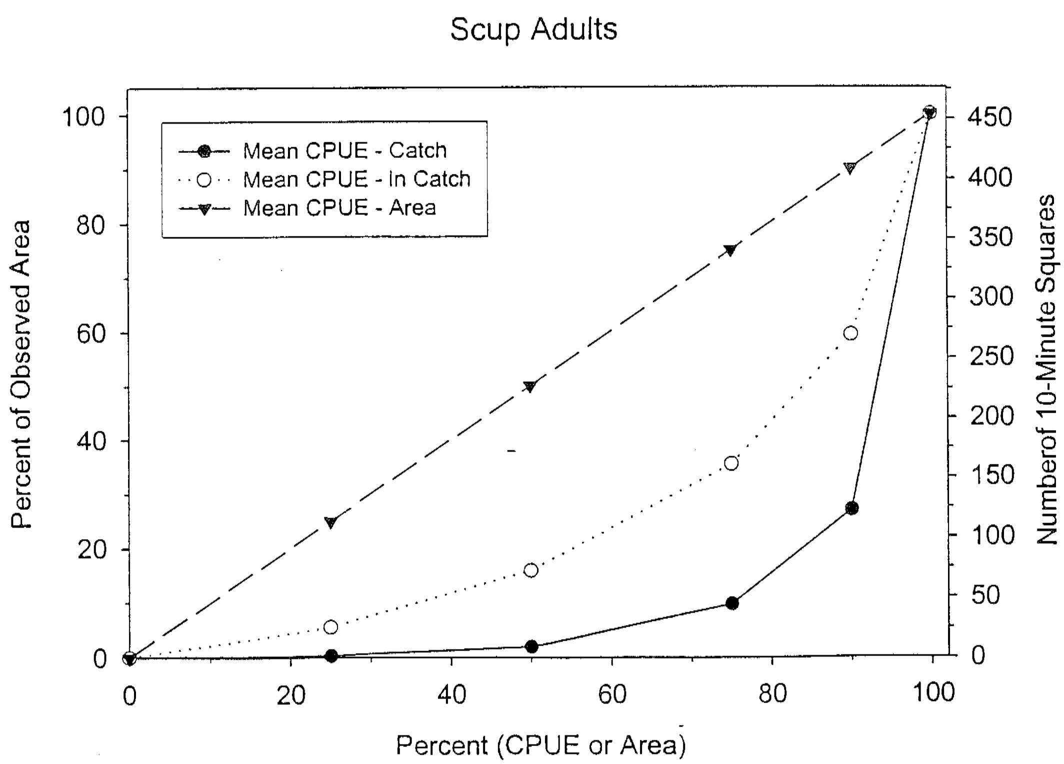


Figure 44a-b. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for scup - (a) juveniles and (b) adults. Source: Cross pers. comm.

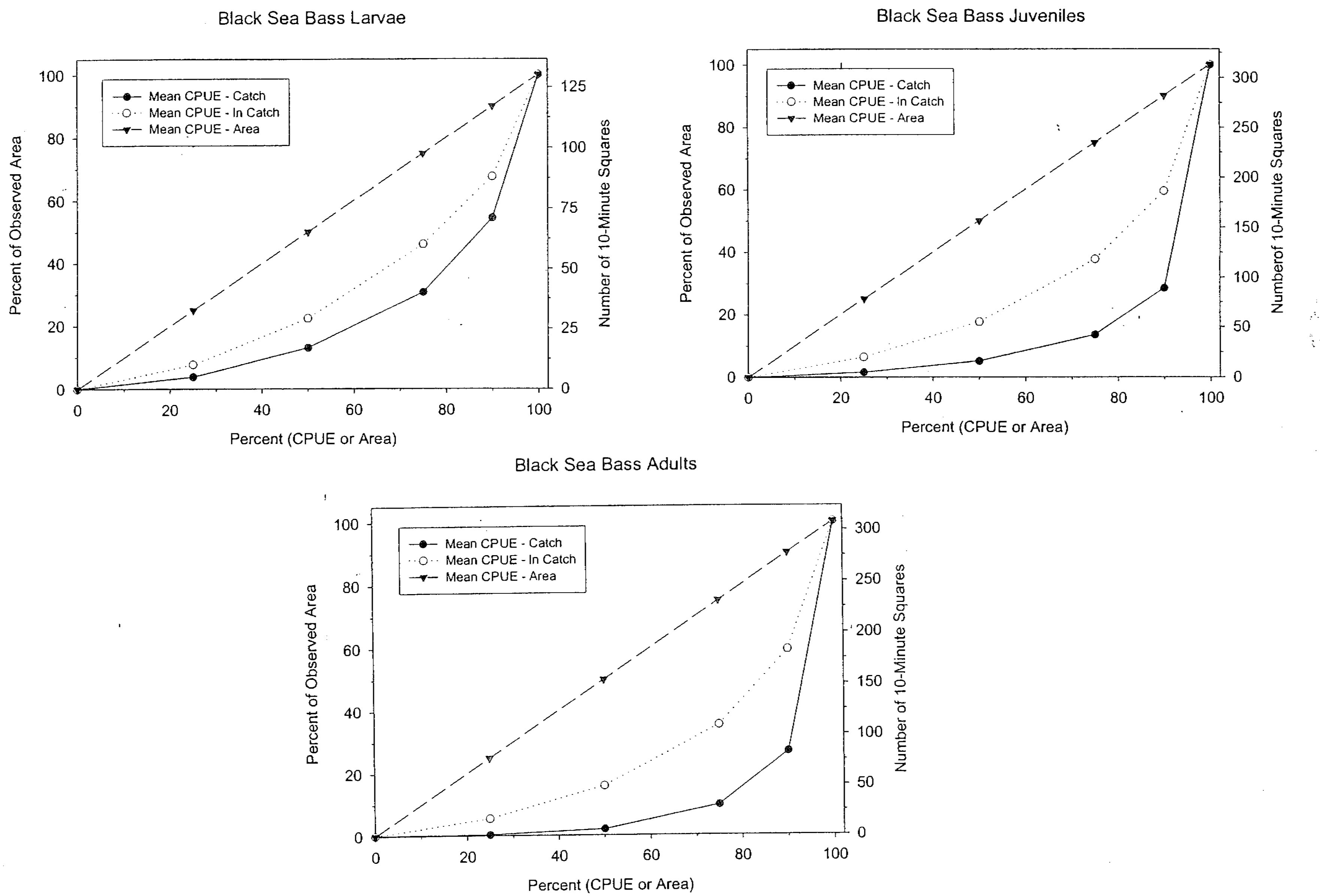


Figure 45a-c. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for black sea bass - (a) larvae, (b) juveniles, and (c) adults.
Source: Cross pers. comm.

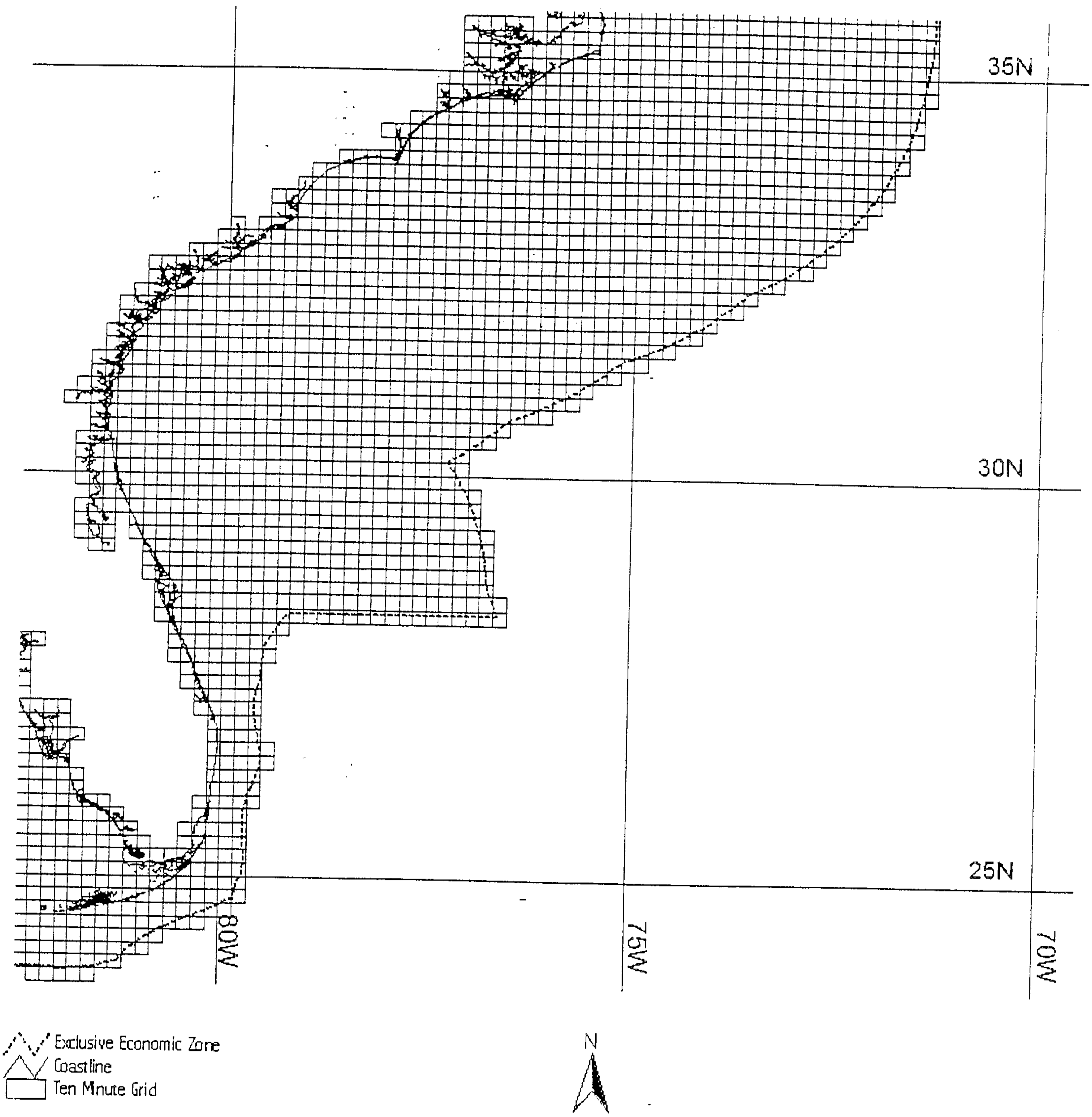


Figure 46. EFH for summer flounder of all life stage south of Cape Hatteras, 100% of the demersal waters over the continental shelf to the limits of the EEZ through Florida.

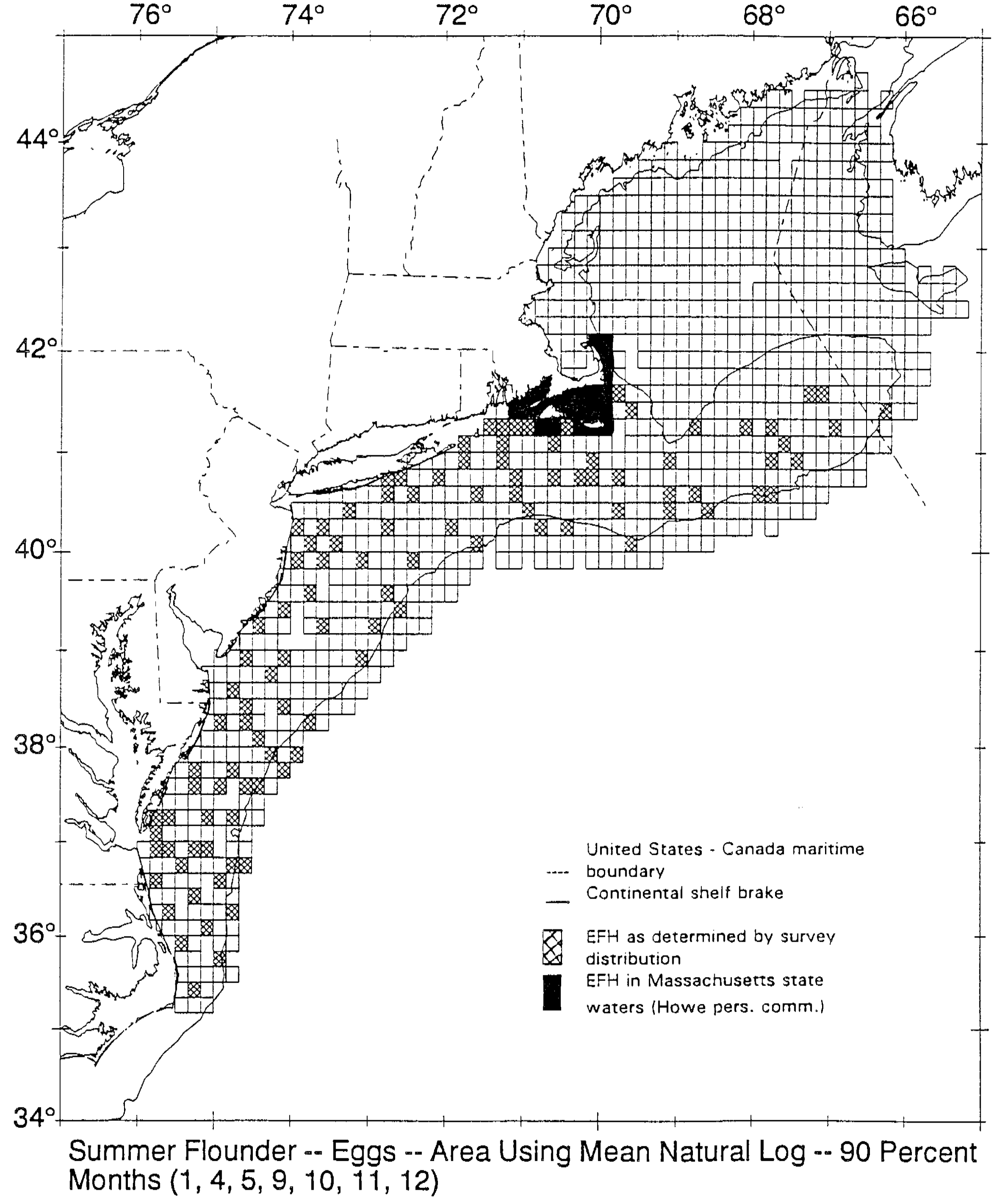


Figure 47a. EFH for summer flounder eggs; the area which encompasses the top 90% of the area where summer flounder are found in the MARMAP and NEFSC trawl surveys.

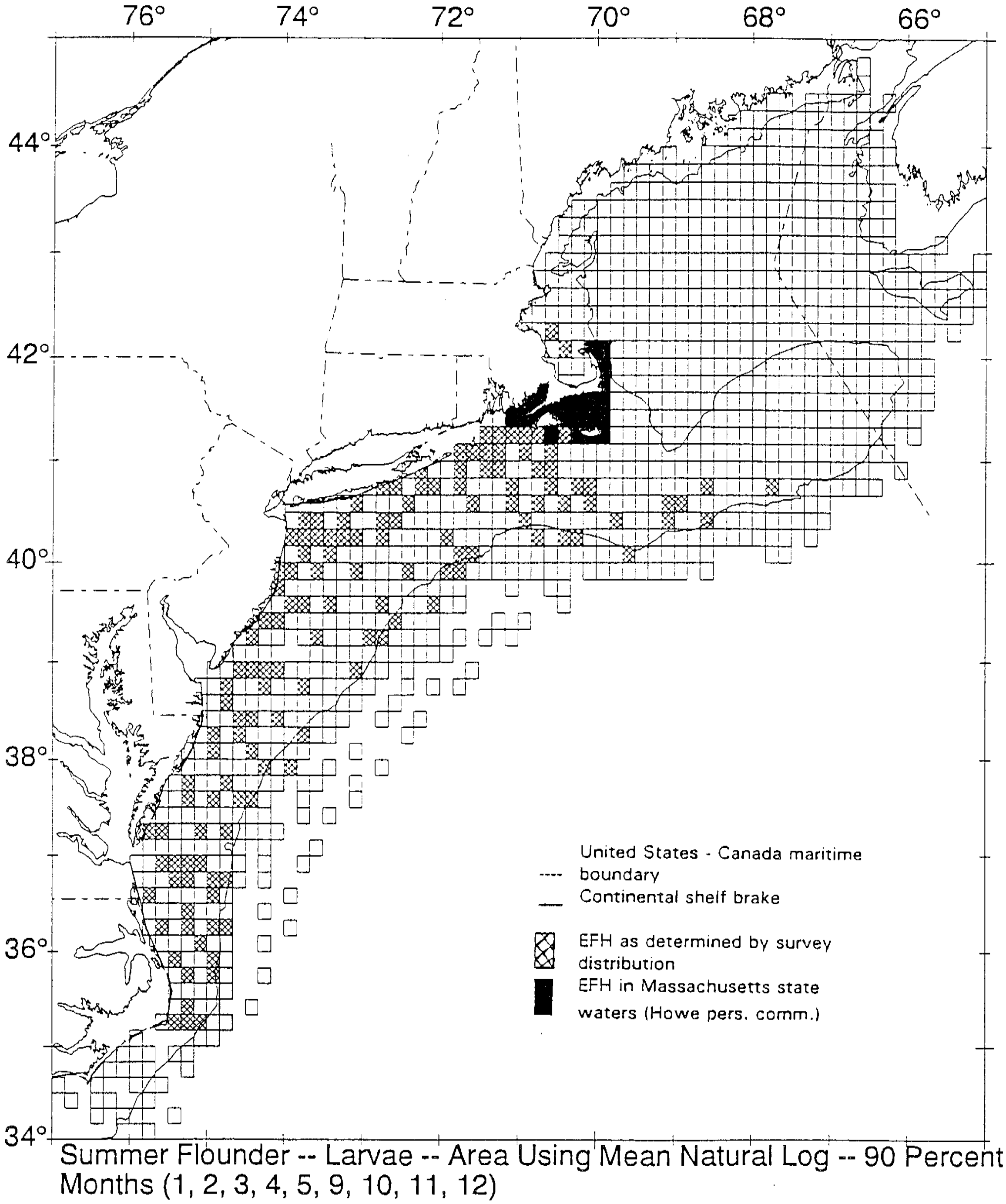
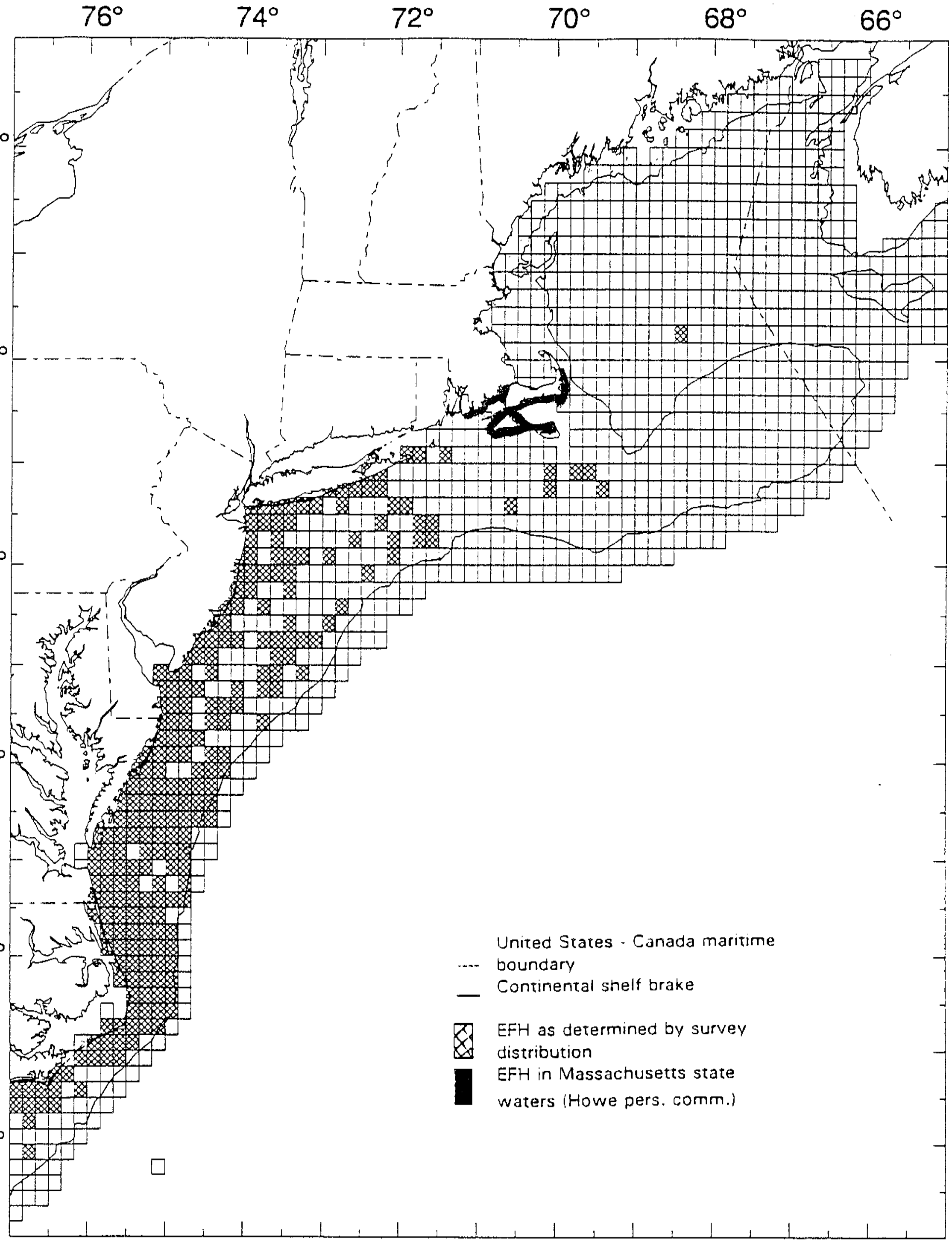
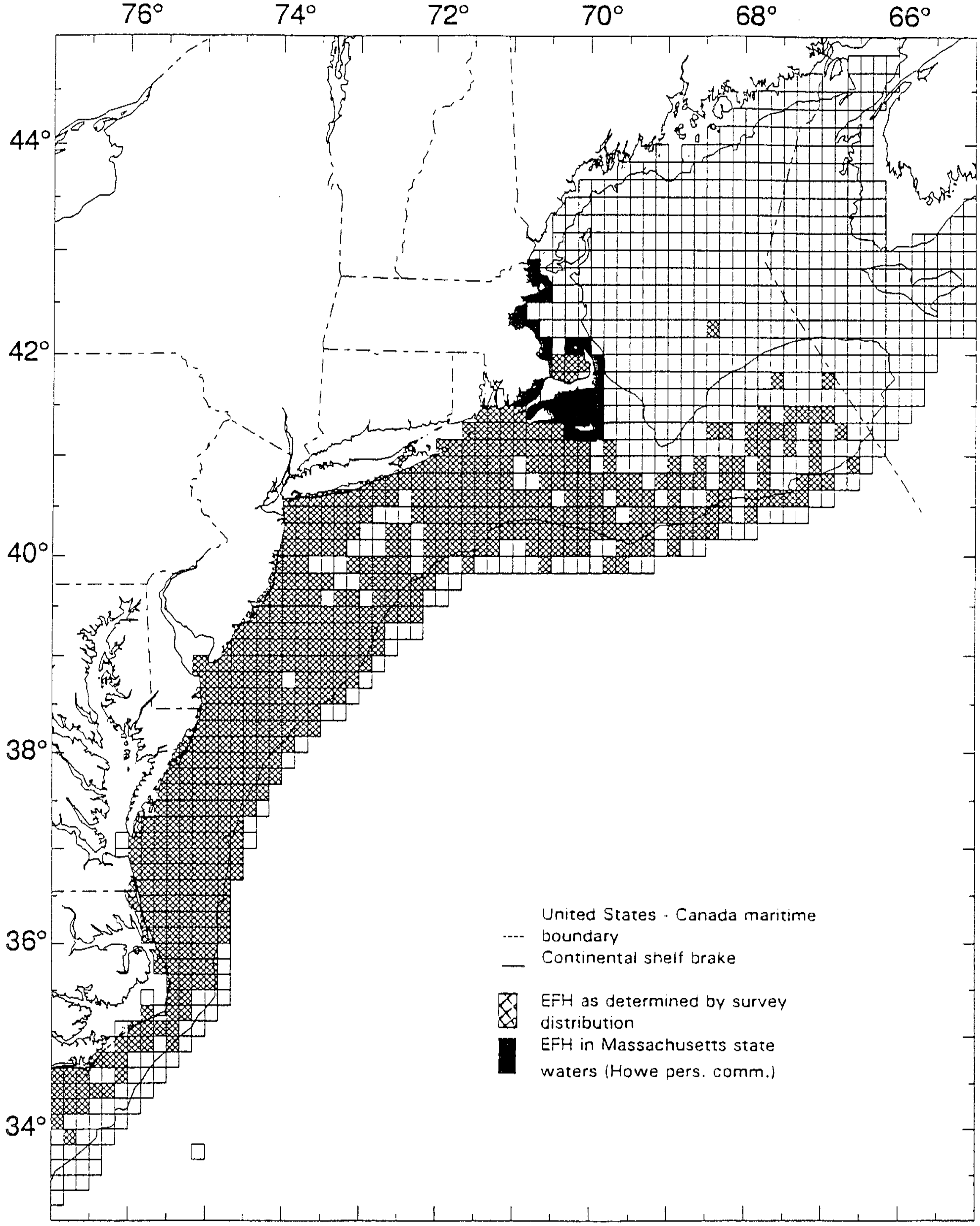


Figure 47b. EFH for summer flounder larvae; the area which encompasses the top 90% of the area where summer flounder are found in the MARMAP and NEFSC trawl surveys.



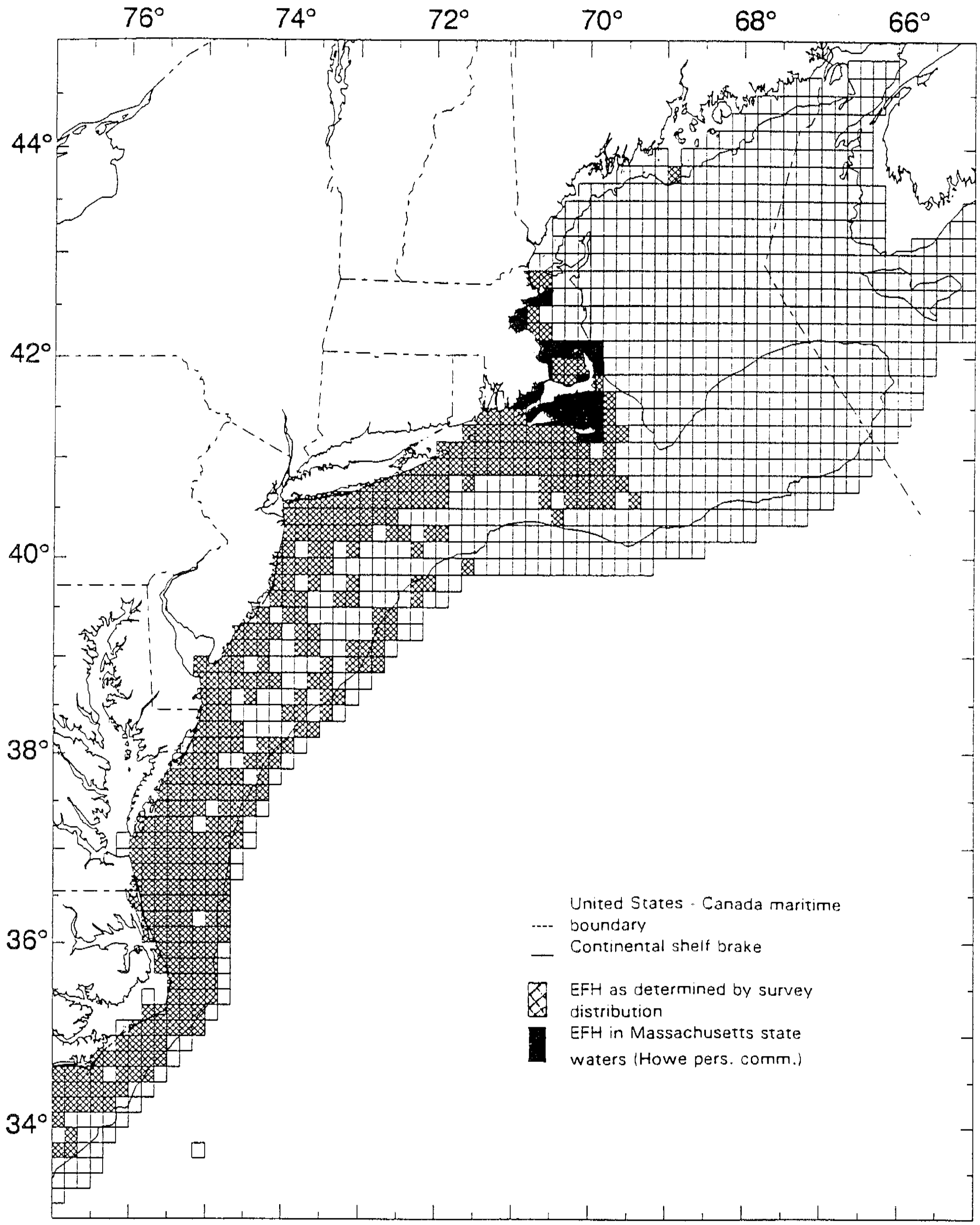
Summer Flounder -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

Figure 47c. EFH for summer flounder juveniles; the area which encompasses the top 90% of the area where summer flounder are found in the MARMAP and NEFSC trawl surveys.



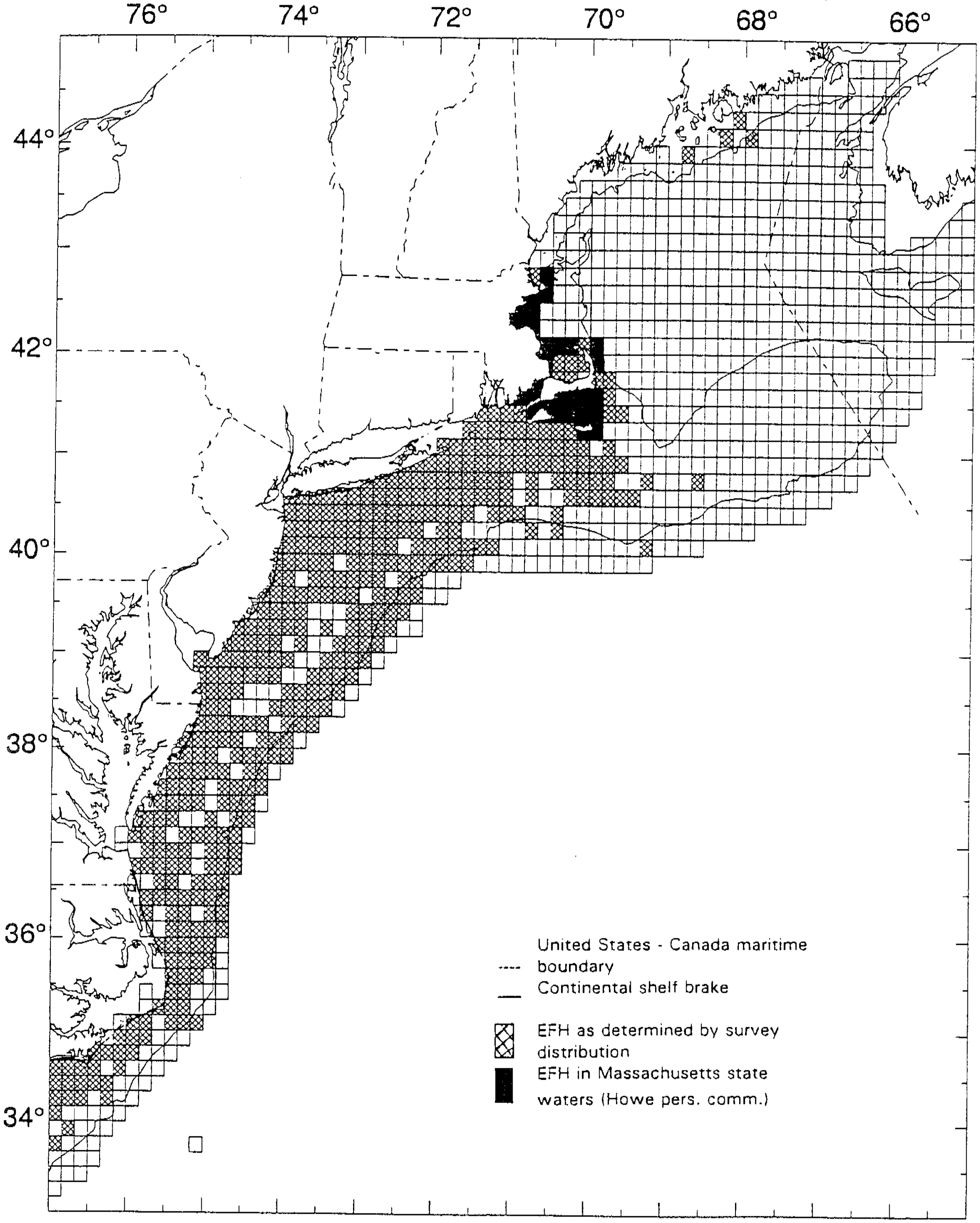
Summer Flounder -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

Figure 47d. EFH for summer flounder adults; the area which encompasses the top 90% of the area where summer flounder are found in the MARMAP and NEFSC trawl surveys.



Scup -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

Figure 48a. EFH for scup juveniles; the area which encompasses the top 90% of the area of scup in the NEFSC trawl surveys.



Scup -- Adults (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

Figure 48b. EFH for scup adults; the area which encompasses the top 90% of the area of scup in the NEFSC trawl surveys.

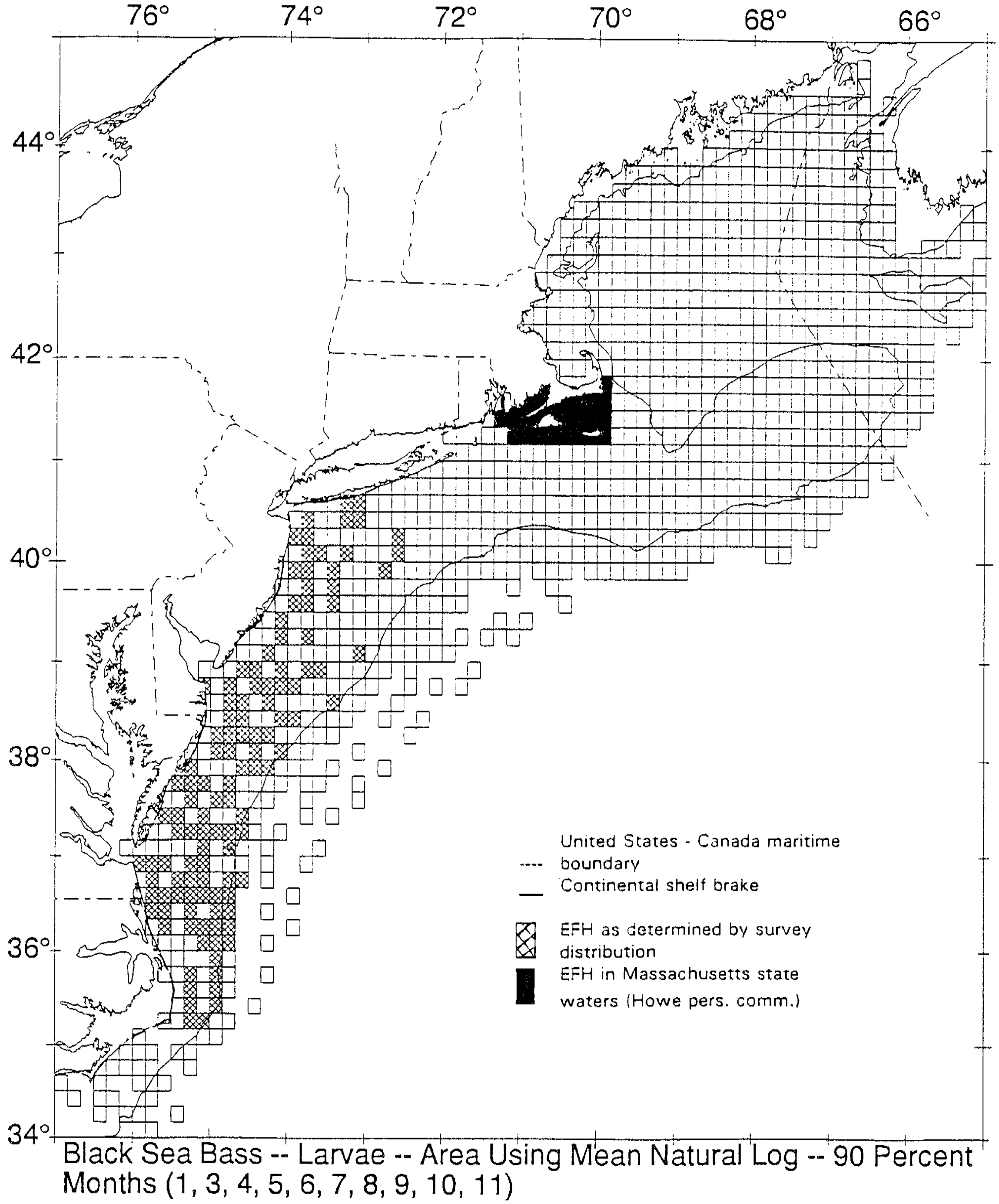
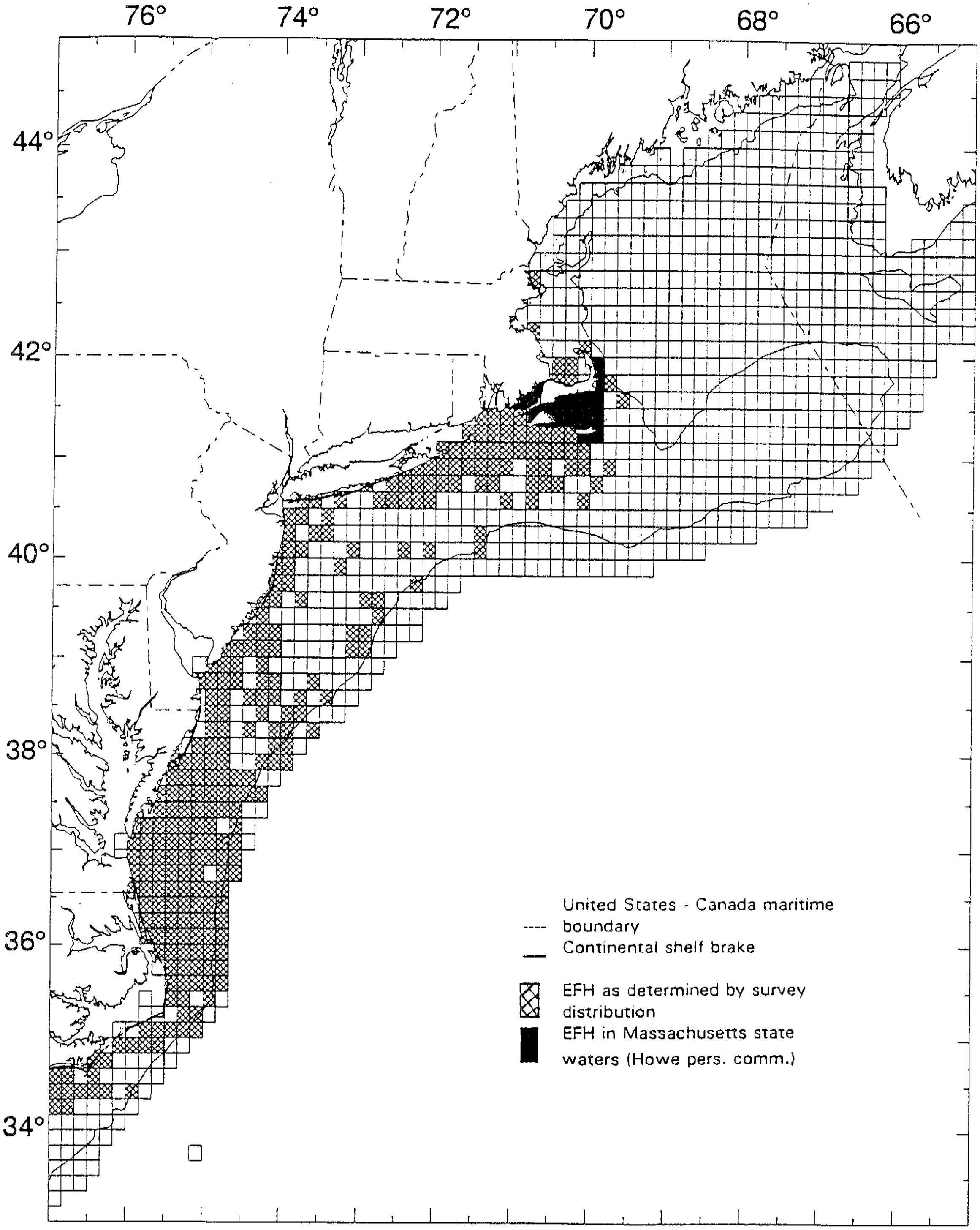


Figure 49a. EFH for black sea bass larvae; the area which encompasses the top 90% of the area where black sea bass are found in the MARMAP and NEFSC trawl surveys.



Black Sea Bass -- Juveniles (Spring and Fall) -- Area Using Mean Natural Log -- 90 Percent

Figure 49b. EFH for black sea bass juveniles; the area which encompasses the top 90% of the area where black sea bass are found in the MARMAP and NEFSC trawl surveys.

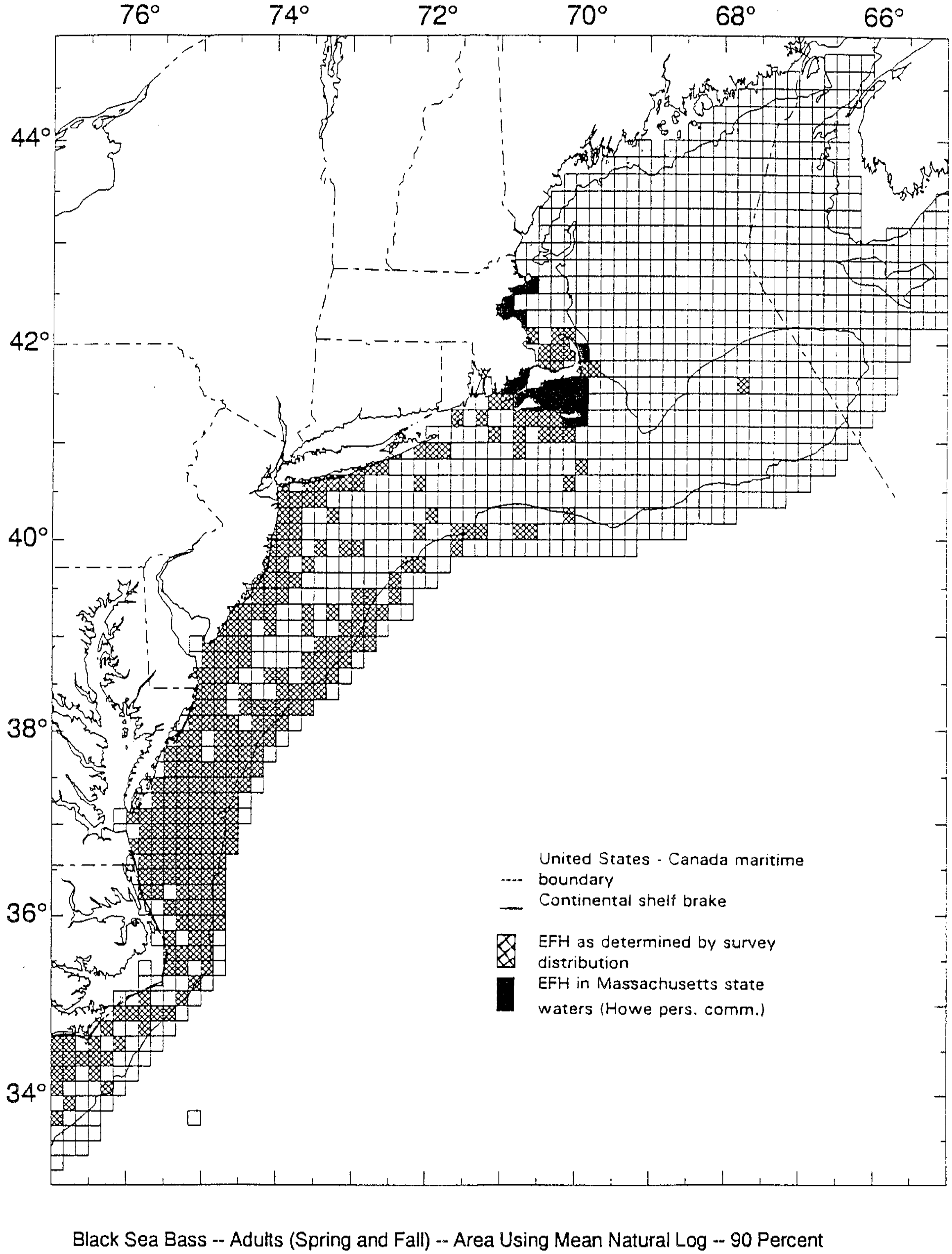


Figure 49c. EFH for black sea bass adults; the area which encompasses the top 90% of the area where black sea bass are found in the MARMAP and NEFSC trawl surveys.

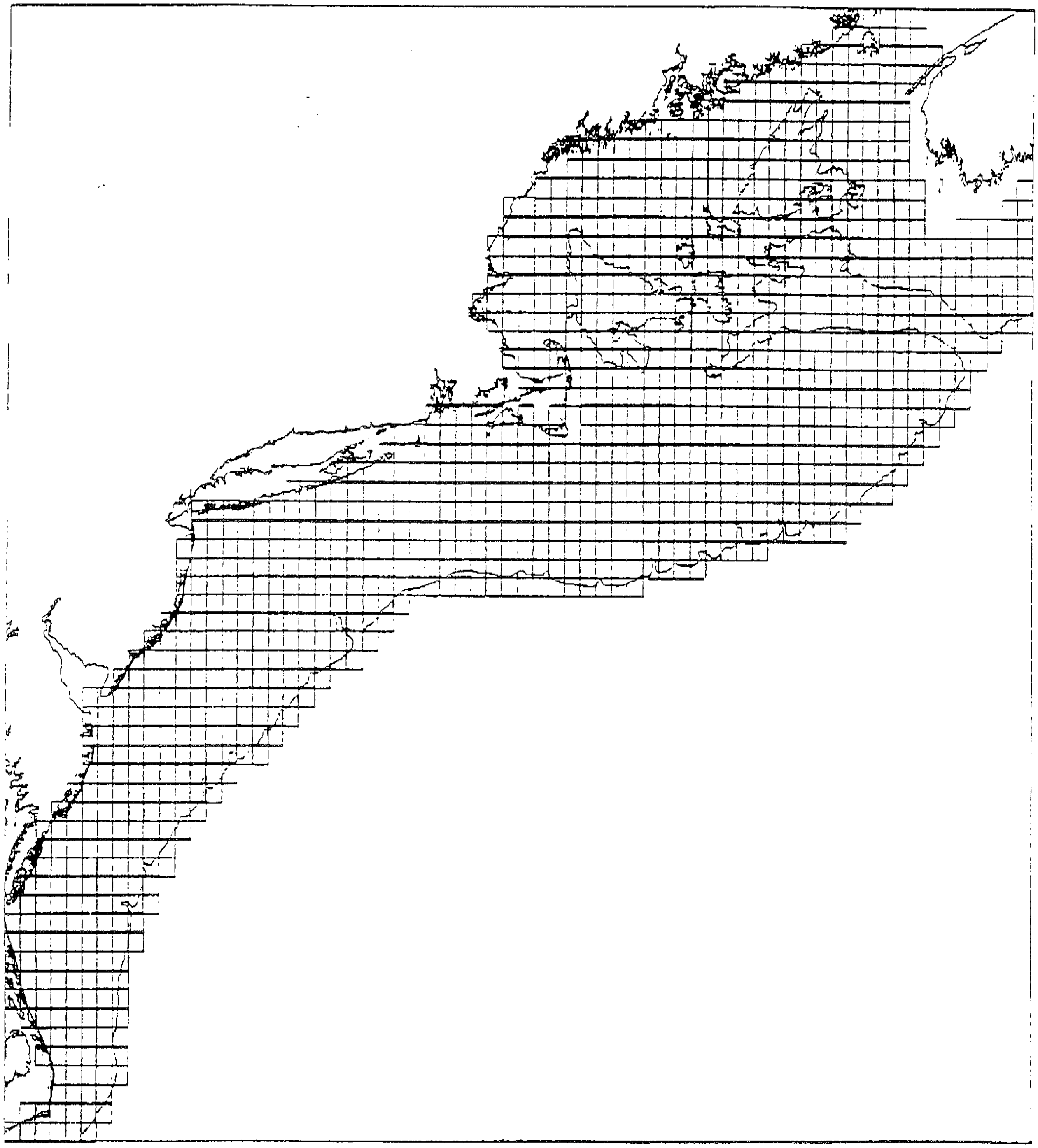


Figure 50. Blank 10 minute grid north of Cape Hatteras, North Carolina for input by the public on summer flounder, scup, and black sea bass EFH.

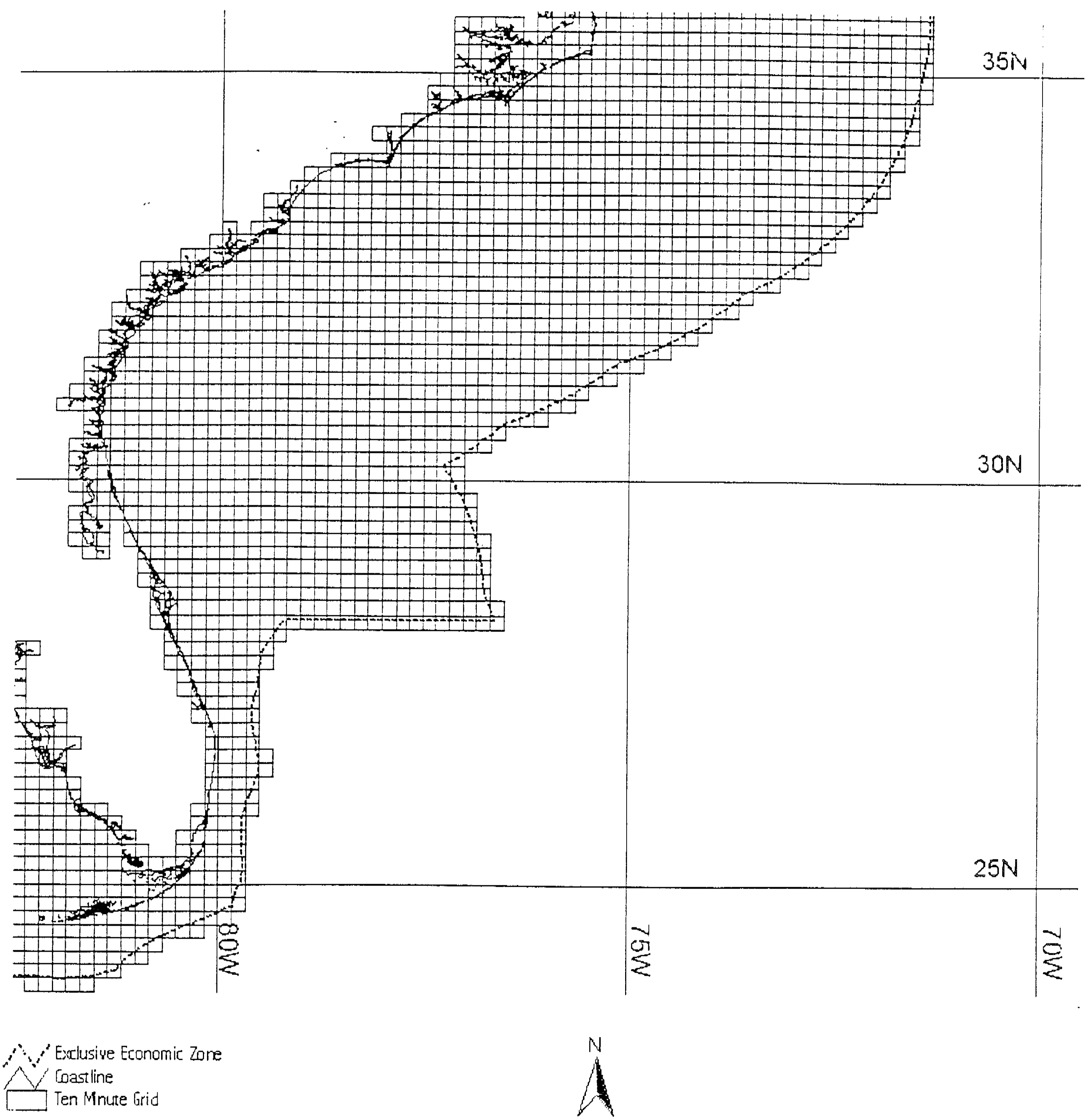


Figure 51. Blank 10 minute grid, south of Cape Hatteras, North Carolina for input by the public on summer flounder EFH.

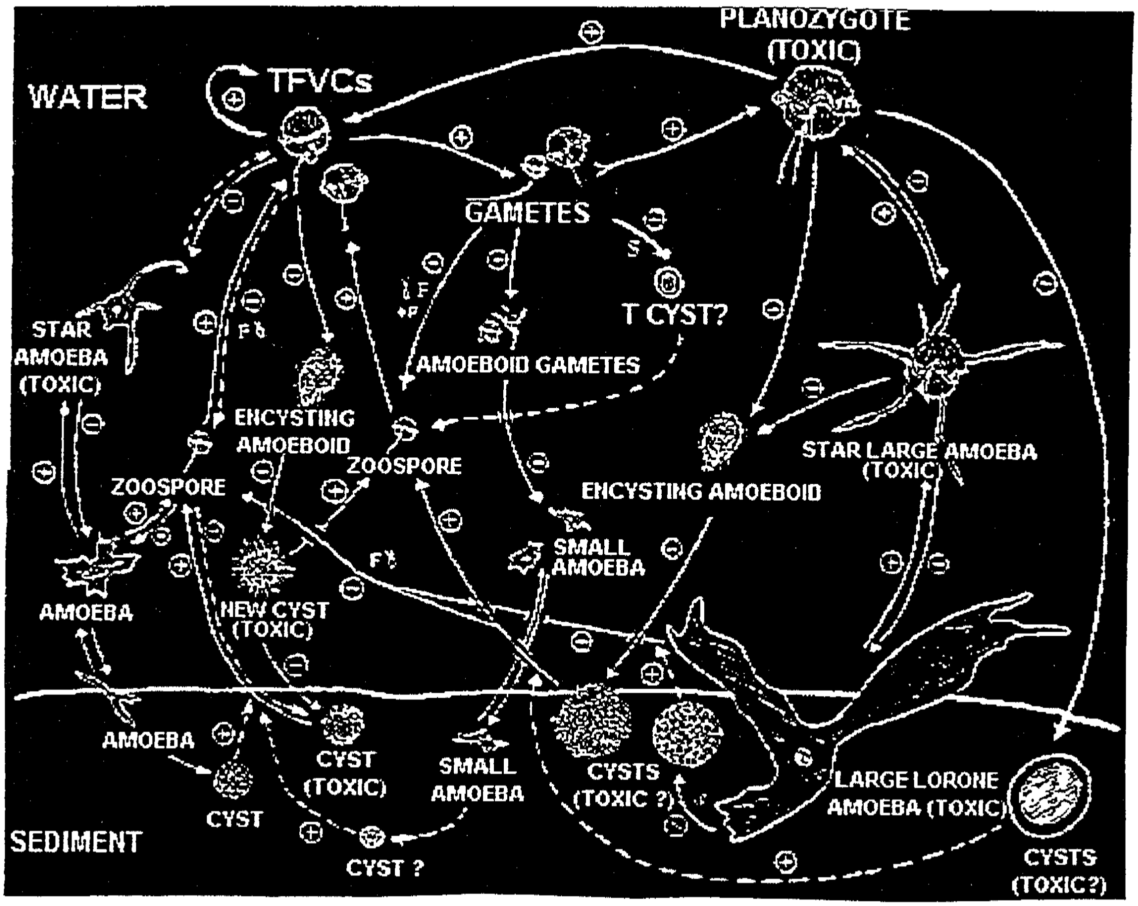


Figure 52. Diagrammatic life history of *Pfiesteria piscicida*.
Source: NCSU 1998.

APPENDIX 1. PUBLIC HEARING SUMMARIES

Amendment 12 to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan, Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan, and Amendment 12 to the Surfclam and Ocean Quahogs Fishery Management Plan

WARWICK, RI - SEPTEMBER 8, 1998

The hearing was opened at 6:00 PM by hearing officer Dick Sisson. Mr. Sisson presented the SFA Amendments.

<u>Comments on Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP</u>

Mike Tarasevitch stated that as long as the Council is talking about a target TAC for *Loligo*, there should be some sort of reasonable trip or possession limit so that the TAC is not caught up too early in the season. The trip limit should be reasonable, perhaps 30,000 pounds. If they have a big winter and the quota gets all caught up by May we won't be able to catch anything.

Dan Cameron, crew member on the Atlantic Star, wanted to comment on the vessel size and horsepower restrictions proposed in the Atlantic mackerel fishery. He read a prepared statement which is attached (see Attachment 1).

<u>Comments on Amendment 12 to the Atlantic Surf clam and Ocean Quahog FMP</u>

George Richardson, Blount Seafood Corp., stated that as he reads the overfishing definition, the Council is going to use the biomass from the Northern New Jersey Area, which is a relatively small area, as the criteria for setting the whole quota. In my mind this is effectively putting a management practice in place of an overfishing definition. I object to this, from the industry point of view. I would like to see this stricken from the amendment and some other criteria put into it's place which is similar to the quahog criteria. I would rather see the fishery managed on a biological basis rather than the economic criteria they are currently using. The biology suggests that we now have six times as many clams as we had last year based on the recently updated surveys. This seems like a contrived way to keep the quota low and I do not like it in any way. I support the old Council policy of extracting 10 % of the biomass per year and maintaining a ten year window of opportunity, this was a sound practice. The quahog portion is ok.

<u>Comments on Amendment 12 to the Summer Flounder, Scup and Black Sea Bass FMP</u>

Mike Tarasevitch stated that I am also on every mailing list and all I received was a brief summary. How am I supposed to comment on a 300 page document I just received. Also, I thought I was coming up here to comment to members of the Mid-Atlantic Council. They were going to send that guy Rich Seagraves up here to take our comments. Who is he? He's not even a voting member of the Council. They should at least send someone up here to listen to our opinions and concerns who is going to vote on this. I hope they transcribe this and I just want to say to members of the Mid-Atlantic Council that I protest this meeting. We are being shafted on this whole process, and I personally demand another meeting. I had some questions for the Council members about what their thought processes were and the fact that they were only going to send one person up here means they are treating us like zero. These scup and fluke issues are very important to this state. I hope that these comments go on to the Mid-Atlantic Council, that the fishermen of Rhode Island are being shafted and I am going to complain to my congressman. We should have another meeting with members of the Mid-Atlantic Council present to listen to our views. Don't we have a liaison to the Mid-Atlantic Council. Who is he? Jim O'Malley, where is Jim O'Malley? I agree with John Kurtesis, I believe that Jim O'Malley should be kicked out as the representative for the State of Rhode Island. This is a joke, there is nothing going on right now that is more important for Jim O'Malley than to represent the fishermen of Rhode Island. I apologize if he had a death in the family, otherwise he should be kicked out, thrown out.

John Kurtesis, Tiverton RI, stated that he is on all the mailing lists and all he received was a brief summary of the Atlantic mackerel amendment. I have a 300 page document and I have no idea what is in it, how can I comment on it? This is crazy, we came in here blind. I agree that this process is totally crazy, having just a state guy here. We want members of the Mid-Atlantic council here - now.

John Carvahlo, stated that they way the hearing is being run , the idea that the fishermen have more time to comment in writing, that practice is not acceptable. The kind of written testimony that the Council is asking for is hard for fishermen. These public hearings are supposed to be an opportunity to express ourselves verbally rather in writing. I don't think that this process is in the spirit of any administrative procedure normally followed during the adoption of an FMP amendment. We fish for many different species, we do not have time to attend every hearing and respond in writing to every management plan for species that we fish for, that would be impossible. We are fishermen, we are not in the business of providing written testimony. We are subjected to this bureaucratic maze for every species. I could write lengthy testimony on the scup mesh size regulation alone. Our discards are not the problem with scup, you have a small group of people in the ocean fishery that are responsible for 90% of the scup discards, yet the rest of us are being beaten to death over this issue. They are going to bankrupt the entire inshore fleet over this issue. That is not what the Sustainable Fisheries Act was intended to do.

Several fishermen at the hearing submitted a petition (see Attachment 2).

Dick Sisson wanted to keep the hearing open to allow additional comment.

NORFOLK, VA - SEPTEMBER 8, 1998

Hearing officer Rob O'Reilly (filling in for Jack Travelstead) opened the hearing at 1810 hours. Twenty six individuals from the public were present. Council member Bill Wells attended. Tom Hoff of MAFMC staff attended.

Comments on the Summer Flounder/Scup/Black Sea Bass FMP were received first.

Dean Isaacson, Papa-si Fish Company, stated that there is no need now for additional management measures on black sea bass.

Luke Negangard questioned whether black sea bass rod and reel fishermen would need any additional permits under this Amendment. He stated that we should make sure we do not put him out of business.

Tim Daniels, Old Point Packing, stated that frameworking management measures was not a supportable idea because of the long term nature of business planning.

William Nuckols stated that the public has a hard time telling where EFH is from the maps in the documents.

James Fletcher, United National Fishermen's Assoc., provided a written statement (see Attachment 3). He said that the information is flawed. Amendment 12 should not be submitted to the Secretary because the information is wrong. Summer Flounder/Scup/Black Sea Bass has all bad information and it is wrong to consider these species overfished. The summer flounder MSY should be what Chang and Pacheco said it should be two decades ago, 44 million pounds. There should be a retrospective analyses done on Chang and Pacheco, who had put a higher F on the table than the F=0.24. The Congressional mandate of the October deadline should not drive the process. The document is wrong. The science is wrong.

Bill Wells acknowledged that Fletcher had some points. Summer flounder will need to be reviewed. The Council is recognizing that something is not tracking in the FMP.

Mark Hodges, Hodges Seafood Ltd., questioned the historical data. He requested that we send him the black sea bass SAW report.

Comments were then received on the Atlantic Mackerel/Squid/ Butterfish FMP.

Jim Ruhle, FV Darana R, stated that the SFA was forcing the Council to jump through hoops. There is lots of pressure and the MAFMC is not performing up to our normal standards. Under no circumstances should the MAFMC try to follow the NEFMC approach, as it is doing with the frameworking measures. The NEFMC track record is not good. The Council does not have the capability to affect 90% of the proposed frameworked measures. One can not change the horsepower within the season. The frameworked measures will not work. NMFS is not putting all their cards on the table, i.e. squid quota was never mentioned at the last Council meeting until the end of the meeting, and now *Illex* will be closed. The same is true with summer flounder. With the SFA overfishing requirements, the decrease of 1000 mt for *Illex* is only mathematics. Congress has put MAFMC under a lot of pressure and it should not be under that pressure to simply meet a deadline. The frameworking measures are not fair to the industry. One can not shuffle the deck in the middle of the year. The community descriptions have changed significantly from McCay in 1993, i.e. Wanchese numbers have changed significantly. The FMPs need to have updated community information.

James Fletcher, United National Fishermen's Assoc., stated his opposition to the permit requirements in Amendment 8 which requires extensive landings. Fishermen with permits for years should be able to fish even if they had no landings. If a fisherman did not have the permits, then he can not fish, but if he had permits then should be able to keep the permits and fish. Same rules apply as flounder and scallop permit holders. They need fishermen to be able to switch back and forth among various fisheries.

Finally the third set of comments were taken on the Surfclam/Ocean Quahog FMP.

John Miles, JH Miles & Co., Inc., buys the majority of the landings that come from Delmarva region. He is opposed to the proposed surfclam overfishing definition because it is based on Northern New Jersey (NNJ) production. The Council is setting unreasonable restraints on the quota. He can not sell the high value clams of NNJ in his process. He stated the objectives of the FMP are for the range of the resource. He stated that if the quota were to increase significantly then Delmarva clams would be more economically valuable. Lots of clams in Delmarva.

Tim Daniels, Old Point Packing, wanted to know how someone could get into the ITQ clam fishery.

James Fletcher, United National Fishermen's Assoc., said the clam ITQ system was set on false information. We should allow for the diversification of the clam fishery and allow more fishermen and processors to get into the clam fishery.

David Moore, JH Miles & Co. Inc., agreed with John Miles about the proposed overfishing definition being based on Northern New Jersey.

Finally, a call for any additional comments produced one.

Jeff Dean stated that summer flounder are rebuilding and no further measures are needed. Good people do not need further hardships.

Mr. O'Reilly closed the hearing at 2015.

RONKONKOMA, NY - SEPTEMBER 9, 1998

The hearing was opened at 6:06 PM by hearing officer John Mason. Council staff present included Rich Seagraves.

Mr. Seagraves presented the Amendments.

Comments on Amendment 12 to Surf Clam and Ocean Quahog FMP

Dave Aripotch commented that this was the only FMP in the country that would make out better under the new SFA.

Mike McCarron stated that there was still ocean quahog quota left, but clammers have no market. If they could work on the quahogs this would take some pressure off of the other species which are overfished. Why can't this excess quota be utilized?

Comments on Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP

Mike McCarron is concerned about the Council policy of eliminating joint ventures for Atlantic mackerel. He feels they offer an option for the fishing fleet to catch mackerel and wants the Council to allow JV's in the future. Since *Illex* is closed, many of the large boats will switch to *Loligo*.

Dave Aripotch also stated that the commercial fishermen need other options. The JV specification for mackerel would give fishermen options. The framework measures proposed in Amendment 8 would have been useful in extending the *Illex* season this year, therefore he favors the framework mechanism being proposed. He was very dismayed that under the description of fishing communities section that the ports of Montauk and Shinnecock were not included or described in the document. Why were they left out? How can this analysis be complete without a complete description of the New York fishing ports? He was opposed to the restriction on vessel size in the Atlantic mackerel fishery.

Comments on Amendment 12 to the Summer flounder, Scup and Black sea bass FMP

Albert Lindroth, stated that the economic impact analysis of the party/charter boat fleet was not adequate. He attended a meeting in Ocean City, MD where he was assured that there would be minimal economic impact on the party/charter fleet fishing for black sea bass. But his business is down 26% in June and 16% in July. This is an economic impact. At the same time VA boats are catching 2,000-3,000 fish per tow while we are closed. Pot fishermen are also catching fish, they are allowed to continue to fish. Seven boats along the east coast are taking the hit from this closure. The Council did not have their facts on economic impact, the two week closure cost him 26% of his business even though the weather was good. Why wasn't the economic impact of this discussed?

Sarah Chassis, representing the Natural Resource Defense Council wanted to address some of the summer flounder issues. The NRDC will be commenting in writing on the other amendments. They are concerned that with the adoption of the current schedule the Council has failed to adhere to the plan. The summer flounder TAC for 1999 has less than a 5% chance of meeting the target for rebuilding. The resulting increase in fishing mortality jeopardizes the 10 year rebuilding plan. This Amendment does nothing to address this problem. Specific measures should be included in the amendment to meet the rebuilding schedule. The landing limits should have a significant chance of meeting the rebuilding goals. Measures need to be implemented to avoid recreational over-runs. The framework measures do not propose any specific measures. Also, better measures to deal with the discard issues in the fishery are needed. In terms of EFH, they support the 90% designation, perhaps 100% would be more appropriate. Habitat loss has been identified as a contributing factor in the decline of the summer flounder resource. They are troubled by the language that only the EEZ portions are EFH. The area designated as EFH should be 90% of the total habitat, state or federal. They also recommend that the data be made ecologically coherent. The area south of Cape Hatteras to Florida should be included. They support the inclusion of estuaries in the EFH designation. Also the small coastal bays and tidal streams should be included. Submerged aquatic vegetation is important and should be included. The amendment does a good job on non-fishing threats to habitat, but there is no proposal to address the impact of fishing on habitat.

Mike McCarron, F/V Jaime Elizabeth, sated that EFH is the up and coming issue. If fishermen were harming or destroying habitat, why do they return to the same areas of bottom year after year? He is very concerned about where we are going with this EFH issue. What about the mussel beds? If the Council is worried about habitat, how about the dredging of New York harbor?

John MCCormick, Capt. Lou Fleet, doesn't want any changes in the fluke regulations. It is getting harder and harder to catch fluke as it is. They won't be able to survive with stricter regulations. They can't survive with a minimum size greater than 15" or a bag limit less than 8 fish. He also wanted to comment on the MRFSS data. He has been fishing for over 20 years and not once has he ever seen a MRFSS interviewer at his dock. He strongly suggests that the logbook data they submit be used instead of the MRFSS data. In addition, future meetings should be held after 7:00 PM so those who fish for a living can attend.

Mike Barnett, Codfather Charters, wanted to reiterate what John said about the effect that these regulations have on communities. If the Council continues to tighten up the regulations on fluke, he will not be able to survive. He sends in his reports. There should be a better evaluation of the economic impact of the regulations. The same goes for sea bass and scup. They have taken all the hits they can on these species.

Fred Kieser, Scamp V, stated that the Council must take a better look at the economic impacts of these amendments. The port and community description does not even mention the party and charter boat fleet or tackle shops. How can the Council make decisions without the proper economic impact analysis? With respect to sea bass, originally the last two weeks were supposed to be closed. Then is was changed to the first two weeks. People booked charters based on the original information. He had to cancel the charters because it wouldn't be fair to his customers. He needs to book his charters at least 6 weeks in advance. He urged the Council to adopt a management strategy and to stick with it. Don't change at the last minute, that cost him a lot of money. He is absolutely opposed to the framework process or changing the regulations in mid-stream.

Nick Manzari, Captree Boatman's Association, was concerned that in the economic analysis section, the party/charter boat industry is not even mentioned. He feels that summer flounder fishery is the brightest part of the industry, but the industry needs consistency. He is opposed to changing the minimum size limit. He feels that the hooking mortality estimate currently being used is too high. He wants the Council to look at seasons or go to a larger hook size.

George Bartenbach, Captree Boatman's Association, stated that the party/charter boat industry can't be cut back any more. The 15 inch size limit and 8 fish bag limit is enough. The season is getting shorter and they are at their limits with the current regulations. He wants consistency in the regulations.

John Robinson, party boat *Rosie*, stated that they need the 15" size and 8 fish possession limits. If you increase the size limit, you will only increase discards. If you decease the bag limit, his customers will limit out in an hour, then what are they supposed to do?

Patrick Gillen, Captain Gillen Fishing Corp., agrees with the other party/charter boat fishermen. He is opposed to the framework provision and thinks it would cause a hardship on his business.

Dave Aripotch, F/V *Cory and Leah*, noted that the SSB for fluke has increased seven fold. The F=0.33 is probably too restrictive. The fluke stock is rebuilding, the fishery is now in the NMFS kill and release program. National Standard 9 is not addressed in the Amendment. The FMP regulations are causing discards and the amendment does not address the problem. There are hooking discards, page 228 states that the discards are 7% in 1997 yet on another page it states they are 13.9%. Your own document is inconsistent relative to discards. The economic impact on communities is not described in the document. Montauk is the largest fishing port in the state of New York and they are not even listed in the port description section. How can the Council evaluate impacts on communities when the largest port in the state is not even listed? He is concerned about the NMFS policy with respect to aquaculture and fluke, they are backing it. On page 144 he disagrees with the statement that fluke are still over-exploited. The document states that F declined to 0.61 in 1997, which is proof that the stock is rebuilding. The SSB has increased seven fold in six years, how can the stock be over-exploited? On page 149, the document specifies recreational logbooks, does the Council mean party/charter logbooks? The document also states that the FMP may have had some impacts. The Council does not want to face the fact that they are killing us. He is sick of throwing over dead fluke. On page 218 there is a description of the impact of fishing gear. What are unknown gear types, and how can the Council conclude that there are no expected impacts if they do not even know what the gear types are? On page 204 there is a section that says that boulders were moved, how did they know this to be the case? That's horse shit. There is nothing in that section on fishing gear effects off of Long Island. There is nothing in there about hook and line fishing, you are singling out dragging gear. With respect to EFH, he favors halting all development in the coastal zone. The number of sportfishing boats should be reduced, they are polluting the water with their outboard motors but there is no mention of this in your document. The statement on page 154 "by maximizing the number of fish alive.." is false. The document also states that we are maintaining optimum yield, if this is so then we have already rebuilt the stock and we do not need quotas any more. This Amendment does not satisfy National standard 9, does the Council really believe that it does? On page 154, the last sentence is contradictory. Also, when the commercial fishery goes over their quota, the overage is deducted from the quota the next year. Why don't the same rules apply to the recreational fishery? If they go over their quota nothing happens. He favors the frame working procedure, it has proven to be useful in multi-species groundfish management in New England.

Dennis Kanyuk, noted that there has been a big increase in the fluke population, everyone knows this. Why does the Council want to increase the size limit. Common sense would tell you that the stock is rebuilt. Maybe we are already where we want to be. The Council is making management decisions , affecting peoples lives, using statistics that are old. There must be more fluke than you think. Don't change what you have going, it is working. There seem to be a tremendous number of fluke out there. The Council statistics must be off. The hook and line mortality assumption of 25% is way too high. He could live with an increase in hook size, but they can't live with any more regulations. With respect to EFH, he would like to see the Council ban the use of roller gear. He is concerned that the goals for stock rebuilding are unrealistic, where are you going to put all of these fish, what will they eat? He is opposed to inn season adjustments to the management measures. There is too long of a lag between the statistics and management actions, yet you make decisions that affect our livelihoods anyway. The fishery managers should take a pay cut when the fishermen have to. The meeting was held too early. Party/charter boat fishermen can't sell their fish, this is not fair. Why does the Council keep raising the size limit, every time you increase the size limit we land more bigger fish so the poundage goes up. We need to catch more fluke, not less. During the years that the recreational fishery was under their quota, why didn't we get any credit for that?

The hearing was closed at 8:30 PM.

CAPE MAY COURTHOUSE, NJ - SEPTEMBER 9, 1998

Hearing officer Bruce Freeman opened the hearing at 1810 hours. Seven individuals from the public were present. Council member Charlie Bergmann attended. Tom Hoff of MAFMC staff attended.

Comments on the Summer Flounder/Scup/Black Sea Bass FMP were received first.

Charlie Bergmann, speaking only for himself, provided several comments. There needs to be a better way for communicating with the public especially concerning acronyms. He is very uncomfortable with the overfishing definitions. There are not estimates of MSY as mandated in the law and the information is not timely. NMFS is not allowing the Council to do its job.

Daniel Cohen, Atlantic Capes Fisheries, supports the framework mechanisms since Plan changes take 2 years. These FMPs are pressured by time limits set by Congress and they are filled with lots of "guesses". He also questioned what the EFH impacts were to the commercial and recreational fishermen.

Paul Thompson stated he has lots of trouble understanding the acronyms. Recreational fishermen are better educated now than in the past, i.e. they are releasing small female black sea bass.

Comments were then received on the Atlantic Mackerel/Squid/Butterfish FMP.

Charlie Bergmann is in total support of restrictions on limitations. He supports attempts to control the overcapitalization of the fishery. He questions the surplus production model for *Illex*. There are problems with vessels being under artificial constraints which may affect effort. Several ports were under trip limits. The assessment used port agent intercepts rather than logbooks. He can not contemplate using overfishing definitions since analyses are flawed because of effort being artificially constrained. We should have more information on *Loligo* than we do on *Illex*. Landings of *Illex* in the 1970s were 150,000 mts and levels now should not be limited to only 18,000 mt. He would like NMFS to somehow use the information on the location of the Gulf Stream in the next assessments.

Dan Cohen, stated that the scientific guesses for *Illex* are now impacting the fishery. He requested the Council request an *Illex* assessment for December. He also requested the Council schedule two framework meetings for February and March for *Illex* quota changes. The Council has chosen 75% and he suggests that we use 100% for next year, to close the directed fishery. He knows the issues can be frameworked. The 75% is not required by law and therefore we can use 100%, especially if there is no new SARC.

Finally the third set of comments were taken on the Surfclam/Ocean Quahog FMP.

Eric Powell, Rutgers University, feels strongly that industry and academics should have been involved in the proposed overfishing definitions. For surfclams the Fpo, replacement fishing mortality, worked well in the calculations for the first year. It is an excellent approach, but we should not codify a model with only one year worth of data. The production model is not appropriate for overfishing definition because we may need to overfish Delmarva. We may need to reduce Delmarva by 1/4 to ½ of biomass to maximize the productivity. He suggested we use other F measures for surfclams like F0.1 for overfishing, while recognizing that the quota will be set with the production model. He proposes a one day meeting at Woods Hole of the Invertebrate Subcommittee to develop different overfishing definitions for surfclams. He will provide written comments before the close of the comment period on the 25th.

James Roussos, Cape May Foods, opposes the overfishing definition being associated with Northern New Jersey (NNJ). He does not believe the health of Delmarva surfclams should be tied to NNJ. The big end users perceive the clam industry as a dead one. Industry is too constrained. Any increase in the quota will be a positive signal to the industry users. He questions industry for product development and the time needed. He wants to see a growing industry. Currently the market is weak for surfclams.

Dan Cohen spoke about the precedent of management throughout the range as opposed to localized overfishing in the NNJ area. He spoke in favor of area management. He would like to see the Council/industry develop a process of orderly growth for the next five years.

Finally, a call for any additional comments produced a few.

Dan Axelsson, H & L Axelsson, Inc., spoke to *Illex*. It was a good year for *Illex*. Most of the landings were made by 20 boats. *Illex* quota has always been too low. Low catch because of low effort. 1998 was a high effort year. Most of the catch was made by RSW boats. He feels the quota can be increased because the amount of fishing at the edge of the Gulf Stream can be increased. The quota can be increased to at least 30,000 mt. We could move the start date for the fishery back to 10 - 20 June.

Charlie Bergmann said that 96% of the June landings in Cape May were *Illex.*

Dan Cohen wants all annual specifications to be frameworkable, especially ABC.

Mr. Freeman closed the hearing at 1955.

OCEAN CITY, MD - SEPTEMBER 9, 1998

Hearing Officer Mr. Ricks Savage called the hearing to order at 6:00 p.m. Others present were Mr. José Montanez and Ms. Valerie Whalon of the MAFMC staff who prepared the summary minutes. There were ten members of the public present.

Mr. Savage presented the opening remarks and opened the hearing for questions and comments on summer flounder, scup, and black sea bass amendment.

Mr. Joe O'Hara (MD Saltwater Sportfishing Association) gave comments on the summer flounder scup and black sea bass amendment. He opened by saying that the figures are not legible and the entire amendment does nothing to reduce mortality, because it doesn't have clout. He raised concerns with proposed conservation measures. He referred to page 68 where it says that SAV beds are designated as a habitat area of particular concern, but he wants to know what is going to be done to protect SAV. More specifically he is concerned with enforcement issues as they relate to protected areas. How will this be done? He used the state of Maryland as an example, they tried to protect SAV beds, but didn't have enough money to mark them. He stated that we will not be able protect SAV without some enforcement, because there is no clout to protect SAV. He strongly supports the effort to protect SAV, but wants to know what the point of having the definition is? What is going to do be done to protect SAV? He also referenced p. 104 where it states that beach nourishment should not be allowed when fish (summer flounder) are present. He says that it is not possible to abide by this because beaches can't be nourished the in the winter when it is stormy. He referenced p. 77 and would like to see the Council look towards compensatory mitigation to solve this problem. For example, put a percentage of the cost of a beach nourishment project into artificial reef construction. He disagrees with the statement on p. 149 that states that the minimum mesh provision in conjunction with the minimum fish size ensures that discards of sub-legal fish are minimized, and on p. 136 37% of the discards will be fish that could be brought to market, the Council should look at their own data, they are increasing discards by throwing 14" fish overboard. He disagrees with the 5th paragraph on p. 150 where it state the economy is not affected negatively by the recreational measure. He stated that they (recreational head boat fishermen) lost 2 weeks of the season in August (when they couldn't fish for black sea bass), it is an economic loss, and needs to be addressed. He disagrees with the statement on p. 152, he does not think that the species mentioned at the bottom of p. 152 has been graded for price, he thinks the council should look at using management measures combining quotas and trip limits. He disagrees with the last sentence on p. 154 that everything has been done to alleviate bycatch, and National Standard 9 is satisfied or has been met, and on p. 153 that a mesh reduction to 5 ½ in. will reduce discards. He does not think that the mesh regulations that changed in June 1998 helped in reducing summer flounder discards. The Council should be studying mesh selectivity to minimize discards. He said that lack of discard data has hampered the ability (of the Council and Commission) to respond to potential discard problems in the commercial fisheries. If this is true, then how can the Council say that National Standard 9 has been met. He agrees with the public education program on catch and release but how will it be implemented. On p.75 he feels that the following should be added to the frameworked provisions: management measures?......that affect EFH?... and measures for conservation and enhancement of EFH, sale of fish, and conservation equivalency by state. He said that comments were specifically requested on research recommendation and suggested the following research: length/frequency studies by statistical areas , net/mesh selectivity (he said we didn't do them before and now the nets are bought and it should have been done in the other order), area closures during summer flounder spawning, and bycatch for all three species.

Mr. Monty Hawkins, a recreation head boat owner stated that the black sea bass moratorium didn't kill his business because luckily the croaker showed up. We're lucky that black sea bass aren't totally collapsed. Scuba divers told him that the water temperature at the bottom is extremely cold (maybe that is why there are so few black sea bass?). He thinks that someone somewhere else had a good year with black sea bass. He feels that conservation measures for black sea bass are needed. He agrees with EFH and he hopes that part of the plan keeps moving forward.

Mr. Robert Gouar of Ocean City Fishing Center suggested that the Council needs a limit on black sea bass. He stated that the north didn't have black sea bass either. He went on to say that a closure is not as good as a limit. He said that the winter trips are where they (the north) are being carried, and they also need them (black sea bass) in May, but a limit is needed instead of a closure.

Mr. Savage called for comments and questions on the mackerel, squid, and butterfish amendment.

Mr. Monty Hawkins stated that since the Atlantic mackerel collapse in 1991, since joint ventures and it has been brutal ever since, from a hey day to how it is now where he can't get people here (to fish for them). The Council should let them rebuild.

Robert Gouar stated that they tried to have a factory trawler in Cape May last year, but it got knocked down.

Mr. Savage called for comments and questions on the surfclam and ocean quahog amendment.

Mr. Wally Gordon felt that some issues needed definition, for instance, "There was minimum short-term economic dislocation to whom?" (he feels his company was economically dislocated). He feels his company has been affected economically (adversely) by the Council's actions. He doesn't think the resource should be managed by economics within the industry itself, it should be managed for economic stabilization of the clam or any species where there is not a fresh market. Clams sitting at a dock without a processor are worth nothing. He would like to see the Council to get out from between the harvester and processor, to let them work together. He wants to see it managed from the point where the harvesters and processors can put the clams in the freezer or can and market it to the best of their ability. Managing for the of good of NJ is not for the good of all. The resource should be managed throughout the range of the species. He goes on to say that 70% of the surfclams haven't been from Ocean City, Maryland in the last 6 or 7 years. These clams need to be caught so they can be productive. The quota can't be based on what New Jersey is catching. He reiterates that clams need to be managed by area and something needs to be done to thin out the small clams in this area. Historically these clams have been as productive as the clams in New Jersey. They should be managed by area.

Mr. Bill Meadows stated the overfishing definition addresses only surfclams offshore of NJ although the management unit is the entire EEZ. The quota should reflect the desire to shift the fishing pressure. He supports the concept of not changing the quota at any time during the year, (either increase or decrease it).

Mr. Tom Alspach asked a question about the proposed overfishing definition, is the NNJ target area in which the overfishing definition is based on in equilibrium? He asked if NNJ becomes overfished, will the entire EEZ be closed? Mr. Alspach also wanted to know what NNJ is (e.g., geographic definition), he could not find a definition in the plan. Is Mr. Montanez replied that he didn't know and he would have Dr. Hoff answer those questions for him. He is concerned that the overfishing definition concept is being grossly misused to achieve a policy issue to keep fishing down in New Jersey. He also feels that prudent quotas at the current landings should be sustainable. If they want to address a problem in NNJ they should produce management measures in this area. The overfishing definition is an effort to undo a managed unit as a whole, it is not a proper way to apply a concept throughout the EEZ. He feels that to use NNJ as a target is a gross misuse of the concept of an overfishing definition.

Mr. Hawkins stated the he can't buy surfclams as bait and wanted to know what they do with the shells. Mr. Gordon replied that at Chincoteague they mix crushed shell with pine pitch for roads, and some places they market the shells for landscaping and driveways, however some places you have to pay to have them hauled away. Mr. Hawkins stated that it seems that the Artificial Reef programs could work out a deal where the costs of shipping surfclam shells for artificial reefs could be a tax write off. He hopes that the bottom area is assessed and it seems that the plan is moving in that direction. Mr. Savage and Mr. Gordon explained to Mr. Hawkins why he can't buy surfclams for bait.

Mr. Tom Alspach stated that under the current assessment, the production model showed that NNJ was at equilibrium or slightly positive. He asked if the model went to negative numbers does it mean NNJ is overfished and therefore the entire resource overfished, and how would that be affected by changing natural mortality.

Mr. Bill Meadows stated that the overfishing definition applied to specific definition assuming we had a definition that would be definite. He asked, if the overfishing definition was tied to a specific area and fishing pressure shifted to another area like Delmarva, could Delmarva area be harvested? Mr. Montanez stated that he didn't know and that he would have Dr. Hoff answer that question. He states that this is the kind of concern he has going to a specific area for an overfishing definition. He stated that an overfishing definition over the entire EEZ should be established. He thinks that the yield from the Delmarva area or region is lower, a strategy is needed or a management scheme to get harvesters to go to Delmarva. It will relieve a lot of pressure off of NNJ.

Mr. Wally Gordon stated that a processor has to encourage harvesters to go to NJ because of the ITQ system. The whole reason the clams are small is because the area was closed.

Mr. John Bundy from Miss Ocean City (party boat) stated that this year was one of the worse years for black sea bass. He doesn't know why. He thinks that the two week closure is very bad and hurt all the party boats in Ocean City. There needed to be enforcement and the marine police can't do it all. There are boats keeping less than 10 in. fish and no enforcement officers are around to enforce the laws. It took place during the busiest part of the season and he's really mad about it. There are better ways to limit catch. He would like to see the size limit stay at 10" and he would rather see a bag limit than a closure. He said he threw back 75% undersized fish and that still wasn't enough fish.

Mr. Hawkins said that boats were fishing in bad weather offshore for hake because of the closure.

The hearing was closed at 7:45 p.m.

APPENDIX 2. COMMENT LETTERS AND COUNCIL RESPONSE

A total of 11 comment letters were received by the Council on the hearing draft of Amendment 12 for Summer Flounder/Scup/Black Sea Bass. One letter was submitted by four different individuals; two letters came from national agencies; one letter represented a miscellaneous interested party; one letter came from a fisherman, and one letter represented a state agency. Two letters were also received from state agencies, which the Council requested.

Comment 1: One respondent advocated the inclusion of management measures to control the use of bottom gear because general data have shown the damage caused by this gear, even if there are no data that specifically show this for summer flounder, scup, and black sea bass. Another commenter stated that dredges destroy sea bottom, as well as other fishing gear, and is a greater threat than pots.

According to section 600.815 (a)(3) Councils must act to prevent, mitigate, or minimize adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH. Evidence of various gear impacts on bottom in the Mid-Atlantic region has been presented to the Council over the past several years. It is because of this anecdotal information that the Council is considering that all mobile gear coming into contact with the seafloor within EFH is characterized as having a potential impact on their EFH. However, the effort of these bottom tending gears is largely unquantified from data that are presently collected by the NEFSC as summarized by Auster and Langton (1998) and therefore no management measures will be proposed at this time.

The requirement concerning gear impact management is to the extent practicable given the evidence that the fishing practice is having an identifiable adverse effect. The Council feels strongly that very little evidence was provided in the synthesis document of Auster and Langton (1998) relative to identifiable adverse effects to EFH in FMPs managed by this Council at this time. Fishing gear impacts along with the description and identification of EFH are frameworked management measures which can easily and readily be changed as more information becomes available. The Council's Habitat Monitoring Committee should be meeting annually and can provide recommendations concerning gear impacts that NMFS and the Council can act on in the future. The Council feels it would be premature, given the lack of identifiable adverse effects of gear impacts to these managed species EFH, to propose gear management measures at this time. It is simply not practicable to impose unwarranted management measures that are unjustifiable. The Council will consider implementing management measures to protect EFH if and when adverse gear impacts are identified.

Comment 2: One respondent stated that the framework adjustment procedure will not give fisherman enough time to plan for the changes or find other sources of income.

The framework adjustment procedure detailed in the amendment would allow the Council to modify or add management measures using a streamlined public review process. The procedure would be used by the Council under special circumstances and would not replace the amendment process that is currently used to make major modifications to the plan. The framework adjustment procedure allows for a somewhat faster process compared to an amendment but would not result in an immediate change to a regulation, i.e., it would be a number of months after the public was notified of a possible change before it was actually implemented.

Comment 3: Two commenters felt that the problems of discard mortality and bycatch are severely understated by this Amendment (especially in terms of the scup discards resulting from the squid

fishery) and advocated the addition of strong measures to end them.

The Council and Commission disagree. The public hearing draft contained analyses which indicated the amount of discards associated with commercial and recreational fisheries for summer flounder, scup, and black sea bass. Additional analyses have been conducted by Council staff prior to the submission of the amendment to more fully detail bycatch in these fisheries. These data are fully described in section 3.4.9 of this amendment.

The discard data for summer flounder, scup, and black sea bass are limited and/or contradictory. Extrapolated estimates of discards from sea sample data indicate that 10% or less of the summer flounder and black sea bass catch was discarded in 1996 and 1997. Estimates of scup discards were 36% and 45% for 1996 and 1997, respectively. However, these estimates are based on samples that are limited in their temporal or geographical scope. In addtion, these estimates differ significantly from estimates derived from VTR data which indicate discard estimates are minimal for all three species, i.e., less than 3%.

The nature of the data make it difficult to develop any definitive or reliable conclusions about discards for these fisheries especially during the periods or in areas where sea sampling has not occurred. As such, it is difficult for the Council and Commission to modify or add management measures to further minimize discards if the data are not available to define the nature and scope of the discard problem or the data indicate that a discard problem does not exist. Once the nature of the problem is more fully identified, the Council and Commission can respond to discard problems by changes in mesh, threshold and minimum size regulations or by implementing season and area closures in response to changes in fishermen behavior or an increased level of discards. In addition, the framework adjustment procedure proposed in this amendment will for additional flexibility so that the Council and Commission can respond more quickly to changes in the fishery through the implementation of new management measures or the modification of existing measures.

Comment 4: One respondent suggested that the proxy value for biomass threshold should be some minimum value rather than a maximum value for scup.

The overfishing definition for scup establishes a minimum biomass threshold based on a proxy. The proxy is the maximum value of the spring survey index based on a three year moving average. As such, the scup stock would be declared overfished if the survey value fell below this minimum biomass threshold.

Comment 5: Five commenters stated that the Amendment should introduce additional measures for the rebuilding of the summer flounder stock because the measures currently in place are not aggressive enough to increase the stock in the time allotted by the Sustainable Fisheries Act. Specific suggestions included: a) that the quotas have an 80% chance of achieving the target fishing mortality; b) the establishment of state by state quotas to prevent recreational overfishing; and c) that measures be included to reduce bycatch and fish mortality in both the commercial and recreational fisheries.

The Council and Commission disagree. Projections conducted for SAW-25 indicate that the stock can rebuild to the B_{msy} level in ten years under the current rate reduction schedule. However, the Council and Commission annually review the status of the summer flounder resource and can modify existing management measures to reduce mortality of summer flounder through this annual process or through the framework adjustment process detailed in this amendment. These specific suggestions for modification can be considered as part of these processes.

Comment 6: One respondent advocated the expansion of EFH to include 100% of the area where summer flounder were found including nearshore coastal waters.

The Council chose the preferred alternative to be the highest 90% of the area because it is the most inclusive and thus the most risk-averse, without going to 100% of the distribution for these overfished resources. The Council did chose 100% of the estuaries where summer flounder have been collected for both the larvae and juvenile stages because as stated in Able and Kaiser (1994) these life stages of summer flounder are "estuarine dependent". It is not obvious from the summary documents produced by NMFS that for the other species/life stages identified in this FMP that there is dependence on a specific habitat type.

Comment 7: One commenter suggested some adjustments to the grouping and labeling of New York State waters in the habitat section (text and tables) of the Amendment.

The Council and Commission agree and the staff has made these suggested changes to the FMP.

Comment 8: Two respondents stated that EFH for waters around Massachusetts should be modified and expanded.

EFH now includes any ten-minute squares that were identified as such on the blank maps that were in the FMP. Comments from individuals that identified EFH in general terms or without any documentation will be supplied to the Habitat Monitoring Committee for their future consideration. It is anticipated that as the various state surveys are compiled in a uniform format by the NEFSC researchers at the Howard Laboratory at Sandy Hook the Habitat Monitoring Committee will be reviewing and perhaps recommending new identification and description of EFH.

Comment 9: One commenter felt that the Amendment is too broad and oversteps the authority congressionally granted to NMFS and the Councils, especially regarding: (a) the EFH definitions which go beyond waters that are "essential" and "necessary" to the species as intended by the Magnuson-Stevens Act and the SFA; (b) that NMFS and the Council have authority to manage fisheries only, and the Amendment transgresses that authority by including non-fishery related measures; and (c) that NMFS and the Council have no authority to extend EFH or any management measures to state managed, inland waters, and that the Amendment should not attempt to include those areas.

The Council disagrees with this commenter's beliefs that this Amendment represents a clear departure from the letter of the MSFCMA and the intent of Congress. The Congressional mandate was clear and NMFS has interpreted that mandate and proposed regulations. During the comment period on the EFH regulations, these types of comments should have been raised. Many similar issues were raised during the comment period on the proposed regulations and were addressed by NMFS. The Council is simply working within the NMFS EFH regulations in the identification and description of EFH. Clearly the Congress wanted the NMFS and Councils to have authority of EFH and not simply propagate rules that reduce fishing mortality only.

Comment 10: One respondent stated that the section on Silviculture NPS (section 2.2.5.3.3) does not contain a balanced presentation of data and does not show in what way silviculture activities affect summer flounder, scup, or black sea bass EFH. Specific objections cover the following points: (a) many of the conservation measures in this section are included in state BMP (best management practices) manuals and do not need to be restated with slight variations in the Amendment; (b) guidelines on road construction have no baselines and are too vague; (c) the statements regarding harvesting contain no objective guidelines or standards; (d) that the

Amendment cannot enforce water quality standards and should instead defer to the existing guidelines in state programs; and (e) that the comments regarding restoration of upland habitat are too vague and not within the intended jurisdiction of EFH.

The Council agrees completely with this commenter's premise that best management practices should be used for all silvicultural NPS issues. All of the description and discussion of silvicultural problems were taken from NMFS (USDC 1997a) and EPA (USEPA 1993) documents. The Council is not proposing any recommendations that are not BMPs as considered by EPA in their *Guidance Specifying Management Measures for Sources on Nonpoint Pollution in Coastal Waters*. The series of recommendations that were attributed to Murphy (1995) have been dropped since they were somewhat duplicative of the EPA recommendations.

Comment 11: One respondent suggest that the 10 minute squares be adjusted so that quadrants not designated as EFH, but surrounded by others that are so designated, be included in EFH.

The designation of EFH now includes any ten-minute squares that were identified as such on the blank maps that were in the FMP as well as all ten-minute squares identified by the various federal surveys that meet the selection criteria . Comments from individuals that identified EFH in general terms or without any documentation will be supplied to the Habitat Monitoring Committee for their consideration. It is anticipated that as the various state surveys are compiled in a uniform format by the researchers at the Howard Laboratory at Sandy Hook the Habitat Monitoring Committee will be reviewing and perhaps recommending new identification and description of EFH. The identification of all ten-minute squares as EFH required data documentation for this initial process.

Comment 12: One commenter supported the inclusion of submerged aquatic vegetation (SAV) as summer flounder EFH.

Section 2.2.2.2.1 identifies habitat areas of particular concern (HAPC) for this FMP and it includes SAV for summer flounder. In the mid-Atlantic area nearly all SAV beds occur in state waters. ASMFC in October 1998 held a conference to develop recommendations to minimize fishing gear impacts to SAV beds. The MAFMC eagerly awaits the results of that conference and anticipates forwarding that report to the Habitat Monitoring Committee for their future recommendations.

Comment 13: One respondent stated that it should be clarified that EFH will include some state waters.

The Council and Commission agree. Clarification of the identification of EFH in state waters has occurred throughout the document after the public hearing draft. Section 2.2.2.2 clearly identifies EFH for each species and life stage that occurs within inshore waters. Figures also identify EFH in state waters.

Comment 14: One commenter felt that all sea floor structural elements should be included in EFH and classified as habitat area of particular concern (HAPC) for black sea bass.

The Council chose not to identify any HAPC for black sea bass at this time. HAPC is a frameworked measure that can be added as new science and information is developed. The Council simply felt that with the synthesis background information developed by the NEFSC, that management measures were not supportable presently.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

September 4, 1998

Christopher M. Moore, Ph.D.
Acting Executive Director
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Dr. Moore:

Enclosed please find the National Marine Fisheries Service's draft recommendations to the Mid-Atlantic Fishery Management Council regarding essential fish habitat (EFH) for summer flounder, scup, black sea bass, surf clams, ocean quahogs, Atlantic mackerel, *Lolligo* and *Illex* squid, and butterfish. Section 305(b)(1)(B) of the Magnuson-Stevens Act requires the Secretary of Commerce to provide recommendations and information to the Council regarding the identification of EFH, threats to EFH, and conservation and enhancement measures to protect EFH. The interim final rule for EFH, 50 CFR 600.815(c), requires NMFS to make its draft EFH recommendations available for public review prior to submitting final EFH recommendations to the Council. To facilitate this public review, I request that you make our recommendations available at the Council's public hearings on the fishery management plan amendments scheduled for September 8-9, 1998. NMFS will provide the Council with final EFH recommendations shortly after the public hearings are complete.

NMFS has also revised tables of the life history and habitat parameters for several of the species, which we will transmit to your staff under separate cover along with technical corrections and editorial suggestions on the EFH information for these species.

As you know, the Congressionally mandated schedule for developing EFH sections of fishery management plans was extremely short. With these initial EFH designations the Council has made a solid start at identifying EFH and potential threats. We look forward to working with you to build upon this work in the coming months. Should you have any questions about our draft EFH recommendations, please contact Jon Kurland of my staff at 978-281-9204.

Sincerely,

Jon C. Rittgers
Acting Regional Administrator

Enclosure

National Marine Fisheries Service Draft Essential Fish Habitat Recommendations to the Mid-Atlantic Fishery Management Council for Summer Flounder, Scup, Black Sea Bass, Surf Clams, Ocean Quahogs, Atlantic Mackerel, *Loligo* and *Illex* Squid, and Butterfish

Background

Section 305(b)(1)(B) of the Magnuson-Stevens Fishery Conservation and Management Act requires the Secretary of Commerce to provide recommendations and information to the Council regarding the identification of essential fish habitat (EFH), threats to EFH, and conservation and enhancement measures to protect EFH. The National Marine Fisheries Service (NMFS) has provided substantial background information to assist in the development of the EFH portion of the fishery management plans (FMPs) for summer flounder, scup, and black sea bass; surf clams and ocean quahogs; and Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish. NMFS prepared a synthesis report of the life history and habitat requirements of each species, which reviews the relevant scientific literature and includes summaries of data on the species' distribution and relative abundance. NMFS also prepared maps and graphs showing the distribution and relative abundance for each major life history stage, and analyzed these data by ranked ten minute squares of latitude and longitude to show the areas that yielded the highest catches per unit of sampling effort. Additionally, NMFS provided the Council with maps of the relative abundance of most of these species in estuaries, based on NOAA's Estuarine Living Marine Resources data set. During numerous meetings, NMFS staff discussed these information sources with Council staff and the Council's Habitat Committee and offered guidance and assistance in the designation of EFH.

To supplement the above information, NMFS prepared the following draft EFH recommendations based on a review of the August 21, 1998 public hearing drafts of Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP; Amendment 12 to the Surf Clam and Ocean Quahog FMP; and Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP. The recommendations are organized into four separate sections: one for issues that apply to all three FMPs and one for additional specific comments on each of the three FMPs individually.

Recommendations that Apply to All Three FMP Amendments

1. <u>Clarify the description and identification of EFH so users of this information can determine the geographic limits of EFH designations.</u>

   (a) The maps of EFH in offshore areas are extremely difficult to read and understand. The final amendments should use larger format maps (e.g., one map per page instead of four for the preferred alternatives) and should include captions that explain that the shaded 10-minute squares are EFH. Also, the final maps should not show any EFH in waters beyond the U.S. exclusive economic zone.

(b) Since the Council is designating EFH in estuaries based on the relative abundance of the animals within the three salinity zones (seawater, mixing, and freshwater) used in the Estuarine Living Marine Resources data set, the final amendments should include maps of the salinity zones for each estuary. These maps are available from NMFS if the Council does not have them already. This information is necessary so that readers can understand the delineation of EFH in estuaries.

(c) If the maps identifying EFH and the text description of EFH differ, the text description is ultimately determinative of the limits of EFH (50 CFR Part 600.815(a)(2)(iii)). Therefore, to avoid any such inconsistencies, the text descriptions of EFH in the final amendments should reference and incorporate the tables and maps of estuaries that are considered EFH, as well as the maps of offshore areas that are considered EFH.

(d) The text descriptions of EFH north of Cape Hatteras should be modified to reflect that EFH is those areas that support the highest density or relative abundance of the managed species, as indicated by the highest X% of catch per unit effort based on an analysis of available survey data. Some of the EFH designations reflect a percentage of area (e.g., a 90% designation represents the top 90% of all the ranked squares) and some reflect a percentage of catch (e.g., a 90% designation represents the highest ranked 10-minute squares that comprise 90% of the catch), but both methods of EFH designation are premised on the assumption that high relative abundance indicates high value habitat. As currently written, it is not clear what the percentages in the EFH descriptions represent.

(e) In all three draft amendments, the first paragraph in Section 2.2.2.2 (i.e., the paragraph immediately preceding the text description of EFH) provides a brief narrative that explains the "general" characteristics of EFH for the managed species. This portion of the documents is confusing because it contains an incomplete summary of the written descriptions of EFH that appear below it. It also conflicts with the text descriptions of EFH by stating that the portions of the EFH designations that are based on the survey data are limited to "those areas in federal waters" that meet certain specifications, whereas the survey data and supporting maps include many areas in nearshore state waters. This paragraph should be deleted from the final amendments to avoid confusion over which section is the correct description of the limits of EFH.

2. Refine the discussion of the methodology used to designate EFH.

(a) Sections 2.2.2.1.2 and 2.2.2.1.3 of all three draft amendments discuss options for designating EFH based on the "objective criteria" approach. This approach appears objective because it uses numeric cutoffs, but actually it is subjective for two reasons: 1) the cutoffs could well have been 40%, 60%, 80%, and 100% rather than 50%, 75%, 90%, and 100%, and 2) the choice of one particular cutoff for designating EFH is based on the best professional judgements of the people involved; there is no *a priori* reason to choose 50% over 75%, or 90% over 50%. The final amendments should clarify that these thresholds were subjective, but they reflect a reasonable range of designation alternatives.

(b) Section 2.2.2.1.3 of the draft amendments states that "The Level 2 data that are summarized in the ten minute square maps came from the MARMAP ichthyoplankton and/or NEFSC trawl survey. Data were assigned to a ten minute square based on the location of the dredge tow sample. Only those squares that had more than four samples and one positive catch were selected." The last sentence of this passage should read "Only those squares that had more than three samples and one positive catch..." The words "dredge tow" should be deleted since the samples from the various data sets involved dredge tows for the bivalves, trawl tows for fish, and bongo nets for ichthyoplankton.

(c) In the discussion of limitations in Section 2.2.2.1.3, the text states that "The NEFSC trawl survey does not survey everywhere...and thus this analyzes (sic) is constrained and significantly biased low." In fact, it is plausible that the area occupied by the species could be significantly overestimated (i.e., biased high) by the 10-minute square analysis. For example, if the species only occurred at depths of 10-75 m, the 10-minute squares where the species occurred could contain a high proportion of area >75 m deep. The NEFSC survey does not sample everywhere, but once the data are cast into 10-minute squares, without further analyses we do not know if there is bias or its direction.

(d) The same section (2.2.2.1.3) of the draft amendments states that the Council's selected approach for designating EFH is "fraught with limitations and based on major assumptions." While it is appropriate to acknowledge the shortcomings of the selected approach, the final amendments should emphasize that this methodology was adopted by the Council because the Council (presumably) determined that it was the best technique available, despite the limitations. Also, the statement that "None of the [state] surveys collect the habitat information that is most needed (habitat type, substrate...)" is not accurate. For example, the Long Island Sound survey has substrate maps.

3. <u>Revise the discussions of threats from fishing and non-fishing activities to be more specific to the species addressed in each FMP.</u>

(a) The discussion of fishing-related threats in Section 2.2.3 of the draft amendments borrows extensively from the Auster & Langton report, but without tailoring the Auster & Langton text to make it pertinent to the species or gears used in these fisheries. It would be far more effective for the discussion of fishing-related threats in each amendment to focus on the fishing activities that may affect the species in the fishery management unit, as well as the gears used in the fishery that is covered by the FMP. For instance, most of the discussion in Section 2.2.3 of the draft surf clam and ocean quahog amendment does not relate directly to the habitat of those species.

(b) The discussion of non-fishing threats and associated conservation and enhancement measures in Section 2.2.5 of the draft amendments lists a variety of concerns, but most of these are generalized and do not apply specifically to the EFH of species covered in each FMP. The final amendments should highlight the connection between the identified threats and their effect on the managed species' EFH. The documents should explain the relevance of the threat to the managed species and discuss how the suggested conservation measures benefit the managed species. For example, dam construction for reservoir development is not a threat for surf clams or ocean quahogs (Section 2.2.5.2.1), nor are hydropower plants (Section 2.2.5.5.1). The recommendation to avoid dredging or dredge spoil placement in submerged aquatic vegetation appears in the draft mackerel, squid, and butterfish amendment (Section 2.2.5.4) despite the assertion earlier in the document that these species have no strong association to that habitat type (Section 2.2.3.8). The recommendation for the fishing industry to familiarize itself with the potential of sea level rise (Section 2.2.5.14.5) is not germane to EFH at all. Section 2.2.5 of all three amendments should be substantially edited and revised to be more relevant to the species managed in each FMP.

4. The amendments should explain how they meet the requirement to minimize to the extent practicable the adverse effects of fishing on EFH.

   (a) The draft amendments do not explain how they address the Sustainable Fisheries Act requirement to minimize the effects of fishing on EFH to the extent practicable. Section 2.2.4 of all three draft amendments states that all mobile gear coming into contact with the sea floor has a potential impact on EFH, but the amount of fishing effort is unquantified "and therefore no management measures will be proposed at this time." However, according to 50 CFR Part 600.815(a)(3)(iii), "Councils must act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH..."

   (b) The final amendments should specifically address whether fishing activities are having an identifiable adverse effect, and if so, what management measures serve to alleviate the impacts. For example, for EFH for adult mackerel, squid, and butterfish, it may be reasonable to conclude that gear management measures are unwarranted because the species are pelagic and do not exhibit strong associations to physical habitat features, but *Loligo* eggs are laid on the bottom in clusters, so Section 2.2.3.8 should indicate whether they may be affected by bottom-tending fishing gear. For surf clams and quahogs, information in Section 2.2.3.8 indicates that hydraulic clam dredges may affect EFH, but Section 2.2.4 does not discuss any existing or proposed management measures that address these effects. Likewise, Section 2.2.4 of the draft summer flounder, scup, and black sea bass amendment does not describe measures to minimize the effects of fishing on EFH, even though Section 2.2.3 discusses potential threats to EFH from fishing. Although submerged aquatic vegetation is proposed as a Habitat Area of Particular Concern (HAPC) for summer flounder, the draft amendment does not discuss impacts to seagrass from fishing gear.

   (c) All three of the final amendments should include a discussion of options for managing the effects of fishing on EFH, including existing management measures that limit effort and may indirectly protect habitat. The final amendments should also explain the strategy and approach the Council intends to use to address this issue over time. The Council is only required to adopt management measures that are practicable, based on the criteria in 50 CFR Part 600.815(a)(3)(iv), but the draft amendments do not indicate whether the Council has determined that existing measures are the only steps that are currently practicable.

5. <u>The amendments should explain why the Council is not proposing to designate any areas as HAPC for most of the species.</u> Section 2.2.2.1 of the three draft amendments states that the Council is not recommending any areas as HAPC at this time (except for summer flounder), but does not provide a rationale. The final amendment should explain why (e.g., if the Council determined that available information for the species is inadequate to justify HAPC designations).

6. <u>The framework adjustment process should include HAPC.</u> The list of management measures that could be implemented or modified through framework adjustment procedures (Section 3.1.1) should include the designation of HAPC, which would give the Council flexibility to establish or modify HAPC designations as supporting information becomes available.

7. <u>The final version of the amendments should be edited thoroughly.</u> Despite the limited amount of time available to comply with the Sustainable Fisheries Act requirements, the Council has amassed a tremendous amount of information in the EFH sections of the draft amendments and has made a solid start at identifying EFH and potential threats. The final amendments could be strengthened considerably by editing the EFH sections to remove superfluous material, correct typographical errors, and clarify the tables and figures. As noted above, some of the material in the non-fishing threats sections (2.2.5) is not germane to the species managed by each FMP, and the maps of offshore EFH for all species are very difficult to read. Also, the lists of EFH research recommendations in Section 2.2.7 are too exhaustive and could be shortened by excluding items such as Stock Assessment Review Committee research recommendations that have very little to do with habitat, even indirectly.

Recommendations on EFH for the Summer Flounder, Scup, and Black Sea Bass FMP

1. <u>Refine and clarify the EFH designations for summer flounder.</u>

(a) The text description of summer flounder EFH south of Cape Hatteras should be improved by refining the geographic references. For example, the southern boundary for EFH south of Cape Hatteras should be more specific by using a geographic reference point such as Cape Canaveral rather than describing the southern limit of EFH as "Florida."

(b) Page 27, 2nd paragraph, notes information regarding adult distribution based upon bottom temperatures from Smith (1973). This type of information should be used in Section 2.2.2.2 to narrow the EFH designation offshore, rather than designating the entire exclusive economic zone as EFH.

(c) Since eggs are part of the neuston, the methodology for designating EFH for eggs south of Cape Hatteras (i.e., using the depth of water at which eggs are found north of Cape Hatteras as a surrogate for egg distribution south of Cape Hatteras) should be refined. Distribution is much more likely to be based on water currents or location of spawning adults. Depth would be more defensible if used as a surrogate for distance offshore.

(d) Limiting the designation of EFH seasonally is biologically defensible, but it interjects difficulties for the consultation process since federal agency actions might not be subject to the consultation requirements if they occur during a season not specified as EFH. The final amendment should eliminate the seasonal aspect of EFH, which would allow NMFS to consult with federal agencies on any actions that may adversely affect the habitat.

(e) The designation of EFH south of Cape Hatteras should be narrowed using the description of habitat parameters given in the amendment text and/or consultation with summer flounder experts, SEAMAP reports, and related information, rather than considering the entire continental shelf to be EFH. Since larvae move into estuaries, inlets to estuaries designated as EFH should be considered EFH as well. Juveniles are said to accompany adults offshore during seasonal migration, so these two designations could be linked. The reference to continental shelf waters between salinities of 10-30 ppt is confusing since most continental shelf waters have a salinity greater than 30 ppt.

(f) The identification of HAPC for summer flounder is appropriate. Additional support for this designation comes from Malloy & Targett (1994 a&b) who conclude that prey availability is very important to the growth and condition of early juveniles during the months immediately following settlement. However, the HAPC designation should be more specific. Unfortunately all SAVs have not been mapped, but the text description could be clarified by stating whether the HAPC designation applies to all species of SAV, whether it includes beds of all sizes, etc.

2. Refine and clarify the EFH designations for scup.

(a) Only estuaries are designated as EFH for the egg and larval life stages of scup. If possible, information from the literature for spawning adults should be used to add to that available for egg and larvae distribution in order to identify important nearshore areas as well.

(b) The terms "North of Cape Hatteras" for the juvenile and adult EFH designations should be reconciled with the figures for EFH, which show shaded squares south of Cape Hatteras.

3. Refine and clarify the EFH designations for black sea bass.

(a) The information given in amendment text and figures depicting egg distribution presents a sound basis for EFH designation in nearshore coastal waters. The EFH description for eggs currently includes only limited estuarine areas, but it may be appropriate to include nearshore areas as well.

(b) General descriptions of habitat preference including bottom type, temperature, and seasonal distribution should come at the end of the text description of EFH.

Recommendations on EFH for the Surf Clam and Ocean Quahog FMP

1. Consider designating EFH in state waters. Section 2.2.1.3 describes "critical" habitat for surf clams and quahogs in state waters off Massachusetts, Rhode Island, New York, New Jersey, and Delaware, based on the expert opinion of state biologists. However, the Estuarine Living Marine Resources Data set does not include data on surf clams or ocean quahogs, and Section 2.2.2.1 of the draft amendment states that the Council is not designating EFH in state waters because the management unit covers the exclusive economic zone only. The maps of EFH for pre-recruits and recruits of both surf clams (Figure 16) and quahogs (Figure 17) show numerous 10-minute squares adjacent to the coast that fall within the selected 90% alternative. Given that the survey data show high relative abundances of surf clams and quahogs in certain state waters, and the observations of state biologists confirm those data, it appears that the Council has ample justification to designate EFH in inshore areas. Designating EFH in state waters would also be consistent with the Council's decision to use "a more inclusive approach" to EFH designation in offshore areas "in an effort to be risk averse" (Section 2.2.2.1.3, p.39).

2. Consider designating EFH in the Gulf of Maine. Section 2.2.2.2 states that the Council is not designating EFH in the Gulf of Maine in the area of the small artisanal quahog fishery that occurs there because the Northeast Fisheries Science Center clam survey covered the area just twice in the early 1990s. Although no data exist to map even the presence or absence of the resource reliably (i.e., there is "Level 0" data), the habitat supports a resource that sustains a small fishery. If possible, it would seem worthwhile to attempt to identify valuable habitat areas through discussions with the fishing industry to designate EFH in the Gulf of Maine, rather than neglecting this area.

3. Revise the text descriptions of EFH. Section 2.2.2.2 should be revised to clarify that the description of EFH "throughout the substrate to a depth of three feet within federal waters" refers to depth below the ocean bottom, and not below the water surface. Also, if the Council decides to designate EFH in inshore waters, the text descriptions of EFH should be revised accordingly by dropping the words "within federal waters" and "throughout the Atlantic EEZ."

Recommendations on EFH for the Atlantic Mackerel, Squid, and Butterfish FMP

1. Clarify the terminology used to describe the life stages of *Loligo* and *Illex*. The use of the terms "pre-recruits" and "recruits" is an operational definition used by the Northeast

Fisheries Science Center referring to the size of individuals taken by the fishery, as opposed to the terms "juveniles" and "adults" which refer to attainment of sexual maturity. The maps and the discussion of distribution are based on the pre-recruit/recruit distinction, whereas the life history and habitat characteristics sections generally make use of the terms juveniles and adults, as discussed in the literature. This explanation should be included in the FMP text, possibly at the end of the "Habitat Requirements by Life History Stage" sections (2.2.1.2.3 and 2.2.1.3.3).

FAX TRANSMISSION

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To: Tom Hoff
Fax #: 302-674-5399
From: Arthur J. Newell
Subject: EFH in FMP's
Date: September 16, 1998
Pages: 1, including this cover sheet.

Tom, here are comments on the EFH sections in three of the four FMP's you sent me. John Mason is looking at the dogfish FMP, and we'll get any comments to you on that one next week.

<u>Summer flounder, scup and black sea bass</u>
Summer flounder - All inshore waters of NY are important summer flounder habitat with the south shore bays, New York Harbor, near shore ocean waters, all bays between the north and south forks of Long Island and Block Island sound being especially important. (Note: In many of the FMP's Great South Bay is listed as a NY estuary with EFH. "Great South Bay" should be changed in all FMP to read as the "South Shore Bay Complex" which extends from the Hempstead Bays in the west to Shinnecock Bay in the east; this includes Great South Bay.)
Scup are found throughout NY marine waters with large concentrations found around eastern Long Island (eastern Long Island Sound, Gardiners Bay, Peconic Bays and near shore waters around Montauk).
Black sea bass are found in eastern Long Island waters of Gardiners Bay, around Montauk Point and the major inlets along the south shore of Long Island. Likewise, they are found associated with hard structure in the near ocean waters off Long Island.

<u>Atlantic mackerel, squid and butterfish</u>
In Tables 13 and 14 Gardiners Bay should be changed to Gardiners/Peconics Bays. Also, the note above regarding the LI South Shore Bay Complex applies here, too.

<u>Surf clams and ocean quahogs</u>
On p. 35 there is a reference to a pers. comm with Fox. Dick Fox informed me that it should be clarified that "inshore waters" does <u>not</u> include the bays. Maybe it should read "all waters of the Atlantic Ocean and Long Island Sound under New York State control."
On p. 50 reference is made to vessels that shuck at sea. Dick Fox also informed me that he doesn't think there is any surf clam or ocean quahog shucking at sea.

cc: B. Young, D. Fox, J. Mason

The Commonwealth of Massachusetts

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PHILIP G. COATES
DIRECTOR

August 31, 1998

Mr. Tom Hoff
Mid-Atlantic Fishery Management Council
300 South New Street
Dover, Delaware 19904-6790

Dear Tom:

Seasonal work priorities and the requested short turn around time on the four amendment documents (nine species) have not permitted me to review all the material in the EFH sections as I would have liked; accordingly, I have mostly confined my comments to sections on 'Importance in State waters' and 'Description and Identification of Essential Fish Habitat'.

For all the habitat section documents, except Surfclams/Ocean Quahog, I strongly object to the rote language describing availability of MDMF data, e.g. 2nd paragraph on p. 49 of the Summer Flounder/Scup/Black Sea Bass Amendment. Because of that wording, I think it is a sham for me to comment on these sections when Massachusetts Inshore Trawl Survey data was available to the people charged with writing these amendments. Contrary to the statement in your letter, I have not been working with Stu Wilk; he and his colleagues have had our data from the very beginning of this process. Because of my involvement with the NEFMC EFH Tech. Team, I had presumed MDMF data was being similarly used by the Sandy Hook people for the benefit of the MAFMC, as it has been for the NEFMC.

I don't understand why NMFS Sandy Hook Laboratory personnel can utilize the MDMF inshore survey data to help the NEFMC identify 'preferred EFH habitat', yet the MAFMC didn't ask or receive it? I think it was a poor decision to exclude valuable survey information "because other states' data are not currently available in a format that makes it possible to compare them". If that is the rationale that has been conjured up, then by my reasoning R.I., Conn., and N.J. surveys may never be used for identifying EFH since none of those surveys are similarly timed, use the same vessel, gear, methodology, etc. or are in the same computer format as MDMF and NEFSC/NMFS.

The rote paragraph contains the following intellectually dishonest statement: "Therefore, these data [the state's data] will only be used to confirm ELMR data. These data generally agree with ELMR presence/absence data for these specific estuaries." Not only does that statement, and some others in the documents, confirm that MDMF information was examined by NMFS writers, but you should know that ELMR data in specific 'estuaries' ought to coincide with OUR data since it IS OUR DATA in a qualitative format, albeit a bit dated!

We regard it as a loss of important EFH information for MAFMC managed species when you haven't utilized our trawl survey data when it has always "exist(ed)" in a "format comparable currently to NMFS data", contrary to the statement on p. 82, 4th para, 5th sentence of Summer Flounder/Scup/Black sea bass FMP. Although our program may be the exception, we would appreciate it if the wording would acknowledge our 21 year effort instead of ignoring it.

The best example of the point I am making is all the existing sections designated as 'Description and Identification of EFH' which I regard as deficient. I don't understand why the MAFMC in "attempting to coordinate and obtain the best information available in Amendment 7, requested each state from North Carolina to Maine identify essential (species) habitat under their jurisdiction", yet failed to designate a 'Preferred Alternative', as the NEFMC did for information other than the NMFS surveys. This could have included: inshore survey results (MDMF, CTDEP, and NMFS Hudson-Raritan/ Sandy Hook Bay); areas already identified in writing by state agency experts (cited in all your documents); and information from the fishing industry, etc. For example, in the case of summer flounder, because your egg and larvae EFH is limited by where the MARMAP survey was conducted, you have excluded many essential inshore areas of recognized egg and larval abundance (Fig. 47 a & b). Utilizing the ELMR data base for larvae, juveniles, and adults grabs only two 'estuaries' northeast of Narragansett Bay (Table 14), thus ignoring much EFH both south and north of Cape Cod. Similarly, relying on the NEFSC trawl survey to discern juvenile and adult EFH (Fig. 47 c & d), excludes important grounds, especially inshore. The determination of EFH for all other MAFMC managed species followed the same flawed rationale.

I submit that if you ask states to provide information, which you did, then why not use it much in the manner of the NEFMC, i.e., the 'preferred alternative'? If Massachusetts DMF had been given an opportunity to have input into the MAFMC process earlier, I would have hoped to prevail on you to utilize the MDMF trawl survey database. I know that this now may not be possible for this iteration; nonetheless, I filled out the 'blank gridded figures' thereby offering you updated knowledge for species stages where, in my judgement, the MAFMC is deficient in the various documents (refer to attached 16 figures). In undertaking this task, I was assisted with fish life stages by Tom Currier and Jeremy King, who share with me over 20 years marine sampling experience (species, sex, and maturity staging) in state territorial waters, and by David Whitaker and Mike Hickey, who have had similar experience with shellfish resources.

When necessary, we queried our trawl survey database for this undertaking. We are also familiar with all ichthyoplankton study results conducted within territorial waters which, all in all, confirm our maturity observations. Except for the sedentary mollusks and the egg and larval fish and squid stages, distribution plots are for September, when inshore water temperatures are highest and our autumn survey is conducted. Where appropriate, I have combined the distribution of one or more life stages as follows:

Summer flounder Eggs & Larvae
" " Juveniles (Age 0)
" " Adults
Scup Eggs & Larvae
" Juveniles & Adults
Black Sea Bass Eggs & Larvae
" " " Juveniles (Age 0)
" " " Adults
Atlantic Mackerel Eggs, Larvae, Juveniles, & Adults
Loligo squid Eggs & Larvae
" " Pre-Recruits & Recruits
Illex squid Pre-recruits and Recruits
Butterfish Eggs, Larvae, Juveniles, & Adults
Spiny Dogfish Juveniles & Adults (both sexes)
Surf Clams
Ocean Quahogs

The MAFMC has identified submerged aquatic vegetation (SAV) beds as nursery habitat of larvae and juvenile summer flounder and a "habitat area of particular concern" (HAPC). I think this may be a premature designation and might require more research and thought relative to its implications. The basis of the designation is the Packer and Griesbach summer flounder background document. While I have not seen this report, the quote on p. 67, 2nd para of section, suggests that this is a learned opinion based on a review of the literature. I think this nomination should be based on peer-reviewed scientific research as implied in the NMFS Technical Guidance Document. While I don't doubt the validity of the observational information relative to juvenile summer flounder and eelgrass, what are the observations relative to other SAV? It is likely that this important ecological function (the principal criteria that would apply according to the interim final rule) is fulfilled by other SAV, such as *Codium*, etc. What were the observations on other prey species? The northern limit of the spot's (*Leiostomus xanthurus*) range is southern N.J. yet juvenile fluke are found north to Cape Cod where they forage on species other than spot and from cover other than eelgrass. Has it been demonstrated that eelgrass is particularly vulnerable to specific fishing gears, and if so, which ones in place and time would adversely effect juvenile feeding? Or, are you more concerned by environmental degradation, like vessel activity in grass beds, or stresses from development? Importantly, the MAFMC has not described the implications of the HAPC designation; you should be up front about this with all constituent groups. Massachusetts DMF believes it is important that impact to this habitat be accurately described before more stringent management measures should be considered by the MAFMC.

With one exception, the biological material presented for all the species is very complete and well assembled by the various authors. Based on my knowledge of the literature, they did a very good job. With respect to the Summer Flounder/Scup/ Black sea bass document, I suggest two corrections:

p. 11, 3rd para. I am certain that the subject of this paragraph is black sea bass, however, because the first sentence starts with "The species is . . .", the presumption from the second paragraph is that the subject of the third paragraph is scup. The ambiguity should be cleared up.

p. 34, last para. 3rd sentence. I dispute the comment that YOY scup were "not evident (north of Cape Cod) in the Massachusetts DMF results." It all depends on what the author means by "locally abundant"? In point of fact, YOY scup have been taken by MDMF in Cape Cod Bay in 12 of 20 fall surveys. Stratified mean catch/tow at length information suggests to me that in two surveys (1981 and 1994), YOY scup were relatively abundant for that area (15-22 fish/tow @ 7 cm mode). Incidentally, a smattering of older fish (18-24 cm) were noted in 1986, 1993, and 1997 fall cruises.

For the Surfclams and Ocean Quahog document, the last sentence in the last complete paragraph on p. 28 is incorrect. Contrary to the Davis et al. 1997 reference, surfclams have been commercially harvested for many years within Massachusetts territorial waters north of Cape Cod, which we consider our corner of the Gulf of Maine. In 1997, 41,907 bushels were taken from Provincetown to Hull, a figure representing 46% of the state's surfclam catch.

I think the Cargnelli et al. 1998 document on Loligo squid is somewhat deficient in that much of the recent research on growth, seasonal distribution by sex, distribution and abundance of egg mops, and dynamics of the mating system is not included in the habitat section of the FMP. I believe It should be, especially the work of Dr. Roger Hanlon and his colleagues at the Marine Biological Laboratory, Woods Hole (508-289-7710). Given the results of Dr. Hanlon's published research, I suggest that wherever Loligo egg mops are encountered (as MDMF has documented for state waters), it is EFH. If the MAFMC is to assume an active role in the protection of this critical habitat, then Massachusetts DMF recommends that a section on Loligo Eggs and Larvae become components be inserted in the document for this submission package (section 2.2.2) in order to meet Congressional mandates associated with the SFA.

With respect to the Hoar (pers. commun.) information on

With respect to the Hoar (pers. commun.) information on Surfclams and Ocean Quahogs for Massachusetts territorial waters (p. 35, last para.), it is dated and should be re-written based on more recent surveys and information. As shown on the attached grid figures, ocean quahogs are now found in relative abundance from Gay Head, Martha's Vineyard along the south shore of the island out into the EEZ. They are also found in abundance in two separate areas in the southern and southwestern reaches of Cape Cod Bay below the 60' contour. Ocean quahogs are also present within a deep-water rectangular block extending from off Boston north to N.H off Cape Ann but are not now abundant enough to be commercially viable. Surfclams beds extend from Westport (Horseneck Beach) westward into lower Vineyard Sound, and are found in a narrow strip along the south shore of Cape Cod from Bass Rip to Point Rip. They are also abundant in Muskeget Channel and in territorial waters all around the backside of Nantucket Island. North of Cape Cod, surfclams beds extend from N.H. to Ipswich Bay, and from Hull south along the shore of Cape Cod Bay to Provincetown. The greatest concentrations in the Bay are from Dennis to Provincetown.

I hope my comments have been helpful.

Sincerely,

Arnie

Arnold B. Howe, AQB III

SUMMER FLOUNDER
EGGS + LARVAE

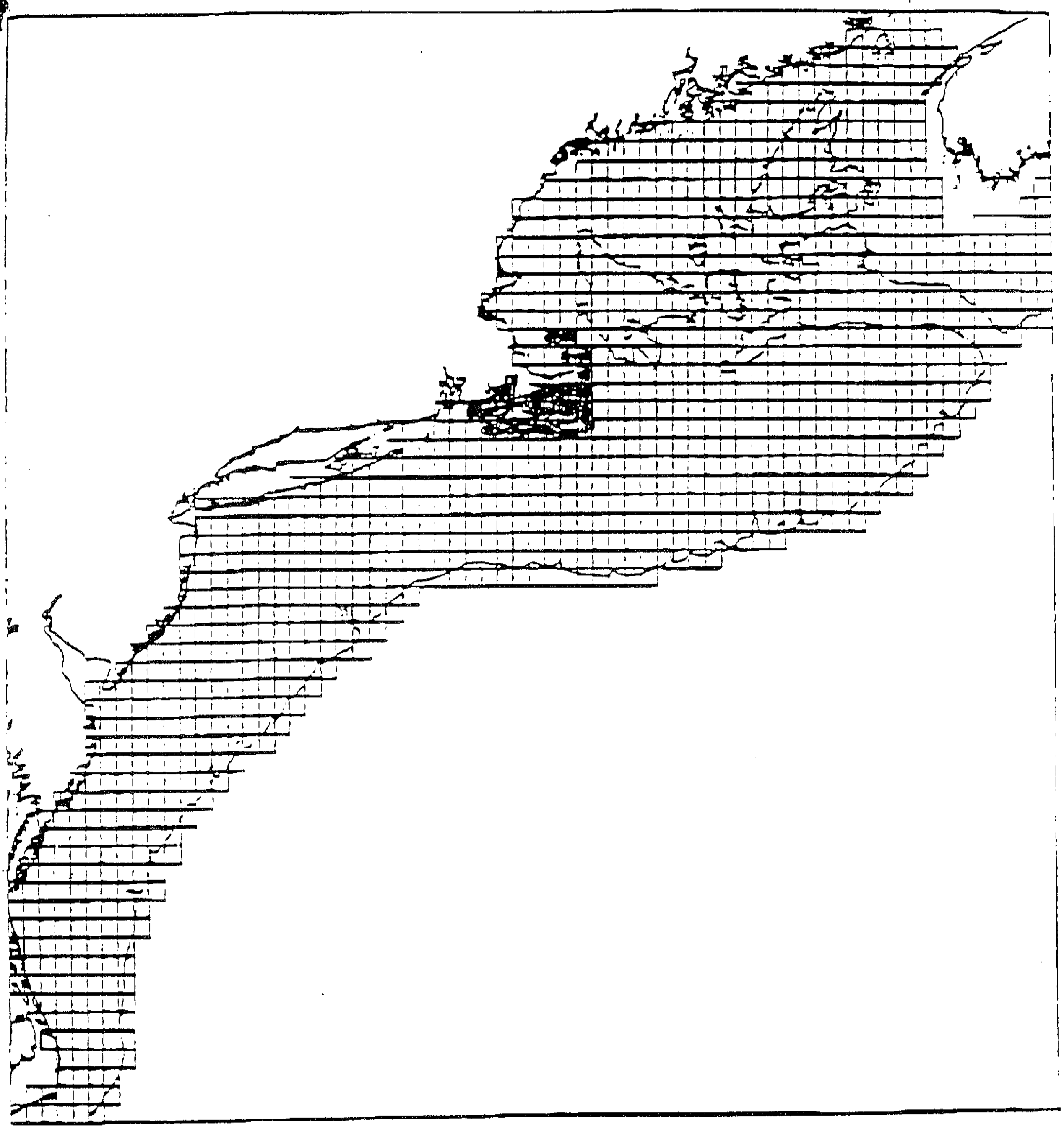

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SUMMER FLOUNDER
JUVENILES (AGE 0)

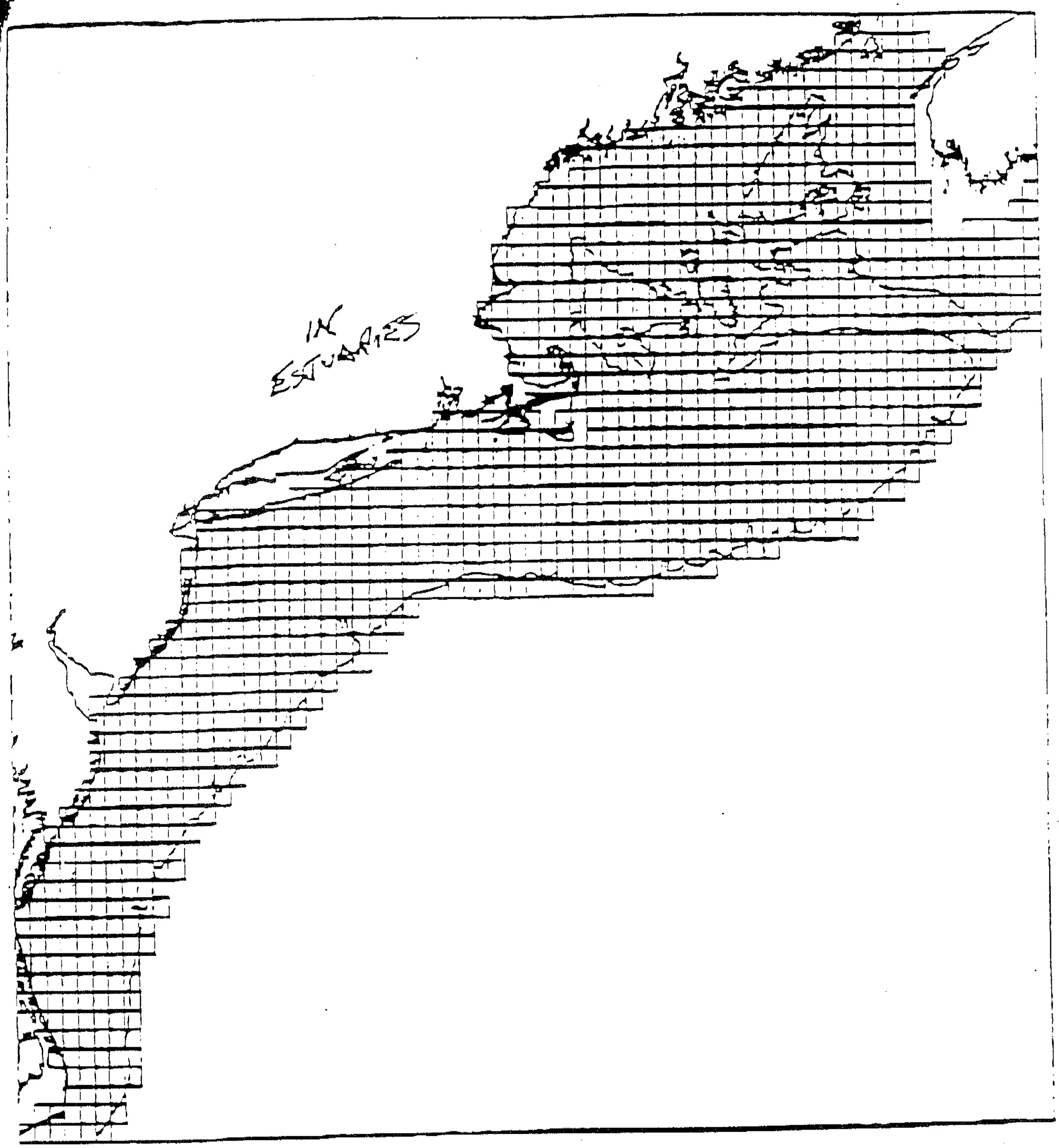

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SUMMER FLOUNDER
ADULTS

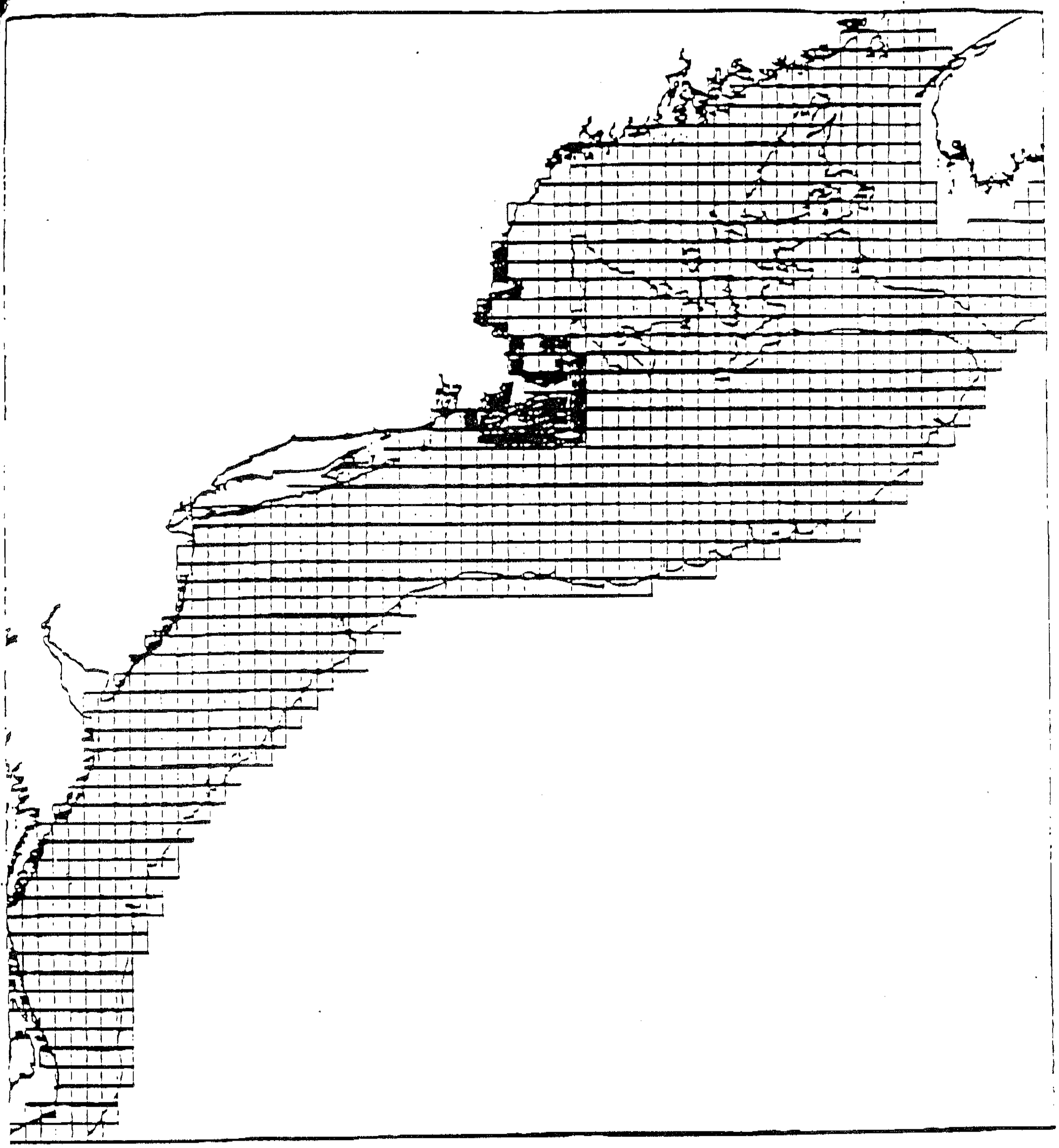

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SCUP
EGGS + LARVAE

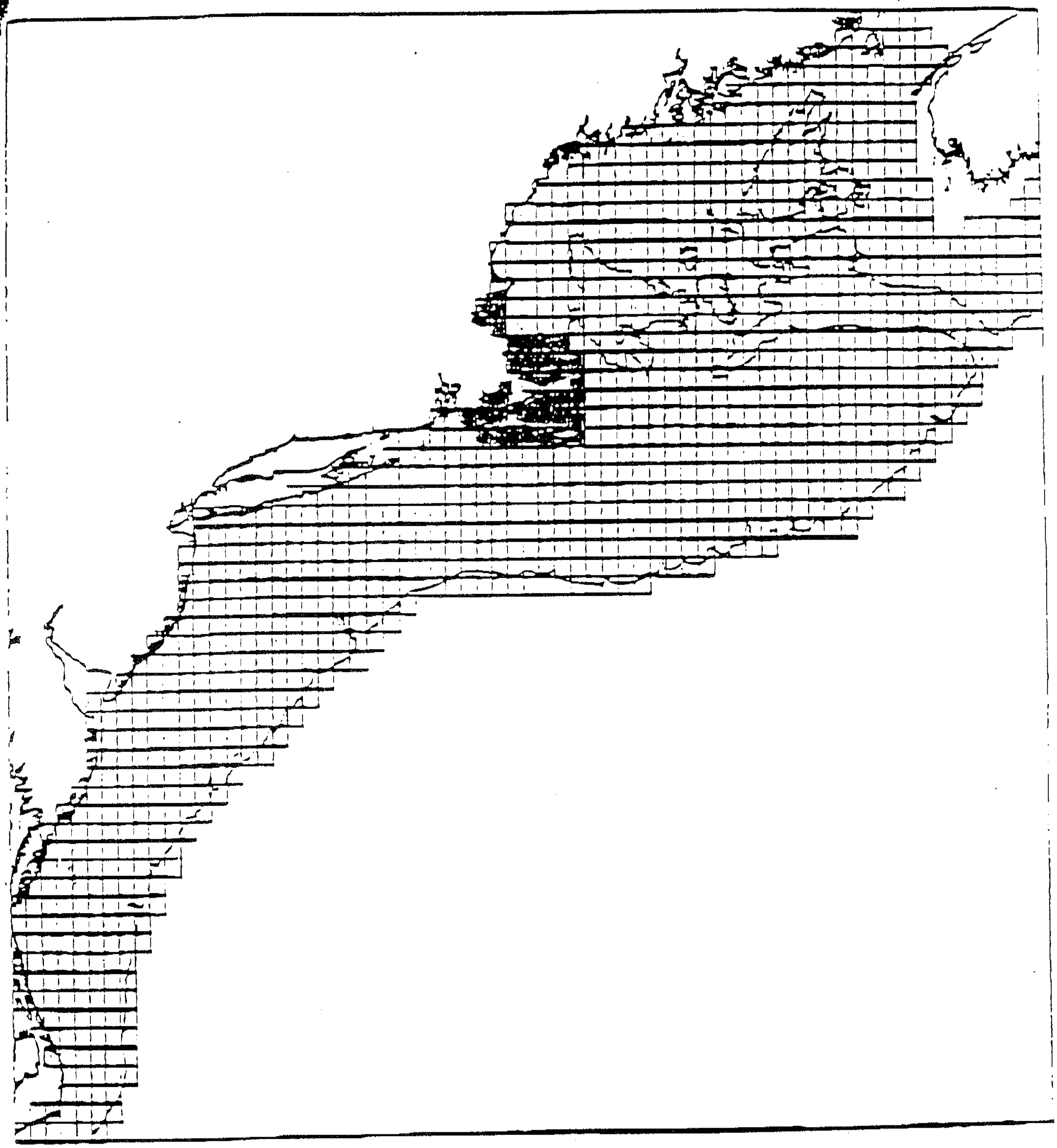

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SCUP
JUVENILES + ADULTS

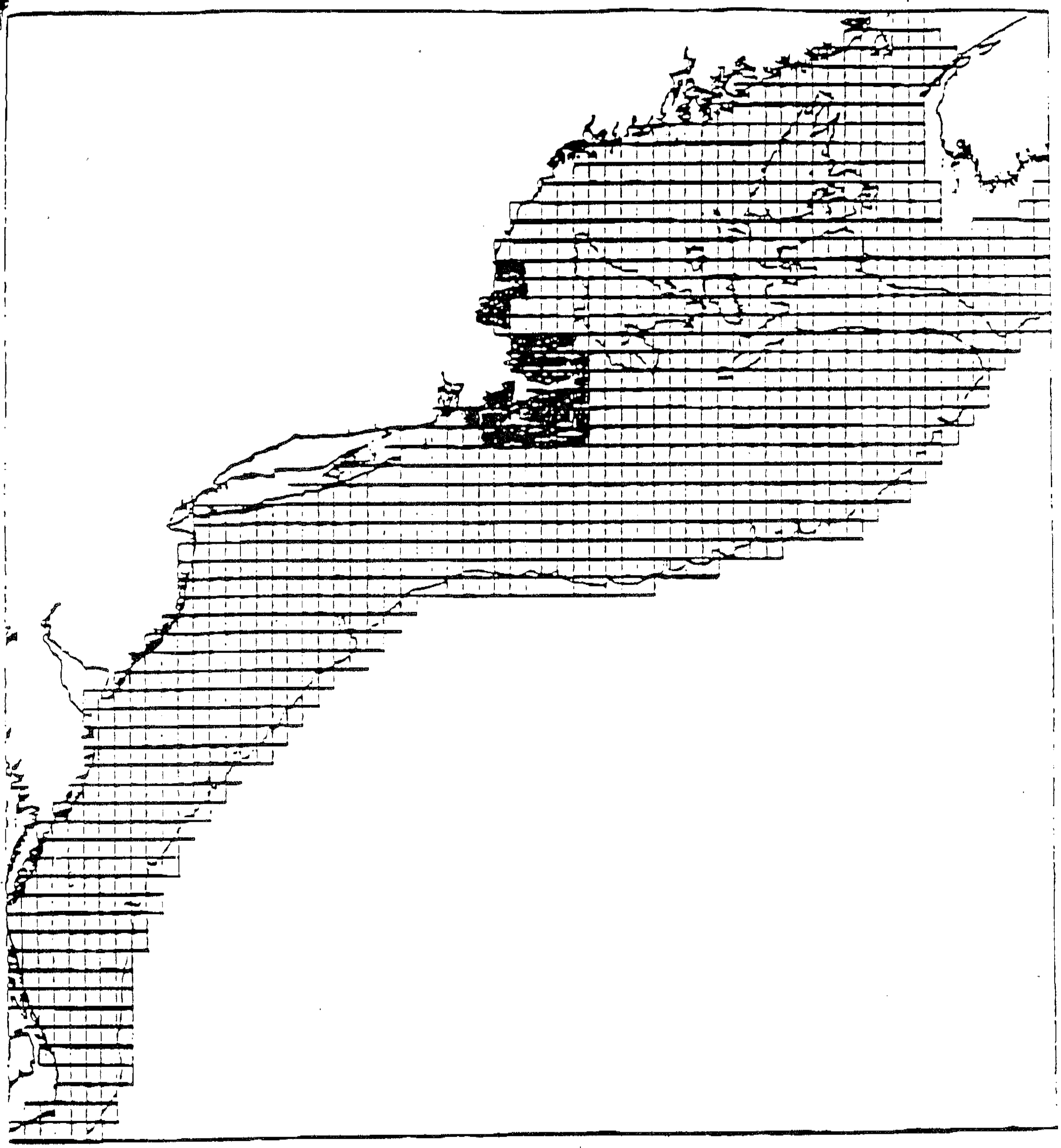

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
EGGS + LARVAE

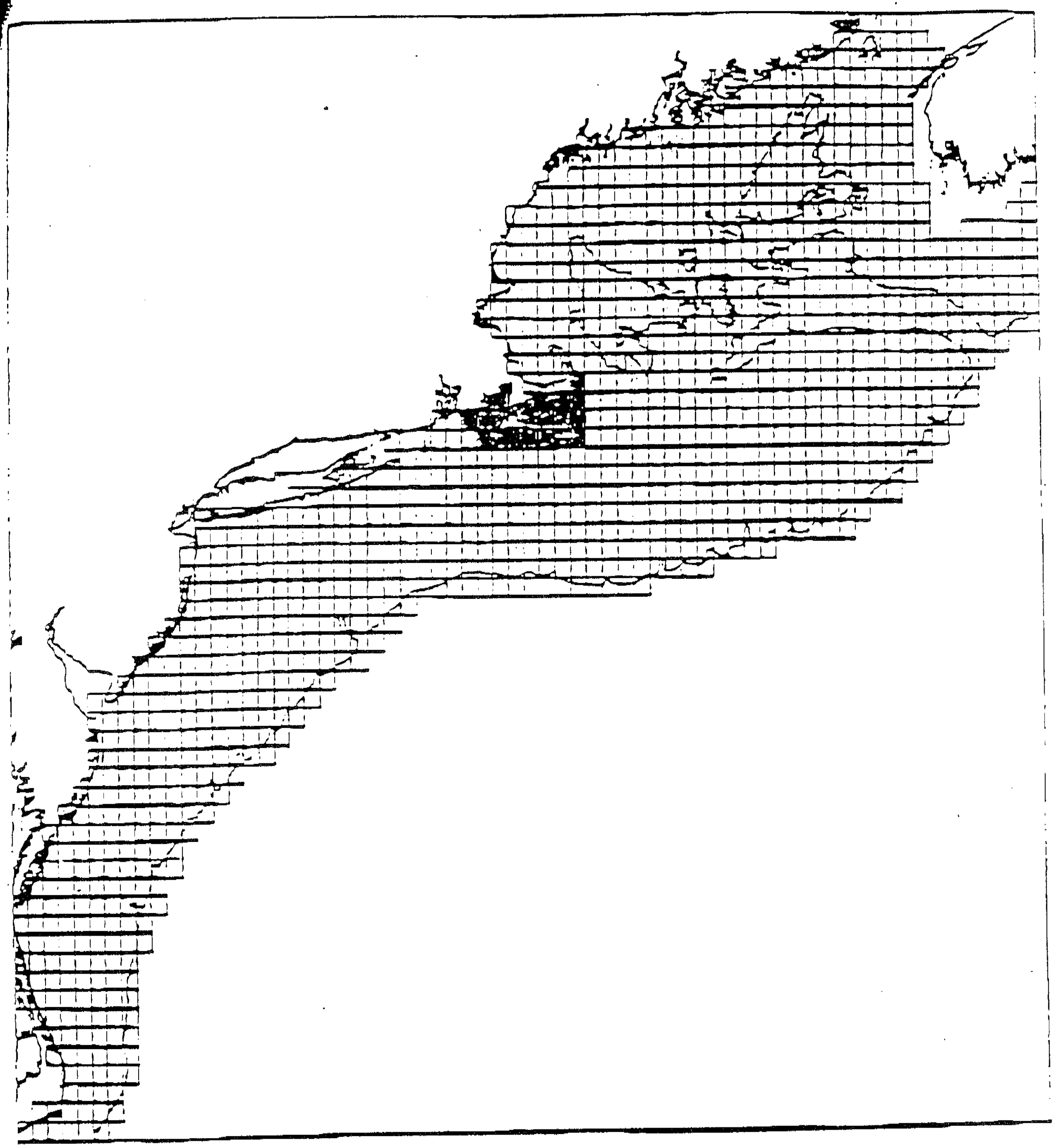

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
JUVENILES (YOY)

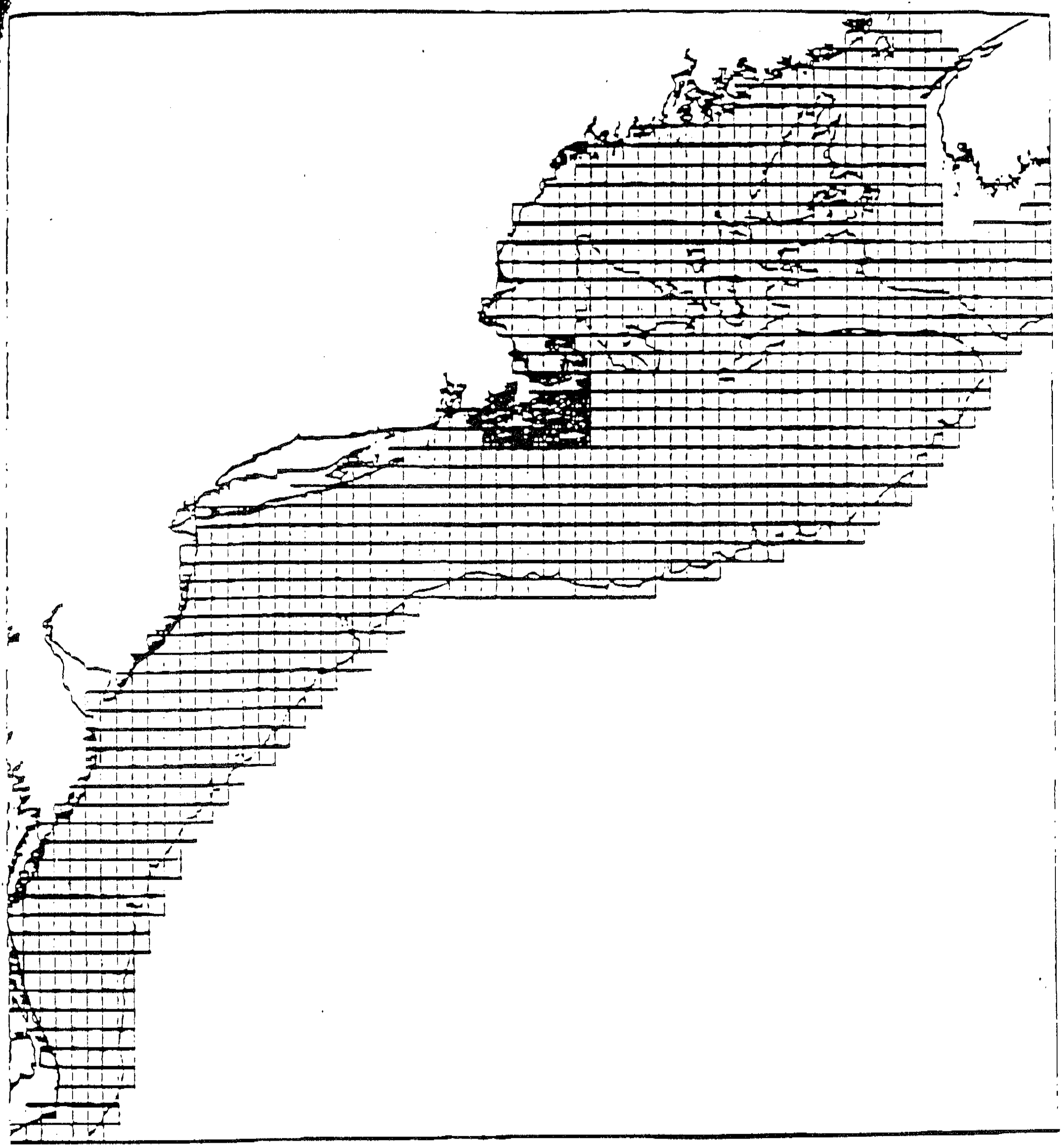

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
ADULTS

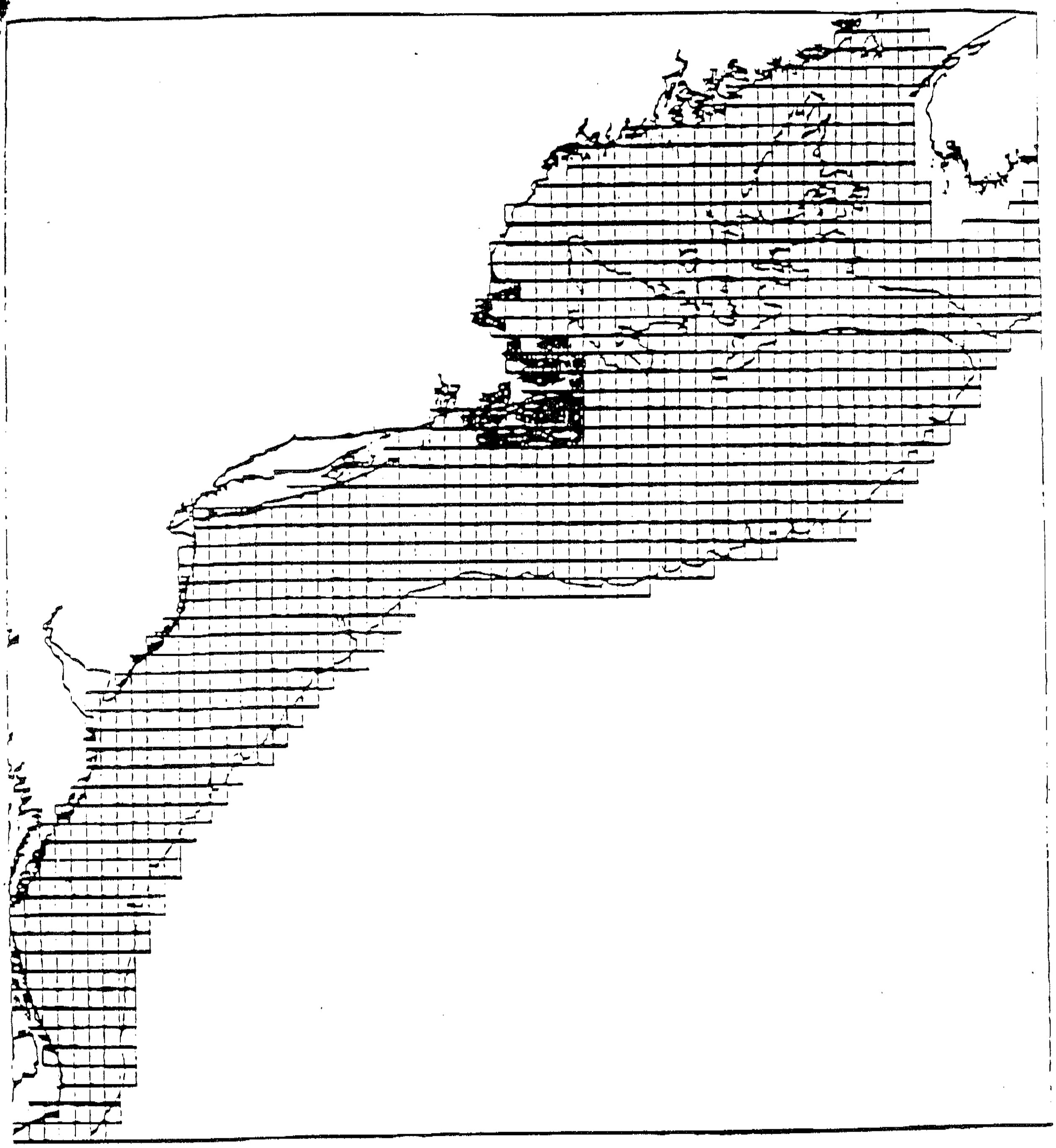

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

AT. MACKERAL
EGGS, LARVAE,
JUVENILES, ADULTS

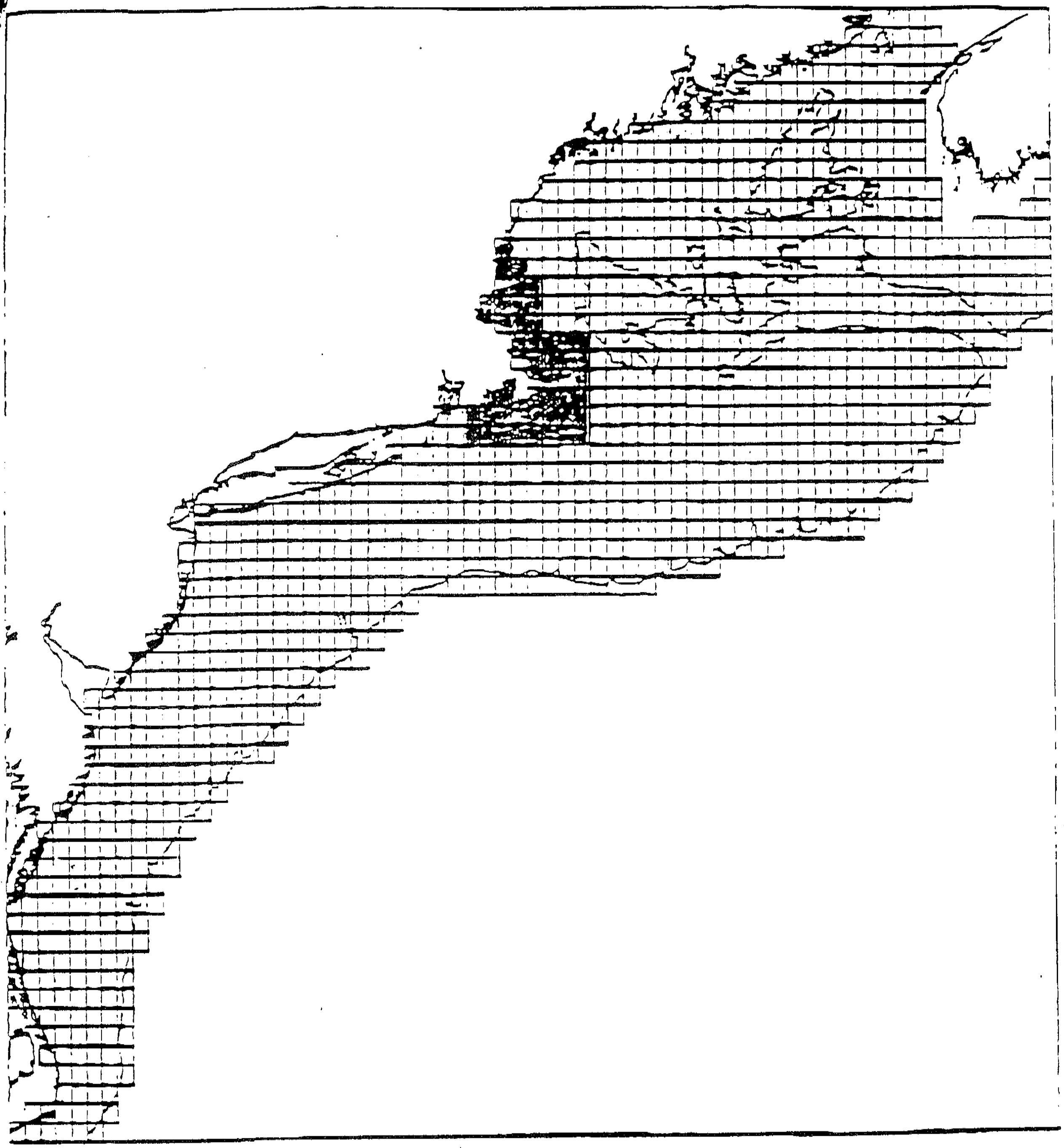

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

LOLIGO
EGGS + LARVAE

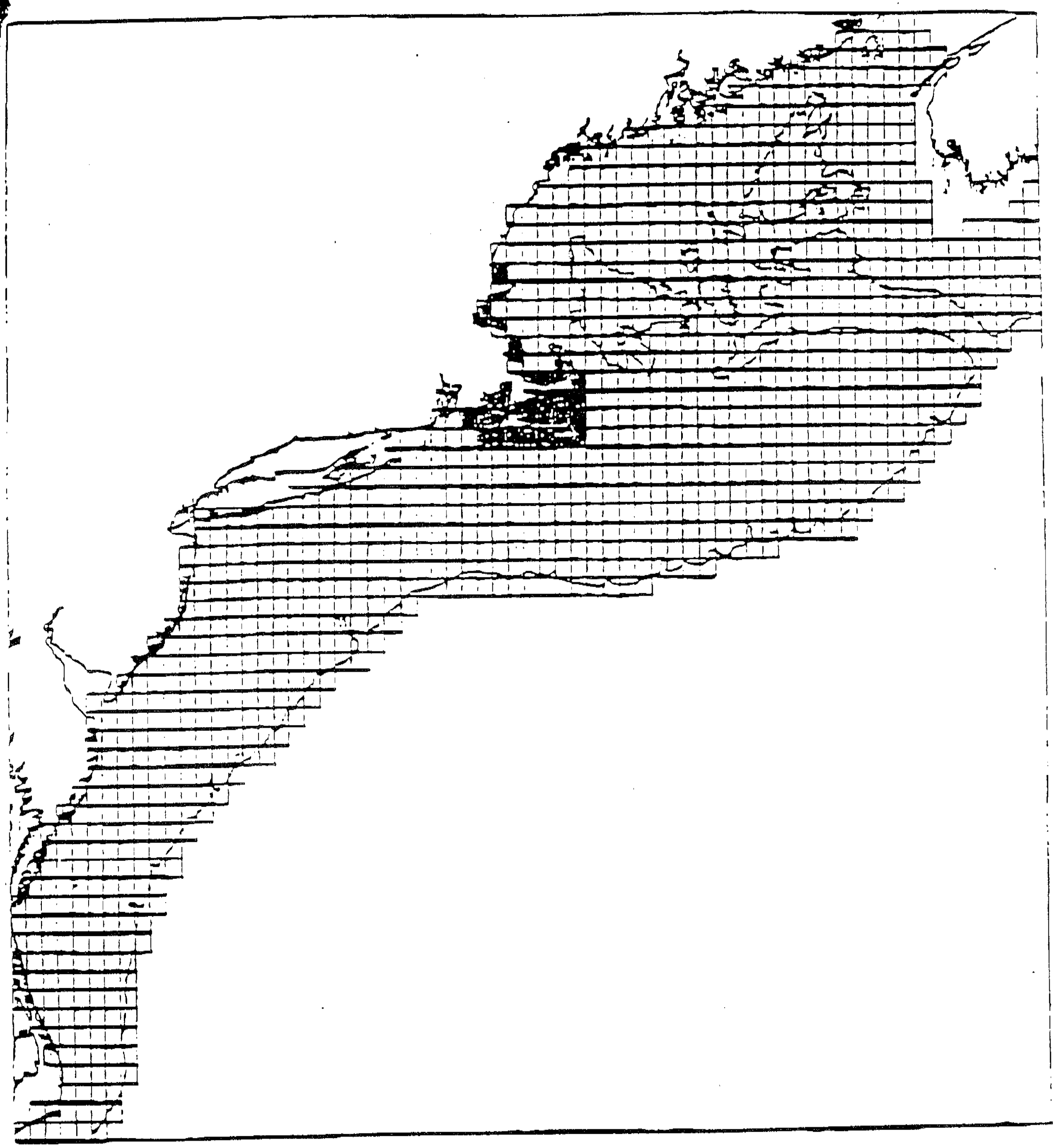

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

LOLIGO
PRE-RECRUITS & RECRUITS

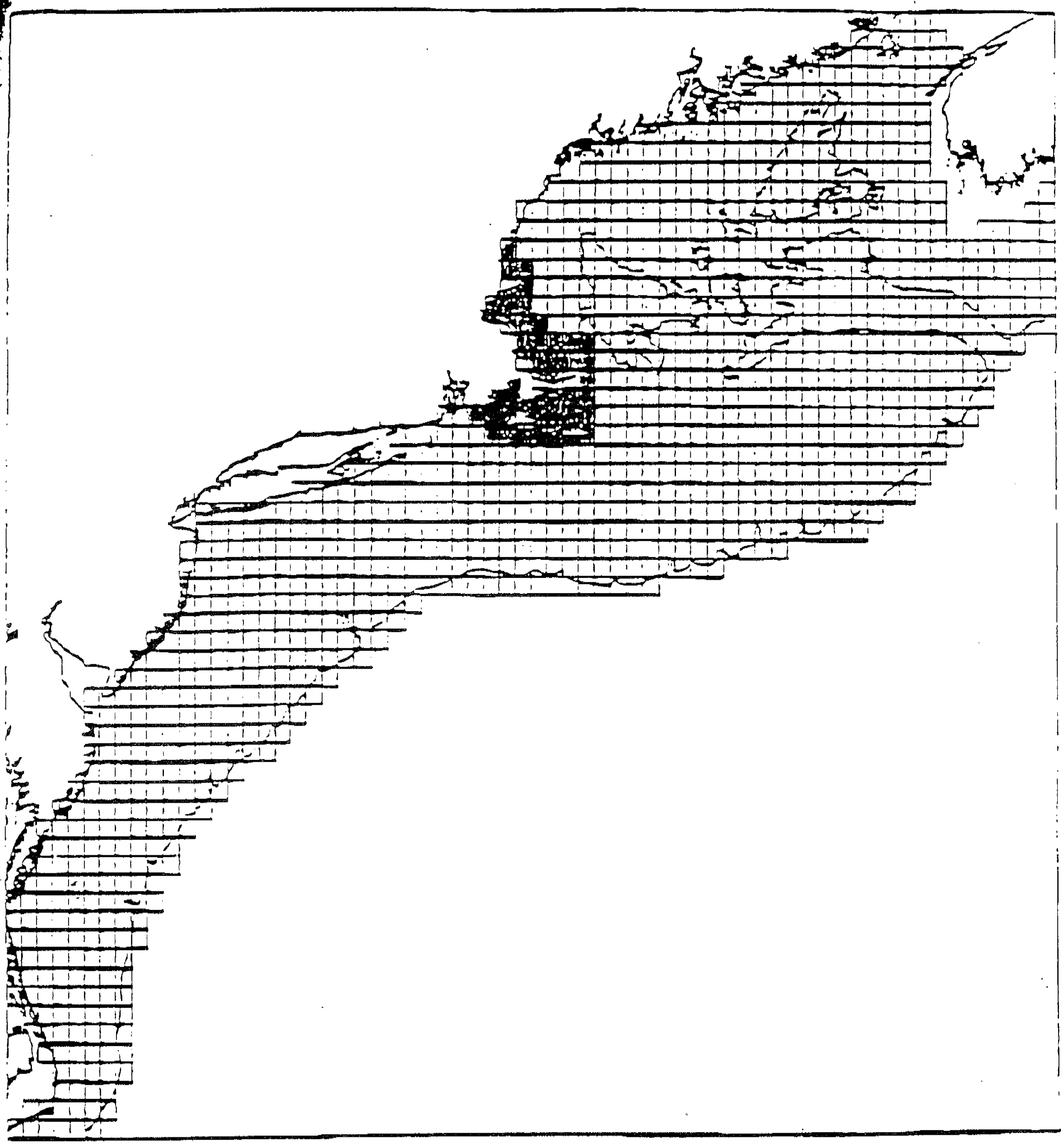

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

ILLEX
PRE-RECRUITS & RECRUITS
(AUTUMN)

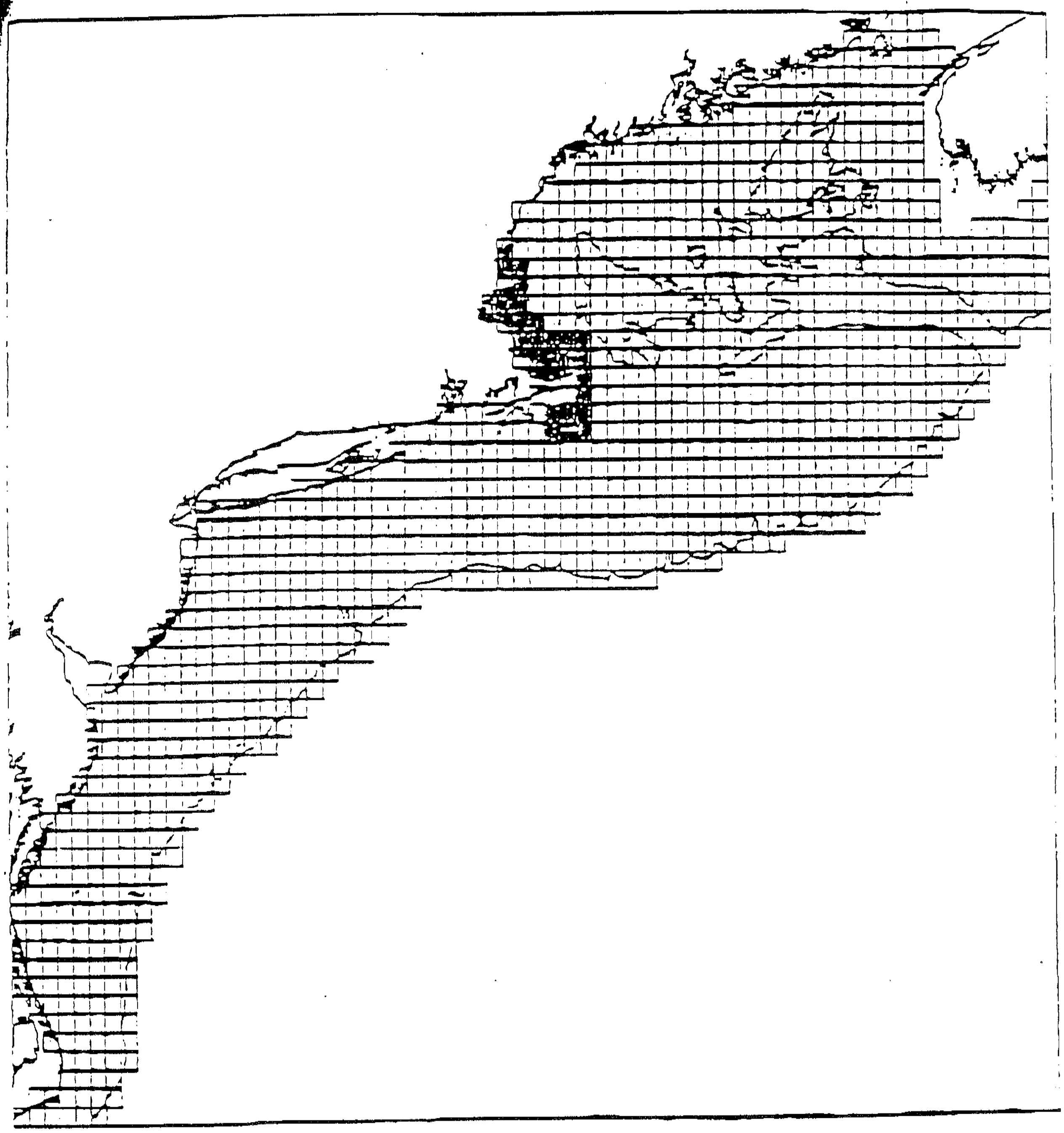

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BUTTERFISH
EGGS, LARVAE,
JUVENILES, ADULTS

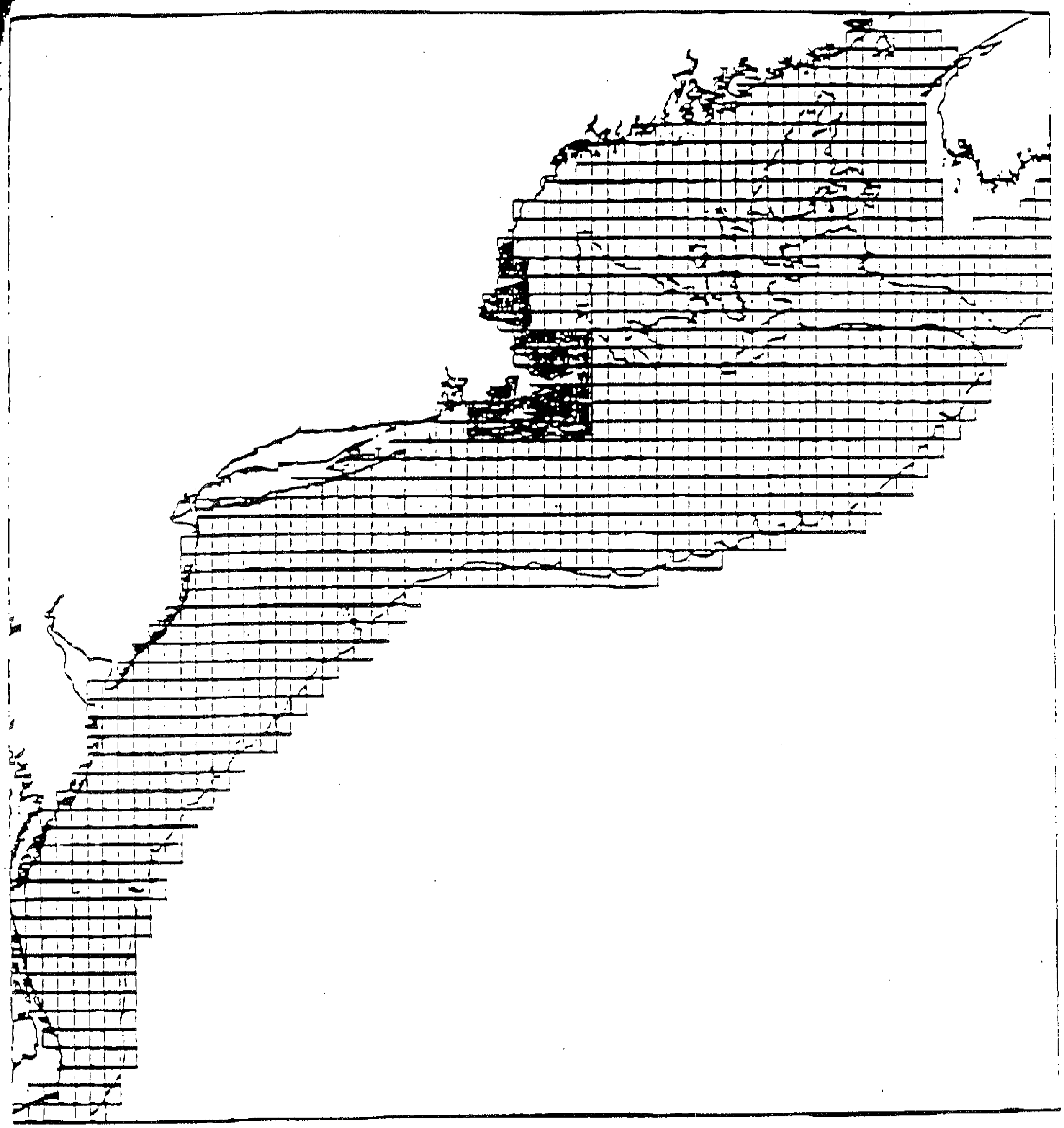

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SPINY DOGFISH
JUVENILES (both sexes)
ADULTS (" ")

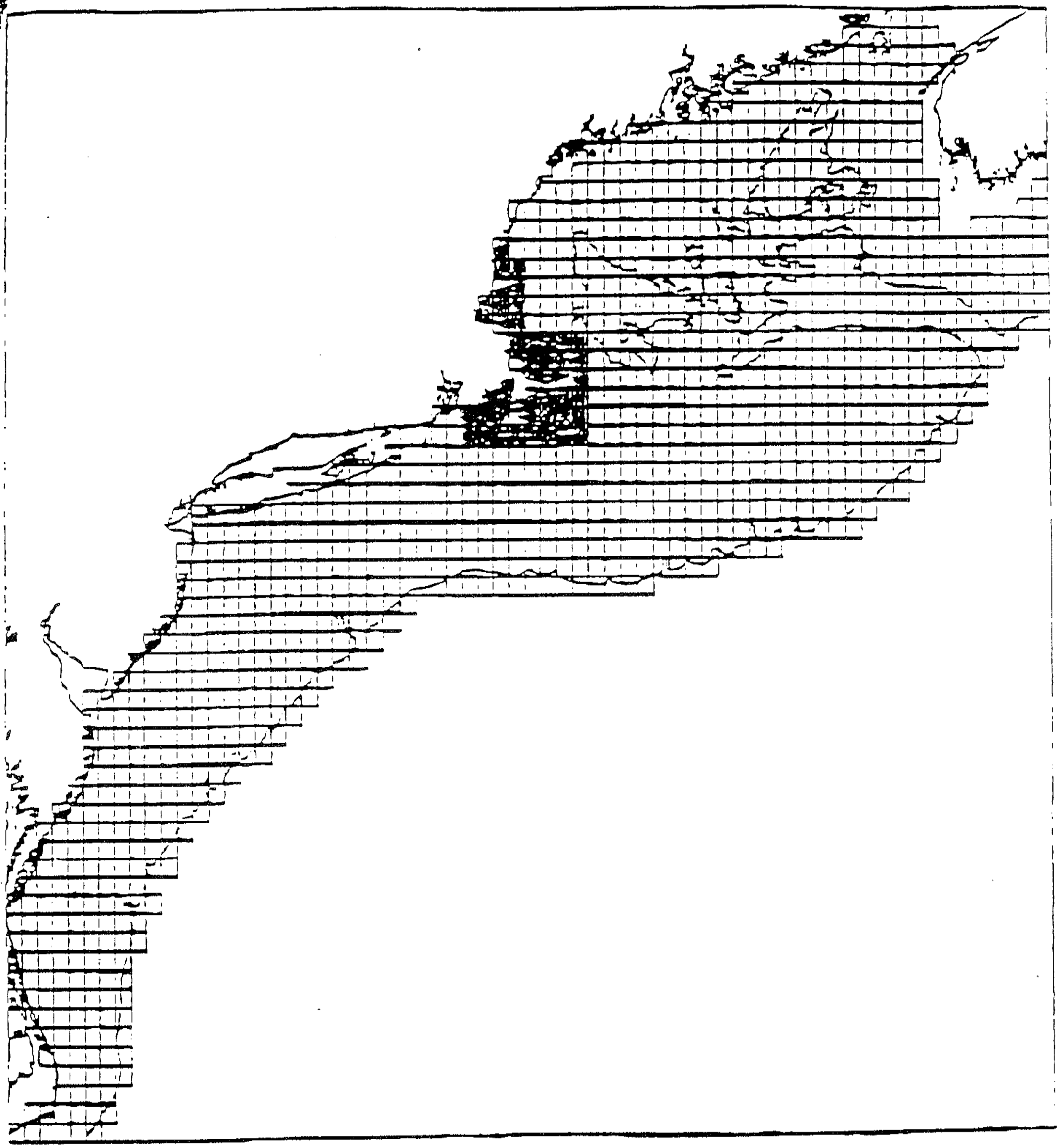

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SURF CLAM

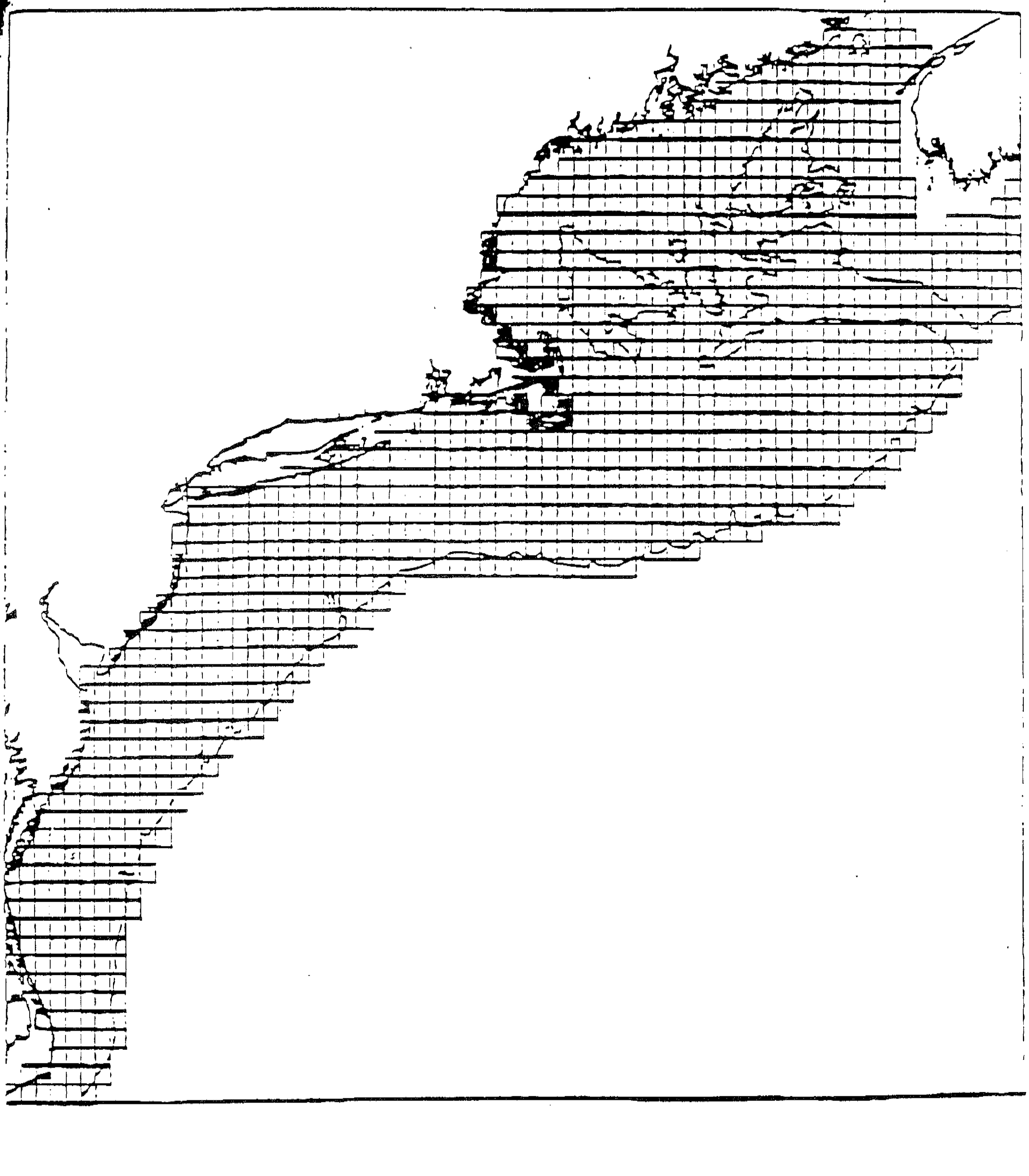

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

OCEAN QUAHOGS

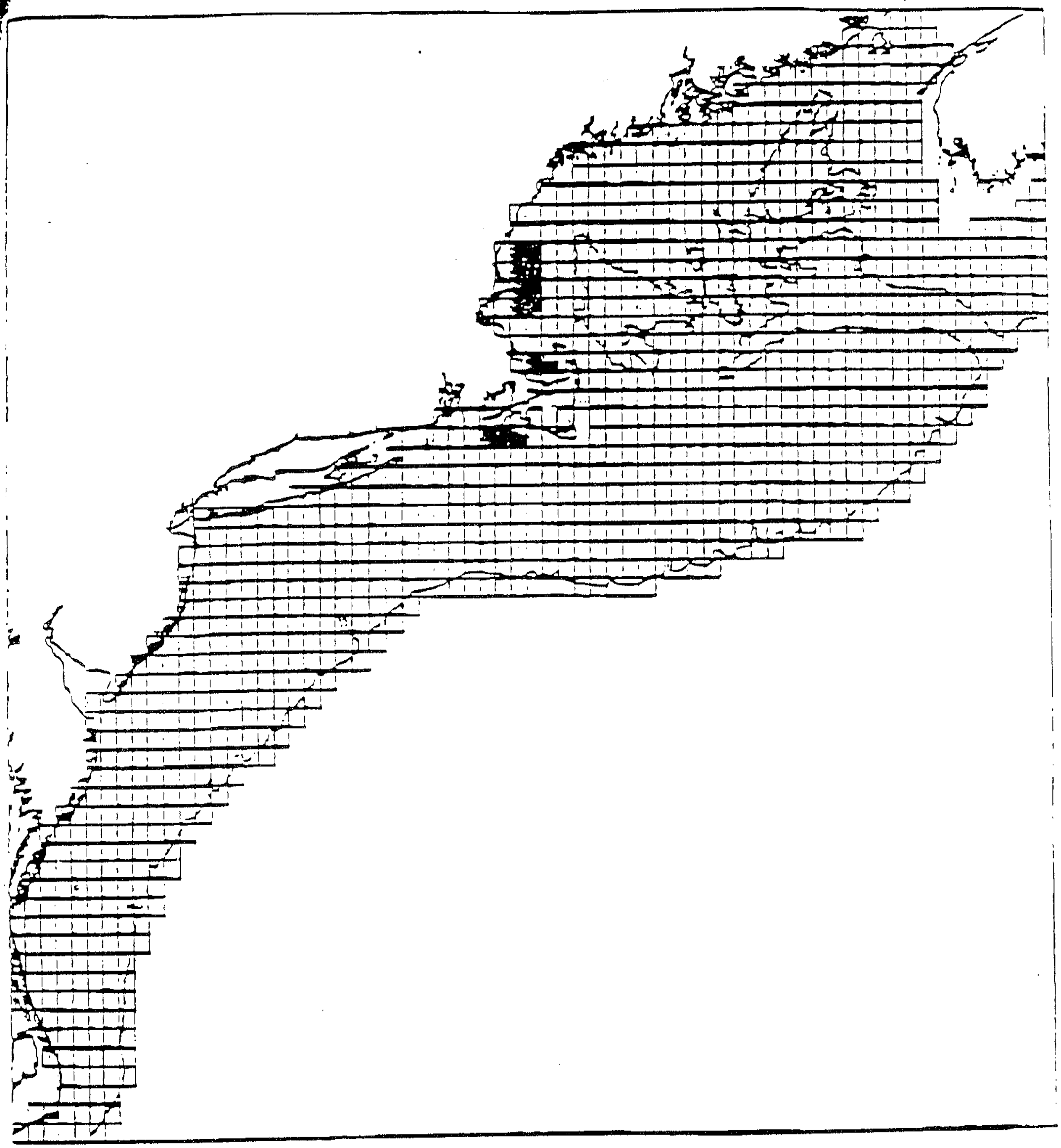

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

AF&PA

AMERICAN FOREST & PAPER ASSOCIATION
Legal Department

September 25, 1998

Dr. Christopher M. Moore, Ph.D.
Acting Executive Director
Mid-Atlantic Fishery Management Council
300 S. New Street
Dover, Delaware 19904

Re: Amendment 12 to the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan; Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan; and Amendment 12 to the Atlantic Surfclam and Ocean Quahog Fishery Management Plan

Dear Dr. Moore:

The American Forest & Paper Association (AF&PA) hereby submits the following comments on the August 21, 1998 drafts of Amendment 12 to the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (FMP); Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP; and Amendment 12 to the Atlantic Surfclam and Ocean Quahog FMP. AF&PA is the national trade association of the forest, pulp, paperboard, and wood products industry. AF&PA represents approximately 250 member companies and related trade associations (whose memberships are in the thousands) which grow, harvest and process wood and wood fiber; manufacture pulp, paper and paperboard products from both virgin and recovered fiber; and produce solid wood products.

While we support the goal of conserving essential fish habitat (EFH), we object to the scope and reach of these amendments. We strongly believe that the amendments represents a clear departure from the letter of the Magnuson-Stevens Fishery Conservation and Management Act and the intent of Congress in adopting the "essential fish habitat" amendments in the 1996 Sustainable Fisheries Act.

The draft amendment for summer flounder, scup and black sea bass, all of which are described as currently overfished, would designate selected estuaries as EFH, based on 90% of the catch, north of Cape Hatteras. South of the Cape, it would designate the entire coast as EFH for summer flounder. EFH for scup and black sea bass is under the jurisdiction of the South Atlantic Fishery Management Council and they have proposed designation of estuaries south of the Cape.

The draft amendment for Atlantic mackerel, squid and butterfish, which are described as not currently overfished, would designate selected estuaries as EFH, based on 75% of the catch, north of Cape Hatteras. South of the Cape, it proposes no EFH due to lack of data and because the species are not being overfished.

The proposed amendment for Atlantic surfclam and ocean quahog would designate limited coastal areas as EFH, based on 90% of the catch, from Cape Hatteras to Cape Cod. The Council chose the 90% factor in part due to lack of data on habitat needs of eggs and larvae.

The following comments expand on our concerns.

1. The Draft Amendment Is Overly Broad and Exceeds Congressional Intent

At the outset, it should be understood that the 1996 amendments (Sustainable Fisheries Act) to the Magnuson Act do not authorize the promulgation of standards or regulations that affect nonfishing entities. By its terms, the EFH provision is limited to "the description and identification of essential fish habitat in fishery management plans." 16 U.S.C. § 1855(b)(1)(A). This limitation makes it clear that NMFS' authority applies only to "fisheries." There is no basis in the Magnuson Act for the Councils to address nonfishing activities. Hence, the Councils' description of EFH and measures to preserve EFH goes beyond the underlying statutory authority and is invalid.

Further, the Sustainable Fisheries Act provides that:

> The term "essential fish habitat" means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

16 U.S.C. § 1802(10) (emphasis added).

The draft amendments would appear to go far beyond the statutory understanding of EFH. The Council's approach to describing EFH is fundamentally at odds with the apparent approach of the Congress in limiting EFH to that which is "essential" or "necessary." EFH should not include any and all habitat nor should it include habitat per se. This approach, on its face, exceeds the authority granted under the Magnuson Act.

2. Inland Areas and EFH

We note that EFH descriptions identify estuarine areas and rivers where juveniles of managed species may occur. We urge the Council to carefully review and revise the amendment in light of the Congress's EFH definition and its historic approach of limiting and constraining the Council and NMFS authority when dealing with fishing interests, as opposed to inland industries, and in deferring to individual states when it comes to matters taking place in state waters, particularly inland waters. There is no authority under the Magnuson Act for the Councils to address prey species or inland areas as EFH, and the Council should avoid any suggestion that EFH will be designated to include such species or areas. E.g., 16 U.S.C. § 1852(a)(1) (the Councils are limited to the management of fisheries "seaward" of the states comprising each Council); 16 U.S.C. § 1801 (b)(1) (the purpose of the Act is "to take immediate action to conserve and manage the fishery resources found off the coasts of the United States"); 16 U.S.C. § 1856(a)(1) (carefully delineating federal and state jurisdiction). Moreover, the Council should focus its efforts on habitat that is truly "essential" and "necessary."

The Council has included estuarine areas as EFH, as well as rivers and other freshwater areas. Further, the Council appears to broadly expand its description of EFH by focusing attention on upland activities that fall well outside the confines of EFH and should not be identified as affecting EFH. In summary, we believe that this definition or description far exceeds statutory authority and the intent of Congress in adopting the EFH provisions to the Magnuson Act.

The Council states in the draft amendments that the alternatives for describing EFH were initially developed for the Bluefish FMP amendment. While we do encourage consistent approaches to similar issues, it appears that the Council also used the same discussion of nonfishing adverse effects with the same suggested conservation and enhancement measures in all four FMP draft amendments, beginning with the Bluefish FMP. We strenuously object to boilerplate descriptions of forestry and other nonfishing adverse impacts, even in the impact priority subsection at 2.2.5.1. Even though the Surfclam and Ocean Quahog FMP amendment provides a more extensive analysis in the priority section, it then repeats the boilerplate for each nonfishing activity with no effort to show how a particular activity impacts clam EFH. Without any connection to the EFH of the species managed under the FMP, these discussions are at best meaningless or, at worst, will cause severe overreaction and overregulation by Council and NMFS staff, not to mention the public.

3. "Silvicultural NPS" - Subsection 2.2.5.3.3 (2.2.5.4.3 in the Clam FMP)

The apparent purpose of the first two paragraphs is to assert that silviculture has significant potential to affect EFH. These paragraphs (a) overstate the importance of silviculture as a nonpoint source of water quality problems and (b) fail to show any connection between silvicultural activities and EFH for any of the species.

The first paragraph of the subsection begins with a sweeping indictment of "Federal land management" for "contributing to the decline of marine and anadramous fish." Various land management activities are identified along with their potential effects on surface waters and fish habitat. Many of the listed activities (e.g., grazing, mining, hydropower development) have nothing to do with silviculture. It is not clear why a subsection on "Silvicultural NPS" includes a general expression of concern about Federal land management activities. Moreover, it is not clear how this general concern connects silviculture with EFH for these species. Most of the Federal forest lands in the eastern U.S. are in mountainous areas many miles from the Atlantic coast. On lands that are near the coast (e.g., Francis Marion National Forest), silvicultural activities are generally focused on wildlife habitat improvement and ecosystem management objectives.

The second paragraph of the subsection comprises carefully selected statements about silvicultural contributions to nonpoint source pollution. The intended message is that managers of EFH should be very concerned about silviculture. These managers should be presented with a more complete and balanced discussion of silvicultural NPS that has some relevance to the particular EFH. It should be noted, for example, that silviculture is a very minor source of NPS pollution in the eastern U.S. compared to agriculture and urban runoff. All states with significant forestry activities have nonpoint source control programs that address silvicultural NPS. Most silvicultural activities are conducted using Best Management Practices (BMP) that are very effective in controlling silvicultural NPS.

Given that localized effects on sediment and temperature in headwaters are the main water quality concerns associated with silviculture, it seems unlikely that silviculture would have any appreciable effects on the EFH for any of the species in these FMP amendments. If there is any evidence to the contrary, it should be included in the particular amendment.

Many of the conservation measures listed in the draft subsection are already included in state BMP manuals. Inclusion of these measures here is potentially confusing to landowners who may receive slightly different versions from various government sources. It would be better to make reference to state BMP manuals than to repeat the information in the FMPs.

Road Construction and Lack of Thresholds. Throughout the documents, no baselines are established to determine whether the stated impact is significant and worthy of addressing or whether it is trivial. For example: "Delivery of sediment from road construction or reconstruction should be reduced." Reduced from and to what levels?

Vague Statements Relating to Harvest Regimes. The documents are altogether vague in places: "Appropriate skid trail location and drainage and proper harvesting in SMAs should be addressed. No guidance is given in the draft Amendments. Standards pertaining to timber harvest can generally be found in federal and state laws, regulations and guidance documents. Generally these statutes, rules and guidelines set forth objective standards. However, here, instead of objective standards from applicable BMPs, the FMP amendments will likely result in a process in which determinations of "appropriate" and "proper" depend on the particular views, values and objectives of the local agency biologist.

Enforcement of Water Quality Standards. The documents suggest that best forestry management practices should be enforced to ensure water quality standards are attained. Generally, federal agencies may not bring enforcement actions based on the failure of a water body to attain articulated water quality standards. The better approach is simply to determine BMPs and implementation through existing state programs.

Restoration of Upland Habitat. The documents speak to the issue of restoring riparian and upland habitat; however, such a recommendation is outside the purview of EFH authority and the documents are too vague to be useful.

4. Conclusions

In summary, we believe the draft amendments are flawed and need reconsideration due to the following:

- NMFS and the Council are promoting EFH so as to include all habitat rather than "essential habitat" and without appropriate justification.
- NMFS and the Council fail to describe in sufficient detail how the listed nonfishing activities represent a "threat" to EFH and what conservation and enhancement measures NMFS contemplates in addressing these "threats," instead relying on boilerplate descriptions.

- NMFS and the Council should indicated with some precision its intent, if any, to extent EFH consultation to areas comprising freshwater and where it is described as EFH.
- NMFS and the Council should clarify and elaborate on its views as to what activity would trigger the EFH consultation requirement.
- NMFS and the Council should produce a realistic assessment of forestry and recognize existing state BMP programs, rather than introducing vague and confusing measures of their own.

We believe that the amendments before the Council, if adopted, will violate the spirit and intent of Congress in adopting the EFH amendments. The proposed amendments go beyond the overly broad, complex, and burdensome approach to EFH articulated in the NMFS proposed and interim final EFH regulations.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

William R. Murray

William R. Murray
Natural Resources Counsel
202/463-2782

The Commonwealth of Massachusetts

Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202

727-3193

PHILIP G. COATES
DIRECTOR

September 25, 1998

Christopher M. Moore, Ph.D.
Acting Executive Director
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790

Dear Dr. Moore:

We offer the following comments on Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP) and Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP. Our focus is on the extent to which these amendments comply with National Standard 9: *"Conservation and management measures shall, to the extent practicable, (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch."*

The Council has not satisfied National Standard 9 for either amendment, and the Council is being disingenuous to claim otherwise. Specifically, on page 126 of Amendment 8 the Council simply states that "staff is currently conducting analyses of sea sampling and vessel trip report (VTR) data to characterize the nature and extent of discarding of other species for Atlantic mackerel, Loligo and Illex squid, and butterfish..." The Council admits that analyses are not completed; therefore, the Council has not met the Standard.

Adding to its failure to meet National Standard 9, the Council proposes no remedy to its longstanding "problem for resolution" regarding the mixed species fishery. For example, in the Council's Amendment 5 to the FMP for Atlantic mackerel, squid, and butterfish fisheries (November 1994), the Council admitted:

> "Butterfish bycatch discard mortality may be inhibiting sufficient growth such that achievement of maximum sustainable yields are prevented...Sea sampling data for 1989, 1990, and 1991 indicate that as much butterfish (by weight) is discarded as is landed..." [Refer to 17th SAW report of January 1994.]

The Council has not taken any steps to address this problem, and this new amendment offers nothing but staff analyses. There are no proposals to minimize bycatch and mortality of that bycatch.

And then there's scup. Here we have another excellent example of the Council failing to meet National Standard 9. On page 151 of Amendment 12 the Council states:

> "...The average discard rate for the 1984 to 1997 period is approximately 33% with a discard rate in the commercial scup fishery in 1997 of approximately 45%. Sea sampling data indicate that the weight of discarded fish may be equivalent to the weight of the landings in some years. Discard rates are higher in years of good recruitment, that is, years when more small fish were available..."

Unfortunately, the Council does not characterize this discard in terms of numbers of fish, a much more telling descriptor of the extent of the discard problem. For example, the table on page 157 of the Report of the 27th SAW (July 1998) revealed:

Number of scup

Year	Landings	Discards
1984	22,011,000	18,237,000
1985	19,899,000	73,470,000
1986	17,742,000	15,903,000
1987	23,768,000	20,478,000
1988	20,098,000	13,841,000
1989	14,221,000	23,774,000
1990	18,427,000	29,141,000
1991	28,112,000	26,160,000
1992	20,703,000	75,279,000
1993	16,149,000	14,119,000
1994	21,499,000	13,486,000
1995	14,565,000	52,486,000
1996	9,576,000	9,383,000
1997	7,213,000	12,775,000

Huge numbers of fish have been discarded dead. Note 1985, 1989, 1990, 1992, 1995, and 1997 when discards greatly exceeded landings. Amendment 12 provides no proposals to reduce this serious discard problem. This is a major omission in light of the 27th SAW conclusion that the 1997 year class appears to be strong. The SAW noted:

> "...Although discard estimates are uncertain, the majority of fishing mortality in recent years is clearly attributable to discards, particularly when incoming recruitment is strong."

The Council retreats to the position of its not being able to respond to the discard problem due to a lack of discard data. The Council holds to its often stated position that:

> "...The collection of additional data by NMFS will allow the Council and Commission to respond to discard problems by changes in mesh, threshold and minimum size regulations or by implementing season and area closures in response to changes in fishermen behavior or an increased levels of discards..."

This is an old tune that does nothing to deal with the immediate problem of recovering seriously overfished scup by achieving F_{max}, the Council's proposed proxy for F_{msy}. The severity of the discard problem argues for an Amendment 12 proposal, i.e., some commitment by the Council for timely and effective action.

The above Council position suggests to the uninitiated that if a discard problem develops, as identified by NMFS new data, the Council will respond appropriately. We are not convinced that the Council knows how to respond to an already identified major problem. Perhaps the Council is unwilling to respond because the squid fishery has a higher priority than scup and no action to reduce scup discard will be taken if that action will hinder the squid fishery.

We argue that the Council intention for 1999 to lower the threshold requiring fishermen to switch to a 4 ½" mesh cod end net (200 lbs. from November through April) will not reduce the magnitude of the scup discard problem; therefore, the Council's claim that National Standard 9 is satisfied through changes in the threshold is false. We support our position with recent NMFS sea sampling data. Specifically, on March 27 a vessel targeting squid in 50-70 fathoms southwest of Hudson Canyon in a 1-hr. tow caught 170 lbs. of Loligo squid and discarded 3,500 lbs. of scup. In another tow (almost 3 hrs.) this same vessel targeting squid discarded about 158,000 lbs. (captain's estimate of 1,500 boxes at 100 lbs. per box)! The net's codend and extension was packed with scup causing the net's belly to rip open spilling most of the catch. Of the amount sorted on deck, 200 lbs. of scup were kept and 8,000 lbs. were discarded. No squid were observed.

The implication of this discard is very significant. A DMF preliminary analysis of the loss to stock biomass at age 3 of this 158,000 lbs. discard indicates that this amount of scup would have produced about <u>348,000 lbs. of 3-year old scup</u> with a natural mortality of 0.20 per year and no fishing mortality at ages 0-2. Note that the Council set a 1997 summer quota of 362,000 lbs. for Massachusetts in 1997. This amount was discarded in just these two tows (4 hours) targeting squid this past March. Our calculation assumes the catch was primarily of age 1 fish based on length frequency data from the nearby tow with the 3,500 lbs. of discard. The average size of discard was about 7" with a range of 5 ½" to 9."

In light of the above discard information and DMF's analysis of its impact, we argue that the Council has not satisfied National Standard 9 for scup, hence Amendment 12. Furthermore, we find the following Council conclusion (p. 153) regarding National Standard 9 to be a "reach" and quite confusing:

> "The commercial and recreational management measures in this FMP represent the most effective tool for managing...The use of these measures are necessary to satisfy National Standard 1...By maximizing the number of fish released alive, the Council has also satisfied National Standard 9 by minimizing bycatch mortality to the extent practicable. Even though...scup...discards occur as a consequence of some of the management measures currently being used to manage the fisheries, the conservation benefits derived from preventing overfishing and maintaining optimum yield on a continuing basis outweighs potential losses due to discarding associated with the implementation of these management measures. Therefore, National Standard 9 is satisfied."

How has the Council maximized the number of fish released alive in this mixed species fishery responsible for so much discard? How has it minimized bycatch? The aforementioned rationale seems to assume that 4 ½" mesh (cod end only) is satisfactory to deal with discard (i.e., maximize releases). Perhaps if the fishery was single species, but it is not. We refer you to the Council's scup "problem for resolution" cited in the May 1995 Scup FMP:

> "The Council has included <u>no measures</u> (emphasis added) in this FMP at this time to specifically address the mixed trawl fishery problem, although the Council 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 measures put in place through this FMP could be used to implement the measures developed through this process."

It is the end of 1998 – a little more than 3 years later. Where are these measures?

You have a non sequitur in your above reasoning – "The commercial and recreational...Therefore National Standard 9 is satisfied." It does not follow that conservation benefits from preventing overfishing outweigh potential losses due to discarding. Discarding will continue to cause overfishing. We continue to insist that until scup discard is reduced significantly in the Mid-Atlantic/southern New England mixed species fishery, overfishing will not be prevented, optimum yield will not be maintained on a continuing basis, and there will be little conservation benefit. Consequently, potential losses due to discarding will not be outweighed. National Standard 9 is not satisfied.

For another important reason it's critical for the Council to significantly reduce discards. As noted above, the Council proposes to use the maximum value of the spring bottom trawl survey index based on a 3-year moving average (2.77 kg/tow) as a biomass threshold. This is the proxy for B_{msy}. Unless discarding during the winter fishery from November through the period just prior to the spring survey is reduced, the Council runs what would seem to be a high risk of never achieving this 2.77 value, only seen once since 1969 (1978). Only seen once in about 30 years! Does the Council really believe an index of 2.77 (as a 3-year moving average) will ever occur when whatever recruitment is produced in any given year (and as ages 1 & 2) potentially will be heavily discarded before the survey net hits the bottom? By the way, what is $\frac{1}{2}B_{msy}$? Is it an index of 1.38? If so, an index this high has only occurred 3 times since 1969 (in 1976, 1977, and 1978). Furthermore, the index was 0.06 in 1997. What are the implications of 0.06 relative to 2.77, or 1.38?

Of note, the Overfishing Review Panel's Final Report (June 17, 1998) stated:

"...Mixed-stock fishery management can now allow a stock to fall below its minimum stock size threshold...The panel, however, considers allowing stocks to fall below the panel's minimum biomass thresholds to be very risky. These thresholds were based on maximum rebuilding potentials or at $1/4B_{msy}$, a level that the panel believes would risk poor recruitment and penial stock collapse..."

What is $1/4B_{msy}$ for scup? Is it 0.69 (1/4 of 2.77)? This value is higher than the 1997 index of 0.06. Using the bottom trawl index as a proxy for B_{msy} raises numerous questions that should be answered in the Amendment.

Finally, we end with a comment about essential fish habitat. Both Amendments have left out Massachusetts waters as essential fish habitat for squid, summer flounder, scup, and black sea bass. Eggs and larvae of squid, scup, and black sea bass are found in these waters (i.e., Nantucket and Vineyard Sounds). Juveniles and adults of these species and summer flounder are also found in these waters. Juvenile and adult butterfish are found there as well. We assume the Amendments missed these areas because data documenting EFH were based on NMFS bottom trawl surveys and ichthyoplankton surveys done in federal waters only. Please correct this omission. If you need assistance let us know.

In conclusion, we appreciate that the Council working with ASMFC has worked hard to meet the deadline for submission of these two amendment to meet the new Sustainable Fisheries Act requirements. Nevertheless, considering the importance of discard elsewhere and its impact on Massachusetts inshore fisheries, we must object to the Amendments and their cavalier treatment of National Standard 9. Our specific concern about scup conservation and effective, equitable management of the scup fishery already has been manifested through our successful lawsuit against NMFS and the Secretary of Commerce. We now await the Council's response to our comments and questions and for a NMFS equally critical review of these Amendments.

Sincerely yours,

Philip G. Coates

cc.
Mass. Marine Fisheries Commission
James Gilford
Paul Howard
Jack Dunnigan
Mid-Atlantic Council members
Patricia Kurkul

Mr. and Mrs. Edward T. Smith
7605 Worcester HWY.
Newark, MD 21841

9/4/98

Dear Sirs,

Regarding the amendments to the managment plans for Flounder, Scup, Sea bass, Surf Clam, Mackeral, etc:

Regarding habitat damage from fishing gear ,pots and dredges are considered to cause potential damage. Any damage from pots is insignificant compared to dredges that not only scrape the bottom but destroy pots and other gear.

Pots do not ghost fish as stated in the plan. Pots have biodegradable panels if they aren't all wood, inwhich case they are eaten by worms in a few weeks.

Overpopulation is blamed for habitat degradation. Overpopulation in the United States is from immigration; our birthrate is at replacement level or below for nonimmigrants. N.M.F.S. should reccommend that congress curtail immigration.

The paper work reduction act is mentioned. Have you considered the time required to read 3 ammendments of over 200 pages each? Working people don't have time for this.

The framework adjustment process won't allow fishermen time to plan for changes or find other sources of income.

Overfishing definitions are indecipherable. They should be explained so a fisherman or even a member of congress could understand them. It sounds like"We don't know this; so we're going to guess at it", writen in gobbly gook.

Sincerely,

Mr. and Mrs. Edward T. Smith

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FISHERIES DIVISION
MARINE FISHERIES OFFICE
P. O. BOX 719
OLD LYME, CT 06371

September 10, 1998

Christopher M. Moore, Ph.D.
Acting Executive Director
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-6790

Comments on Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass FMP

Dear Chris:

In reviewing the public hearing summary describing the scup and black sea bass control rules, I'm curious about the recommendation to adopt the maximum value of the spring survey index as a biomass threshold. Perhaps I'm off the mark on this, but it seems to me that the proxy value for a biomass threshold (the minimum boundary of the control rule?) should be some minimum value, or percentile, of the distribution of observed survey values (e.g. the 25th percentile) rather than a maximum value. The proxy for $F_{threshold}$, it seems to me, would be a maximum value or some percentile close to the upper bound of the distribution.

Could you explain the rationale for adopting the biomass threshold proxy values? If anything I've said herein makes any kind of sense at all, perhaps a re-examination is in order (S&S Committee, a peer review of some sort).

Thanks for your consideration!

Sincerely,

Eric M. Smith
Assistant Director

NATURAL RESOURCES DEFENSE COUNCIL * ENVIRONMENTAL DEFENSE FUND *
NATIONAL AUDUBON SOCIETY * CENTER FOR MARINE CONSERVATION

September 25, 1998

Dr. James H. Gilford
Chairman
Mid-Atlantic Fishery Management Council
Room 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Re: Draft Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan

Dear Dr. Gilford,

The Natural Resources Defense Council (NRDC), Environmental Defense Fund (EDF), National Audubon Society (NAS) and Center for Marine Conservation (CMC) submit the following comments on draft Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP). The comments address overfishing, bycatch and habitat for each of these fish in turn.

SUMMER FLOUNDER

I. Introduction

Summer flounder (or "fluke") is a flatfish which inhabits the Atlantic Coast from Maine to Florida. It is managed jointly (north of Cape Hatteras) by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission. The species is currently classified by NMFS as "overfished." It is recovering from severe overfishing which depleted the population during the late 1980's. It is estimated that it will take up to ten years to rebuild the stock to healthy, sustainable levels.

The current biomass is estimated to be about 120 million pounds versus a rebuilt target of 338 million pounds. The size and age structures are severely truncated. There are strong 1994 and 1995 year classes, but the upcoming 1996 and 1997 year classes are weak and there is very low abundance of larger, older fish. This situation warrants a careful management approach.

Summer flounder is caught both by commercial fishers in a directed fishery using trawl gear or gillnets (and sometimes poundnets inshore), as bycatch in directed commercial fisheries for squid and other finfish using smaller mesh sizes, and by recreational fishers using hook and line. Over recent years, the proportion of the catch taken by recreational fishers has declined from about 60% to about 40%. Total landings were about 69 million pounds in 1980, declined to about 18 million pounds by 1990, and have partially recovered to about 24-27 million pounds since 1991. Fish killed, but not landed, add significant mortality estimated to be 25% of the recreational catch and 6% of the commercial catch. However, bycatch and discard mortality is known to be much higher in some commercial fishing operations.

II. Problems in the fishery

The collapse of the summer flounder stocks occurred as a direct result of overfishing by both commercial and recreational interests. Amendment 2 to the Summer Flounder FMP established a fishing mortality reduction program, adjusted by Amendments 7 and 10, that should, if met, drastically reduce fishing mortality rates and rebuild summer flounder stocks within ten years.

Four separate problems threaten the recovery of summer flounder: liberal quota setting, recreational overages, mortality due to commercial bycatch and discards and with recreational releases, and habitat degradation. The recommendation of the Summer Flounder Monitoring Committee charged with monitoring the rebuilding of this species was recently (August) overridden by the MAFMC and the ASMFC, resulting in a total allowable landings (TAL) limit for 1999 that is higher than biologically supportable and inconsistent with the rebuilding plan. Conservation groups have contested the 1999 TAL limit, asking NMFS to substitute the limit recommended by the Monitoring Committee.

Overages in the recreational sector are another serious problem. Recreational fishers overran their catch limit by about 7.2 million pounds in 1996 and 1997 combined; preliminary data for 1998 suggest that an overage of as much as 13 million pounds may occur. Conservation groups have asked NMFS and the Commission to take emergency measures to limit further recreational overruns.

Bycatch and mortality of discards and releases remain a serious problem in this fishery. For example, approximately 25 percent of the flounder by weight that are caught and released by anglers are estimated to die later due to injury and other trauma. Mortality associated with commercial operations is know to result in significant, but largely undocumented additional losses.

The fourth major threat to healthy summer flounder populations is habitat loss and degradation in inshore nursery areas, where burgeoning coastal development accumulates, threatening both the physical and hydrological integrity of the habitats and the water quality which supports them. Submerged plant beds and brackish creeks are particularly important nurseries, vulnerable to destruction both by water pollution and by damage from inshore trawling.

III. Current Management Issues

The rebuilding schedule established in Amendment 2 is expected to restore the population within 10 years to Bmsy. However, the MAFMC has failed to adhere to the rebuilding plan, jeopardizing the recovery of the population. As noted above, for example, the Total Allowable Landings limit adopted for the 1999 fishing year has a *three percent* chance of realizing rebuilding on the required schedule. Even that estimate may prove optimistic if the existing levels of fishing mortality lead to the extinction of the two good year classes, leaving only poor to average year classes from 1996 and 1997.

The 1999 TAL limit would increase the fishing mortality rate by *fifty percent* over the rate specified in the FMP (from F=.24 to F=.36). Meeting the target F specified in the FMP is necessary to end overfishing of summer flounder and to rebuild the fishery within 10 years, both requirements of the Magnuson-Stevens Act.

Recreational overruns are a second major issue that requires attention. A fundamentally new approach to managing recreational allocations is needed, imposing a true quota rather than an allocation of little consequence.

Additional measures are needed to reduce bycatch and minimize the mortality of unavoidable bycatch and to reduce post-release mortality. According to the NMFS' Northeast Fisheries Science Center, "Analysis of Summer Flounder Discarding in 1997 and 1998 Based on Examination of 1997 and 1998 Sea Sampling Data and 1997 Commercial Vessel Trip Reports," the average discard: catch ratio for summer flounder increased to 28 percent in 1997 (from 17 percent in 1996) for otter trawls and scallop dredge gear. The major reason for summer flounder discards in the otter trawl fishery, according to the analysis, is the minimum (14 inch) size regulation.

IV. The Proposed FMP

A. Overfishing

Unfortunately, the MAFMC and the ASMFC are not using the SFA requirements as an opportunity to correct several of the problems in this important fishery. In fact, Amendment 12 does nothing to address overfishing problems beyond simply establishing a frameworking process to address them at an unspecified time in the future, with no other alternatives even being considered.

Given the problems the Council has had in sticking to the rebuilding plan, it is essential that the FMP contain an implementation plan that identifies specific steps or measures that will be adopted to ensure that the recovery targets will be met. Such measure should include:

1) A requirement that Total Allowable Landings/quotas will have a significant chance (we recommend at least an 80% chance) of achieving the target fishing mortality rate specified in the rebuilding plan (as noted above, the 1999 quotas have a 3 percent chance of achieving that goal);
and

2) Measures to prevent recreational overruns, such as establishing state by state recreational quotas. Such quotas, which could be monitored by an improved MRFSS, would require states to close the fishery when the allocation has been reached.

The National Standards Guidelines note that an FMP must be implemented and enforced so that OY is achieved. (63 Fed. Reg. 24212, at 24233, May 1, 1998). "If management measures prove unenforceable—or too restrictive or not rigorous enough to realize OY- they should be modified......" (Id.). The Council currently is not implementing the FMP in a manner that will achieve OY. The FMP amendment must include provisions that will rectify the current problems that stand in the way of achieving OY as soon as possible, and in no event, in less than 10 years, as required by the Act.

The Magnuson-Stevens Act requires that "overfished" stocks, such as summer flounder, scup and black sea bass, be rebuilt as soon as is possible to population levels that will support the optimum yield (OY) on a sustainable basis. Optimum yield is now defined to include consideration of not only food production but also recreational opportunities and protection of ecosystem integrity. Further, the OY population level must always be larger than that which would produce the maximum sustainable yield (MSY). In our view, this new definition means that sufficient population abundance and age distribution must first be restored and then maintained in order to provide: (a) a viable commercial fishery (where appropriate), (b) a quality recreational fishery (where appropriate), and (c) healthy food webs and other ecological relationships - in short, more biomass than just that needed to support the maximum possible total landings over time. Accordingly, we recommend that the discussion of OY, MSY and related concepts found in section 1.1.2.1. (p. 8) and elsewhere throughout Amendment 12 be revised to reflect the law's new provision.

B. Bycatch

The Magnuson-Stevens Act established new requirements to address the issue of bycatch. Section 303(a)(11) requires that an FMP establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority: minimize bycatch; and minimize the mortality of bycatch that cannot be avoided. National standard 9 in section 301 requires that: Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

As noted above, bycatch and discard mortality in the summer flounder fishery is a significant problem. Yet, Amendment 12 fails to identify specific measures for discard data collection, bycatch reduction and minimization.

In the discussion of the new National Standard 9, Amendment 12 cites a "lack of discard data" as an obstacle to addressing discard problems. (Amendment 12, p.153) However, it does not make any suggestions for improving data collection within the fishery. In fact, the Guidelines require that Councils improve data collection. (63 Fed. Reg. p.24235). The FMP amendment needs to add measures for improving the collection of discard data (including bycatch reporting requirements) as part of fulfilling the requirements of the amended Magnuson-Stevens Act. We recommend provisions for observers to more accurately determine the extent of bycatch of summer flounder.

The amendment asserts that bycatch and discards are a necessary part of the management plan to prevent overfishing under National Standard 1. (Amendment 12, p. 154) However, the Council has not considered options which reconcile the need to prevent overfishing *and* reduce bycatch. For example, the amendment fails to even analyze the adoption of a requirement to use circle hooks in the recreational fishery, or to further modify mesh size restrictions or provide time-area closures in the commercial fishery. These measures should be considered to further reduce bycatch below its current levels *and* ultimately restore the fishery to optimum yield as soon as possible.

For each managed species, the bycatch issue should be considered in two ways. Bycatch of all species in the fishery targeting the species in question should be analyzed and bycatch in any fisheries targeting other species which includes individuals of the species in question should be analyzed. Analysis in the amendment also should make clear the way in which the phrase to the extent practicable in being applied (i.e. technically practicable, economically practicable, etc.).

C. Habitat

1. Description and Identification

We support the Council's proposed identification of 90 percent of the offshore areas where life stages of summer flounder have been found as Essential Fish Habitat (EFH). Indeed, we urge the Council to go further and support Alternative 5, Option 4 which would include 100 percent of the area.

A broad designation of EFH is mandatory: fluke remain over-exploited. Moreover, loss of habitat is considered to be a contributing factor to the poor status of the stock. (Amendment 2 to the Summer Flounder FMP, pp. 33-34; Amendment 12, p.64).

The NMFS regulations specifically say that: "If a species is overfished, and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species should be considered essential in addition to certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible." 50 CFR Section 600.815 (a)(2)(ii)(B). There is some evidence that current summer flounder range – or at least the abundance distributions within that range—remains contracted from historical levels for at least some life history stages (Packer and Griesbach Figures 3C and 3D), arguing against further contraction in designated EFH.

In addition, the survey data relied on (both the NEFSC trawl survey and the MARMAP survey) are biased on the low end based on gear effects and sampling protocols (Amendment 12, p. 63), apparently in some cases significantly so. The surveyed area itself does not represent the full extent of summer flounder habitat, making it even more important to designate as much of the surveyed area as possible.

We are troubled by the language on page 65 suggesting that it is only those areas within federal waters that are proposed for EFH designation. (Amendment 12, p. 65) Although EFH is properly characterized subsequently to include "from the coast out to the limits of the EEZ" (pp.65 and 66), the apparent discrepancy in the introductory language must be corrected to make clear that state waters are included. EFH must include at least 90 percent (preferably 100 percent) of the areas, whether occurring in federal or state waters.

We also strongly recommend that the EFH identification be adjusted by filling in the holes and smoothing the data to make the designations more ecologically coherent and less the artifact of sampling design. (For example, in figures 40a-d, the gaps in many cases apparently result principally from gaps in the survey rather than from the observed absence of summer flounder in these areas.) To this end, we recommend that all quads surrounded on at least three sides by identified quads and all coastal quads be included as EFH.

We support the inclusion of those offshore areas south of Cape Hatteras to Florida that exhibit similar parameters to EFH north of Cape Hatteras as EFH. Amendment, pp. 64-66. These areas are omitted from the data layers used to create the initial EFH maps, and may be less well studied, but clearly support an important component of the summer flounder population and must be included. The guidelines permit, where more specific information is lacking (as is the case here), EFH to be inferred from information about its habitat and behavioral characteristics of the species.

We strongly support the proposed inclusion of the mixing and saltwater portions of all major estuaries along the Atlantic coast where summer flounder larvae and juveniles are found, as well as those where adult summer flounder are "common", "abundant", or "highly abundant." Amendment 12, p. 64. Summer flounder are estuarine-dependent and, as such, this habitat is particularly important to protect.

We also recommend that the following additional areas be included as EFH: nearshore coastal waters behind barrier islands and in protected coves and embayments that serve as summer flounder nursery areas; and small estuaries and tidal creeks not tracked by ELMR (which focuses on major estuaries only) where summer flounder are found. State data identifying such areas exists (e.g., North Carolina) and should be utilized now, not just during the subsequent frameworking process.

We support the designation of Submerged Aquatic Vegetation (SAV) as a Habitat Area of Particular Concern (HAPC. Amendment, pp. 67-68. We recommend that it be so designated not just because of its potential value to nursery habitat for larvae and juvenile flounder (who appear to use SAV as a "blind" when they are feeding), but also as a refugia for juvenile and adult summer flounder, including spawning flounder, and for flounder prey.

Finally, we strongly urge the MAFMC to adopt small tidal creeks as HAPC's for summer flounder. These habitats are especially critical to sustain the recovery for this species.

2. Fishing Activities that may Adversely Affect EFH

Bottom gear (otter trawls, clam dredges, sea scallops dredges and other dredges) used from Maine to Virginia in both state and federal waters to catch summer flounder, scup and black sea bass have the potential to adversely affect EFH of these species. Amendment, p. 75. However, the Amendment states that effort of these bottom tending gears is largely unquantified and therefore no management measures designed to minimize adverse effects on EFH are proposed at this time. Id. Not only are explicit management measures lacking from this amendment, but so too is a schedule and clear process for adopting them.

The Magnuson-Stevens Act requires that FMPs minimize to the extent practicable adverse effects on EFH from fishing. Section 307(a)(7). The regulations implementing this section of the Act also require the inclusion of management measures that minimize adverse effects on EFH on fishing, to the extent practicable. 50 CFR Sec. 600.815(a)(3)(ii). The regulations also call for special attention to equipment types affecting habitat of special concern. For summer flounder, inshore trawling—especially in state waters—has a strong potential for degrading EFH, especially SAV's. This fishing-related impact must be addressed through the EFH process.

We urge the Council to take a precautionary approach to safeguarding habitat, acting on the basis of available general information while local data are being gathered. The regulations endorse this approach: they require, as mandatory contents of FMPs, management measures that minimize the adverse effects of fishing activities *"that may adversely affect EFH"* (italics added), using the best available scientific information.

A great deal of prime habitat could be lost if we wait for local site-specific evidence of damage from fishing before action is taken to protect vulnerable habitat from activities known to cause harm elsewhere. Marine reserves (closure areas) are both an essential research tool and a way to protect habitat. Without such areas, it will become increasingly difficult to secure the baseline information needed to understand the impacts of fishing and other human activities. In addition, many scientists consider reserves an important strategy for protecting the habitat and vulnerable life stages from the potential impacts of fishing practices. We urge that Amendment 12 contain a schedule and process for designating marine reserves. We propose identification of a range of proposed sites by April 1999, and final designations of an initial set of research reserves by September 1999.

3. Measures for Conservation and Enhancement of EFH

The Amendment does an admirable job of describing habitat threats from non-fishing activities and recommending measures for conservation and enhancement of habitat in the face of these threats. Amendment, pp. 77-113. The list of activities identified as threats is comprehensive and well-prioritized. The recommended measures are generally strong and effective.

One recommendation we would like to make is on page 103, under Measure D. We would recommend that the language be revised to read:

"Hazardous waste sites should be cleaned up (i.e., remediated) and damaged natural resources restored to prevent contaminants from entering the aquatic food chain and to reduce toxic contaminants in fish to levels that will be safe for human consumption and to sustain a healthy fishery."

4. Review and Revision of EFH components of FMP

We strongly recommend that it be made clear that the framework process will be used to develop measures to minimize fishing impacts on EFH.

SCUP

I. Introduction

Scup is managed jointly by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission, in an FMP along with summer flounder and black sea bass (north of Cape Hatteras only). The species, which is distributed primarily between Cape Cod and Cape Hatteras, is classified by NMFS as "overfished." The spawning stock is at a record low level, and one tenth of the maximum observed in the late 1970s. The age structure is severely truncated, with very few older fish in the fishery. Although estimates are uncertain, in recent years the majority of scup killed result from bycatch.

Scup is caught both by commercial fishers in a directed fishery using otter trawl gear, as bycatch in directed commercial fisheries for squid and other finfish using smaller mesh sizes, and by recreational fishers using hook and line. Commercial landings decreased from 15.1 million pounds in 1991 to the lowest value recorded, 4.8 million pounds, in 1997. Recreational landings have declined from 11.6 million pounds in 1986 to 1.2 million pounds in 1997, again the lowest value recorded. Commercial landings account for about 75% of total landings. Although data are limited, the minimum estimate weight of scup discarded approaches the amount of scup landed by commercial fishermen in most years.

II. Problems in the fishery

The dramatic decline of scup occurred as a direct result of overfishing and bycatch. A major issue in this fishery is the lack of basic information on the biomass of the stock, fishing mortality rates, Bmsy, Fmsy, MSY, bycatch and discards, and other basic information necessary to informed management decisions. This lack of information is affecting the ability of the Council to effectively implement the rebuilding plan, adopted in Amendment 8 and approved by NMFS in 1996, which established a 7 year recovery schedule and imposed target reductions in the fishing mortality rate according to the following schedule:

1997-1999 target F = .72
2000-2001 target F = .45
2002 target F = .24 (Note: .24 equals F_{MAX} equals the overfishing definition)

For example, the lack of good scientific information contributed to the setting of the 1997 TAC at a level far too high to achieve the target F (the actual 1997 F was estimated by the Council staff to be 1.8, more than double the target F). The Council recently approved a 40% reduction in the TAC to get back on track, but the level of uncertainty is such that the Council cannot estimate the likelihood that this TAC will actually achieve the target F.

Similarly, in their 1998 analysis, the Stock Assessment Review Committee (SARC) was not able to provide estimates of B_{MSY}, F_{MSY}, or current estimates of fishing mortality or stock biomass, which has rendered the setting of biological reference points difficult.

Bycatch and discards of scup in the loligo, scup and other small mesh fisheries remain a serious problem. The exact distribution of discards between different commercial fisheries remains unknown, and data that would enable time and area closures to be established to reduce bycatch is scant. To address the bycatch problem, the Council recently dramatically reduced the threshold commercial catch at which minimum mesh size restrictions are triggered. It remains uncertain, however, how much of an effect this will have in reducing bycatch.

The other major threat to scup is habitat loss.

III. Current Management Issues

Several issues are of serious concern. First, uncertainty regarding basic parameters in the fishery severely impacts management. Given the level of uncertainty, a much greater level of caution is called for than is the case in other fisheries. Second, it is far from clear that the target F reductions adopted in amendment 8 will actually achieve rebuilding within ten years, as required by the SFA. Third, the current rebuilding schedule allows overfishing to continue until 2002, which is contrary to the requirements of the Magnuson-Stevens Act and the National Standards Guidelines. Fourth, given the considerable uncertainty about the effect of discarding on exploitation patterns, the overfishing threshold of Fmax is not sufficiently precautionary. Finally, bycatch and discards remain a critical issue requiring further action.

IV. The Proposed FMP

A. Overfishing and Rebuilding

Draft Amendment 12 does little to address overfishing problems beyond simply establishing a frameworking process to address them at an unspecified time in the future, with no other alternatives even being considered. This is a minimalist document from an overfishing perspective, a deficiency which must be corrected. Several issues must be addressed in the revised FMP.

First, the FMP does not estimate the probability that rebuilding will be achieved as soon as possible and within ten years under the F reductions specified in Amendment 8. According to the SARC, the likelihood that rebuilding will in fact be achieved within 10 years by the target F reductions in Amendment 8 is "minimal," even if perfectly implemented. The target F reductions in Amendment 8 need to be revisited and be revised to assure that those reductions will actually achieve rebuilding within 10 years.

Second, the SARC raised questions about the fishing mortality threshold, which is set at F_{MAX} (=.24) in the proposed FMP. "The SARC believes greater caution is necessary in setting a fishing mortality threshold to accommodate the greater uncertainty in the assessment of scup compared to other species where F_{MAX} has been acceptable (i.e., summer flounder). (SARC report, page 147). The SARC recommended a fishing mortality threshold of $F_{0.1}$ = .15. The FMP should be revised to adopt a more precautionary approach, based on the technical guidance for National Standard 1, given the significant uncertainty involved.

Third, the target F reductions in Amendment 8 exceed the fishing mortality threshold of F_{MAX} (.24) until 2002. This is inconsistent with the National Standards Guidelines, which do not permit a "gradual approach" to ending overfishing. (See response to comment 31, 63 FR 24220). In addition, given the SARC conclusion that F_{MAX} is not sufficiently conservative, and the difficulty already experienced by the Council in assuring that TACs will achieve the target F reductions, a much more conservative set of target F reductions is called for.

Fourth, a plan for filling essential data gaps must be developed.

B. Bycatch

The Magnuson-Stevens Act bycatch provisions require three elements: adequate discard data collection, measures to reduce bycatch, to the extent practicable, and, where bycatch is unavoidable, minimization of bycatch mortality. As noted above, bycatch and discard mortality in the scup fishery is a significant problem. Yet, Amendment 12 fails to identify specific measures for discard data collection, bycatch reduction and minimization.

In the discussion of the new National Standard 9, Amendment 12 cites a "lack of discard data" as an obstacle to addressing discard problems. (Amendment 12, p.153) However, it does not make any suggestions for improving data collection within the fishery. In fact, the Guidelines require that Councils improve data collection.(63 F.R. 24235). The FMP amendment needs to add measures for improving the collection of discard data as a first step to fulfilling the bycatch requirements of the amended Magnuson-Stevens Act.

Recent Council action to reduce the landings thresholds that trigger minimum mesh size requirements is an important step forward. However, there does not appear to be 1) a plan for evaluating the efficacy of this measure, or 2) criteria by which to judge its effectiveness. The FMP should establish targets and timetables for reducing bycatch and discards, and then assess the efficacy of the threshold requirements in achieving those targets. In addition, we urge the Council to expand observer coverage of the scup and squid fisheries.

C. Habitat

We support the Council's proposed identification of 90 percent of the offshore areas where life stages of scup have been found as Essential Fish Habitat (EFH). Indeed, we urge the Council to go further and support Alternative 5, Option 4 (p. 61) which would include 100 percent of the area.

We are troubled by the language on page 65 suggesting that it is only those areas within federal waters that are proposed for EFH designation. (Amendment 12, p. 65) Although EFH is properly characterized subsequently to include "from the coast out to the limits of the EEZ" (p. 66), the apparent discrepancy in the introductory language must be corrected to make clear that state waters are included. EFH must include at least 90 percent (preferably 100 percent) of the areas, whether occurring in federal or state waters.

We recommend that the EFH identification be adjusted by filling in the holes and smoothing the data to make the designations more ecologically coherent and less the artifact of sampling design. (for example, in figures 41a and b), the gaps in many cases apparently result principally from gaps in the survey rather than from the observed absence of summer flounder in these areas). To this end, we recommend that quads surrounded on at least three sides by identified quads and all coastal quads be included as EFH.

We strongly support the proposed inclusion of the mixing and saltwater portions of all major estuaries along the Atlantic coast where scup eggs, larvae, juveniles and adults are "common", "abundant", or "highly abundant." Amendment 12, p. 65.

We also recommend that the following additional areas be included as EFH: small estuaries and tidal creeks not tracked by ELMR (which focuses on major estuaries only) where scup are found. State data identifying such areas should be utilized now, not just during the subsequent frameworking process.

With respect to the other habitat issues, including fishing activities that may adversely affect EFH, measures for conservation and enhancement of EFH, and review and revision of EFH components of the FMP, we refer to our comments above in the section on summer flounder. These comments also apply to scup.

BLACK SEA BASS

I. Overfishing

Black sea bass has a life history which makes it unusually susceptible to overfishing among MAFMC-managed species. Black sea bass are very strongly associated with seafloor structural elements in the adult stage; they are protogynous hermaphrodites, with higher proportions of males among larger fish. Juveniles are estuarine associated, making this species particularly vulnerable to habitat destruction from both fishing and non-fishing threats. Management is also fragmented, through the MAFMC north of Cape Hatteras, but by the SAFMC south of Cape Hatteras (matching the current judgment that two fairly distinct populations exist in the Atlantic Ocean, broken approximately at Cape Hatteras).

Moreover, the Mid-Atlantic Bight population is considered overexploited, and in need of rebuilding. SAW 27 confirmed the overfished status of this resource, identifying the current low level of biomass, and relatively high fishing mortality of 0.73. The South Atlantic Bight population is also overexploited. The current rebuilding plan for the northern population was adopted in Amendment 9, and established an 8-year rate reduction schedule to rebuild the stock within ten years.

The draft FMP correctly indicates that MSY (and associated B_{MSY} and F_{MSY}) for black sea bass cannot now be reliably estimated. The overfishing definition is defined as a fishing mortality rate in excess of the threshold fishing mortality rate of F_{MSY}; the MAFMC has adopted a proxy for F_{MSY} of F_{MAX}, which is estimated to be about 0.32 under current stock conditions.

Black sea bass north of Cape Hatteras (but also south of Cape Hatteras according to the SAFMC and NMFS, letter August 1998) should be considered to be "data-moderate" under the recent Technical Guidance Document on National Standard 1. In such cases, the TGD recommends the use of proxies, as the MAFMC has adopted for black sea bass. However, that document clearly discourages the use of F_{MAX} as a proxy for F_{MSY}, based on the likelihood of F_{MAX} to overestimate F_{MSY}. This overestimation occurs because F_{MAX} does not take into account the recruitment declines which always occur at low spawning stock sizes, and because F_{MAX} does not recognize inherent limitations to production related to certain life history characteristics and growth/mortality patterns.

Black sea bass may be a particularly poor species to use F_{MAX}, since these fishes are protogynous hermaphrodites, with delayed sexual transition, and susceptible to impacts on sex ratio and spawning success. The TGD specifically suggests that exceptional precaution be used in such cases (TGD p. 41). For this species, F_{MAX} is not adequately precautionary, and should be modified to a more precautionary proxy.

The ASMFC and MAFMC have argued that F_{MSY} would be equal to F_{MAX} once stocks are rebuilt. While that may be possible, it is a very risky assumption given the overfished and depressed condition of the stock at present. In fact, in the most recent stock assessment conducted at SAW 27, the SARC expressly recommended that F_{MAX} was not adequately protective, and recommended instead that $F_{0.1}$ be substituted, where $F_{0.1} = 0.15$, versus $F_{MAX} = 0.32$.

In keeping with the TGD and consistent with the SARC, we recommend the use of $F_{0.1}$ as a more conservative and precautionary F_{MSY} proxy, and immediate revision of the fishing mortality reduction schedule to reach this goal in the next fishing year. The current schedule will leave in place excessive fishing mortality targets which will likely fail to achieve stock rebuilding on the statutorily required time frame.

Finally, totally inadequate attention has been paid in the document to possible impacts on sex ratios in this species. Given the aggregatory nature of the animal during spawning, and it site-orientation, the larger males are disproportionately vulnerable to fishing mortality. Strong effects have been seen on sex ratios in other protogynous hermaphrodites in the South Atlantic, and may well be occurring in the Mid-Atlantic.

II. Habitat

Black sea bass are particularly vulnerable to habitat destruction or degradation, both from fishing and non-fishing threats. We strongly endorse the identification of EFH for black sea bass to include both estuaries where juvenile abundance is high, and areas offshore where adults congregate. For this species, it is particularly valuable to track life history stages separately, but to protect all of them through appropriate EFH identification and protection efforts.

We also note, as with summer flounder, that many smaller estuaries are not tracked by the ELMR database, and could be left out systematically when important habitat exists for black sea bass life history stages. We request that attention be given to this problem for this species. In contrast to summer flounder, where adequate information exists to list all such tidal creeks now, we recommend that a framework action be initiated as soon as the draft FMP is adopted to expand the EFH definition to include any smaller estuaries not listed for which state or other data demonstrate the presence of life history stages of lack sea bass.

We do not at this time request the same uniform "ecological smoothing" we have requested for summer flounder for EFH for various life history stages of black sea bass, mostly because there is a solid ecological basis for their disjunct arrangement derived from their strong habitat affinities. We do request that all quads where inadequate sampling was conducted under MARMAP be listed as EFH for black sea bass until such time as they are demonstrated not to contain the habitat elements on which the species depends. We also request that transit areas for young adults emerging from estuaries migrating towards offshore structures all be included as EFH, and be considered in the future for HAPC status.

We also strongly recommend that all sea floor structural elements be identified as EFH-HAPC for black sea bass. The Habitat AP recommended this action, as we do not understand why it does not appear in the draft. The listing of such structures as HAPC's does not preclude fishing on those structures, but will allow enhanced management for their habitat value – absolutely critical for black sea bass.

Spawning aggregations are particularly at risk as fishing targets. It seems likely that the full recovery of this species will depend upon the installation of zones where all fishing is precluded, to allow recovery of more natural size and sex distributions, and elevated spawning success. The MAFMC should immediately initiate an analysis of the utility of marine reserves expressly for population enhancement for black sea bass. We are spending considerable effort developing the technical basis for such reserves as elements of fisheries management programs, and would be pleased to work with the MAFMC, the ASMFC, and staff to develop a proposal along these lines.

MISCELLANEOUS COMMENTS

1. Framework Adjustment Procedure

We strongly support the framework adjustment procedure outlined at pp. 141-2. This procedure would allow the Council to impose management measures at any time during the year following a stream-lined review process (that we understand will take 2-3 months). The current plan apparently permits such measures to be adjusted only on an *annual* basis. As long as there is adequate opportunity for public review and comment, we believe this process represents a valuable element of the amendment (although the existence of this process in and of itself may not substitute for measures that should be included in this amendment now). For example, if quotas are being seriously overrun, this procedure would enable the Council to impose measures mid-year to minimize the overages, rather than wait until year end. For this reason, we strongly support the inclusion of this procedure.

2. Objectives of the FMP

The objectives of the FMP (p. 9) should be revised to more completely reflect the new requirements of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act. Those objectives should include:

- To end overfishing of summer flounder, scup and black sea bass and implement the precautionary approach to fishery management;
- To rebuild overfished fisheries and control all components of fishing mortality, both directed and incidental, so as to ensure the long-term sustainability of the stocks and promote stock recovery to the level at which the maximum sustainable yield (MSY) can be supported on a continuing basis;
- To minimize to the extent practicable, bycatch of living marine resources and the mortality of such bycatch that cannot be avoided in the fisheries;
- To provide the data necessary for assessing the fish stocks and managing the fisheries, including addressing inadequacies in collection and ongoing collection of social, economic, and bycatch data;
- To identify and protect areas identified as essential fish habitat.

We appreciate this opportunity to comment.

Yours sincerely,

Sarah Chasis

Sarah Chasis, Senior Attorney
Lisa Speer, Senior Policy Analyst
Natural Resources Defense Council

Doug Rader

Doug Rader, Ph.D.
Senior Scientist
Environmental Defense Fund

Sonja Fordham
Fisheries Project Manager
Center for Marine Conservation

Jim Chambers
Fisheries Biologist
Living Oceans Program
National Audubon Society

Cc: Chris Moore, Acting Executive Director, MAFMC
Jack Dunnigan, Executive Director, ASMFC
Jon Rittgers, Acting Regional Administrator, Northeast Region, NMFS
Susan Fruchter, Director, Office of Policy and Strategic Planning, NOAA

Christopher M. Moore, Ph.D.
Acting Director
Mid-Atlantic Fishery Management Council
300 S. New Street
Dover, DE 19904

Re: <u>Proposed Amendment 12 to Summer Flounder Fishery Management Plan</u>

Dear Dr. Moore:

I am writing regarding proposed Amendment 12 to the Summer Flounder Fishery Management Plan which the Mid-Atlantic Fishery Management Council has prepared in response to recent changes in the Magnuson-Stevens Fishery Conservation and Management Act.

Summer flounder, also known as fluke, are a marine fish popular with recreational and commercial fishermen. Summer flounder were severely overfished in the late 1980's. Due to management measures adopted by the Council and the Atlantic States Marine Fisheries Commission, the population has begun to rebuild; however, it is still considered overfished and, according to the proposed amendment, it will take up to a decade of proper management to rebuild summer flounder back to sustainable levels.

Habitat degradation has contributed to the poor state of the stock. Summer flounder are dependent on estuaries as nursery and feeding areas. Many of these estuaries have been adversely affected by the filling of wetlands, polluted runoff, dredging, alternation in freshwater flows and other activities. Protection of essential fish habitat is thus a important component of a rebuilding strategy for summer flounder.

The Magnuson-Stevens Act requires that the proposed summer flounder amendment end overfishing and rebuild the stock as quickly as possible (but in no event in more than 10 years), reduce bycatch and bycatch mortality, and identify Essential Fish Habitat (EFH) and measures to protect it. The proposed amendment satisfies these requirements only partially.

It contains no new measures to end overfishing and rebuild the stock, instead relying on current measures and the rebuilding schedule already in place. It also fails to identify specific measures that will reduce bycatch and minimize bycatch mortality.

Given current problems in the fishery that threaten achievement of the current 10 year rebuilding schedule (for example, a 1999 quota that is inconsistent with the rebuilding schedule, significant overruns in the recreational fishery, and high discard mortality), it is not enough to rely on current measures. Instead, the proposed amendment must contain

(over, please)

additional measures to ensure that these problems are dealt with and that recovery targets are met and bycatch minimized.

Such additional steps should include:

1) A requirement that annual quotas have at least an 80% chance of achieving the target fishing mortality rate specified in the rebuilding plan;
2) Measures to prevent recreational overruns, such as establishment of state by state recreational quotas that when exceeded would result in season closures and deductions from the state's quota the succeeding year;
3) Measures to reduce bycatch and bycatch mortality in both commercial and recreational sectors.

The amendment overall does a good job of identifying Essential Fish Habitat. The identification, however, should be made even more complete by the inclusion of: 100 (rather than 90) percent of the offshore areas where life stages of summer flounder have been found; areas excluded because of sampling methodology; and nearshore coastal waters behind barrier islands, protected embayments, small estuaries and tidal creeks that serve as summer flounder nursery areas.

The amendment fails to include any measures to minimize the impacts of fishing activities on EFH, despite the Act's requirement that such measures be included. I support the designation of marine reserves (closure areas) both as a research tool and a way to protect habitat, as well as recommended measures to minimize the adverse effects of inshore trawling on Submerged Aquatic Vegetation (SAV).

I appreciate this opportunity to comment on the proposed amendment and I look forward to your response.

Sincerely,

John J. Seigel
(Name)
4425 Olive Grove Lane
Va. Beach Va. 23455.
(Address)

P.S. Party boat get Fish to small to cook, Seining off Coast. Clean out Fish. before they can reproduce. – I used to get 5# Flounder in Va. waters Now 1# is average. – Please help. restore the stock. Thanks.
9/19/98.
John Seigel

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I appreciate this opportunity to comment on the proposed amendment and I look forward to your response.

Sincerely, Elizabeth Hanke

Elizabeth Hanke
(Name)
P.O. Box 1024
Parksley, VA 23421
(Address)

P.S. Our wetland Community (the Eastern Shore of Va.) relies heavily on the Commercial fishing industry and the tourist trade that recreational fishing attracts. Our local watermen are already suffering due to the decline of the oyster and the blue crab. The recovery of the "Rockfish" is proof that only tough measure will ensure the survival of a depleting species. You must also consider what hurricanes and Nor'easters of the past years have done to underwater ~~ve~~ vegetation and the Coastal landscape. I urge you to take the additional steps needed to bring Amendment 12 up to the requirements of the Magnuson-Stevens Act. Thank you! Eliz

Christopher M. Moore, Ph.D.
Acting Director
Mid-Atlantic Fishery Management Council
300 S. New Street
Dover, DE 19904

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I appreciate this opportunity to comment on the proposed amendment and I look forward to your response.

Sincerely,

[signature]
(Name)

4689 Shoulders Hill Rd
Suffolk, VA 23435
(Address)

P.S. Stopping the fishing for one year seems to have worked for other species.

Christopher M. Moore, Ph.D.
Acting Director
Mid-Atlantic Fishery Management Council
300 S. New Street
Dover, DE 19904

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I appreciate this opportunity to comment on the proposed amendment and I look forward to your response.

Sincerely,

Lauren Johnson
(Name)
[illegible] Trail
Virginia Beach VA 23454
(Address)

P.S.

APPENDIX 3. PROPOSED REGULATIONS

50 CFR PART 648

Fisheries of the Northeastern United States; Amendment 12 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan

§ 648.76 Framework specifications.

(a) *Within season management action*. The Council may, at any time, initiate action to add or adjust management measures if it finds that action is necessary to meet or be consistent with the goals and objectives of the Summer Flounder, Scup, and Black Sea Bass FMP.

(1) *Adjustment process*. After a management action has been initiated, the Council shall develop and analyze appropriate management actions over the span of at least two Council meetings. The Council shall provide the public with advance notice of the availability of both the proposals and the analysis and opportunity to comment on them at the first Council meeting and prior to and at the second Council meeting. The Council's recommendation on adjustments or additions to management measures must come from one or more of the following categories: minimum fish size, maximum fish size, gear restrictions, gear requirements or prohibitions, permitting restrictions, recreational possession limit, recreational seasons, closed areas, commercial seasons, commercial trip limits, commercial quota system including commercial quota allocation procedure and possible quota set asides to mitigate bycatch, recreational harvest limit, annual specification quota setting process, FMP Monitoring Committee composition and process, description and identification of essential fish habitat (EFH) and fishing gear management measures that impact EFH, description and identification of habitat areas of particular concern, overfishing definition and related thresholds and targets, regional gear restrictions, regional season restrictions (including option to split seasons), restrictions on vessel size (LOA and GRT) or shaft horsepower, operator permits, any other commercial or recreational management measures, any other management measures currently included in the FMP, and set aside quotas for scientific research.

(2) *MAFMC recommendation*. After developing management actions and receiving public testimony, the MAFMC shall make a recommendation to the Regional Administrator. The MAFMC's recommendation must include supporting rationale and, if management measures are recommended, an analysis of impacts and a recommendation to the Regional Administrator on whether to issue the management measures as a final rule. If the MAFMC recommends that the management measures should be issued as a final rule, the MAFMC must consider at least the following factors and provide support and analysis for each factor considered:

(I) Whether the availability of data on which the recommended management measures are based allows for adequate time to publish a proposed rule, and whether regulations have to be in place for an entire harvest/fishing season.

(ii) Whether there has been adequate notice and opportunity for participation by the public and members of the affected industry in the development of the MAFMC's recommended management measures.

(iii) Whether there is an immediate need to protect the resource.

(iv) Whether there will be a continuing evaluation of management measures adopted following their implementation as a final rule.

(3) *Regional Administrator action*. If the MAFMC's recommendation includes adjustments or additions to management measures and, after reviewing the MAFMC's recommendation and supporting information:

(I) If the Regional Administrator concurs with the MAFMC's recommended management measures and determines that the recommended management measures should be issued as a final rule based on the factors specified in paragraph (b)(2) of this section, the measures will be issued as a final rule in the Federal Register.

(ii) If the Regional Administrator concurs with the MAFMC's recommendation and determines that the recommended management measures should be published first as a proposed rule, the measures will be published as a proposed rule in the Federal Register. After additional public comment, if the Regional Administrator concurs with the MAFMC recommendation, the measures will be issued as a final rule in the Federal Register.

(iii) If the Regional Administrator does not concur, the MAFMC will be notified in writing of the reasons for the non-concurrence.

(b) *Emergency action.* Nothing in this section is meant to derogate from the authority of the Secretary to take emergency action under section 305(e) of the Magnuson-Stevens Act.