AMENDMENT 8

TO THE

ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERY MANAGEMENT PLAN

(Includes Draft Environmental Assessment and Draft Regulatory Impact Review)

August 1998

Mid-Atlantic Fishery Management Council

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: 20 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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TO THE

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2. SUMMARY

Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to manage the Atlantic mackerel, squid, and butterfish fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The 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 in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised.

The purpose of this amendment is to bring the Atlantic Mackerel, Squid, and Butterfish 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 Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish 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 FMP modified by this Amendment was implemented on 1 April 1983. The current management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction.

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

The fishing year for Atlantic mackerel, *Illex* and *Loligo* squid, and butterfish is the twelve (12) month period beginning 1 January.

National Standard 1: Overfishing Definitions

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

Atlantic mackerel

Overfishing for Atlantic mackerel will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (F=0.45), and the target F is the tenth bootstrap percentile of F_{MSY} (F=0.25). To avoid low levels of recruitment, the threshold F decreases linearly from 0.45 at 890,000 mt SSB to zero at 225,000 mt SSB (1/4 B_{MSY}), and the target F decreases linearly from 0.25 at 890,000 mt SSB to zero at 450,000 mt SSB (½ B_{MSY}). Annual quotas will be specified which correspond to a target fishing mortality rate according to this control law. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}.

The annual quota specification in the current FMP is based upon a catch associated with a fishing mortality rate of $F_{0.1}$ ($F=0.27$). The proposed target fishing mortality rate in this Amendment is 0.25, a slight reduction from the previous value of $F_{0.1}$ (0.27). As a result, the adoption of the target F proposed in this amendment would result in a quota specification slightly lower than the value specified in the current FMP. The catch associated with a fishing mortality rate of $F_{0.1}$ is 405,000 mt given the most recent estimates of stock size. The catch associated with the target fishing mortality rate of $F=0.25$ proposed in this amendment would be 369,000 mt, or an 8.8% reduction.

Loligo pealei

Overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Target F is defined as 75% of the F_{max} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy). Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as 1/2 B_{MSY}. Quotas will be set annually by the Regional Director according to the FMP.

Based on the proposed definition of overfishing, the target fishing mortality rate would be $F=0.135$. The quota associated with this fishing mortality, assuming average biomass conditions in the upcoming year, would be approximately 21,000. Maximum OY, defined by the overfishing threshold, would be specified as the catch associated with $F_{max,}$ which is estimated to be 26,000 mt. The new definition of overfishing would not change the specification of OY or Maximum OY for *Loligo* relative to the current definition of overfishing.

Illex illecebrosus

Overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}.

The most recent estimate of MSY for *Illex* is 24,000 mt, which is the same as the current specification of Maximum OY (24,000 mt) for *Illex*. However, the proposed fishing mortality target (75 percent of F_{MSY} or $F=0.56$) would result in a yield of 18,000 mt, which is 1,000 mt lower than the current OY quota specification for *Illex*.

Atlantic butterfish

Overfishing for Atlantic butterfish will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}.

The overfishing threshold for butterfish is currently specified as F_{msy}, so this part of the overfishing definition is unchanged. The most recent estimate of MSY for butterfish was 16,000 mt which is the current specification of Maximum OY. The yield associated with the target fishing mortality rate (75% of F_{msy}) proposed in this Amendment is 12,000 mt, which is well above the current annual quota specification of 5,900 mt.

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 measures adopted by the Council for this Amendment are:

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 (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. Any other commercial or recreational management measures.
22. Any other management measures currently included in the FMP.
23. Set aside quota for scientific research.
24. Regional management.
25. Process for in season adjustment to the annual specification.

Vessel Size Restrictions in the Atlantic Mackerel Fishery

This Amendment would restrict the size of domestic harvesting vessels permitted in the Atlantic mackerel fishery. Vessels issued Atlantic mackerel permits are not to exceed 165 feet in length overall (LOA) and 750 gross registered tons or have shaft horsepower exceeding 3000 shp.

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APPENDICES

1.0 INTRODUCTION

Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to manage the Atlantic mackerel, squid, and butterfish 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 Atlantic Mackerel, Squid, and Butterfish 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 Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish 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

In March 1977, the Council initiated development of the Mackerel and Squid FMPs. The Council adopted the Mackerel FMP for hearings in September 1977 and the Squid FMP for hearings in October 1977. Hearings on Mackerel and Squid FMPs were held in December, 1977. The Mackerel and Squid FMPs were adopted by the Council in March 1978. The Mackerel FMP was submitted for NMFS approval in May 1978. The Squid FMP was submitted for NMFS approval in June 1978. However, based on NMFS comments, the Council requested that the Mackerel and Squid FMPs be returned.

The FMPs were revised, the revisions being identified as Mackerel FMP Supplement 1 and Squid FMP Supplement 1. These two Supplements, along with the original Butterfish FMP, were adopted for public hearings by the Council in July of 1978. Hearings on all three documents were held during September and October 1978 and all three FMPs were adopted in final form by the Council in November 1978. The Butterfish FMP was submitted for NMFS approval in December 1978. Mackerel FMP Supplement 1 and Squid FMP Supplement 1 were submitted for NMFS approval in January 1979. NMFS approved Squid FMP Supplement 1 in June 1979 and Mackerel FMP Supplement 1 in July 1979. Both FMPs were for fishing year (1 April - 31 March) 1979-80.

The Butterfish FMP was disapproved by NMFS in April 1979 because of a need for additional justification of the reasons for reducing OY below MSY. The Butterfish FMP was revised, adopted by the Council, and resubmitted for NMFS approval in June 1979. It was approved by NMFS in November 1979 for fishing year 1979-80.

The Council adopted Amendments 1 to both the Mackerel and Squid FMPs for hearings in August 1979. Hearings were held during October 1979. The Amendments were adopted by the Council and submitted for NMFS approval in November 1979. Both Amendments were approved by NMFS in March 1980. This extended the Squid FMP for an indefinite time beyond the end of fishing year 1979-80 and extended the Mackerel FMP through fishing year 1980-81. Butterfish FMP Amendment 1, extending the FMP through fishing year 1980-81, was adopted by the Council for hearings in December 1979 with hearings held during January 1980. During January 1980 the Amendment was adopted in final form by the Council and submitted for NMFS approval and was approved in March 1980.

The Council began work on an amendment to merge the Mackerel, Squid, and Butterfish FMPs in March 1980 the document being identified as Amendment 2 to the Mackerel, Squid, and Butterfish FMP. The Amendment was adopted by the Council for public hearings in August 1980. However, NMFS commented that there were significant problems with the Amendment that could not be resolved prior to the end of the fishing year (31 March 1981). The Council then prepared separate Amendments 2 to both the Mackerel and Butterfish FMPs to extend those FMPs through fishing year 1981-82. Since Amendment 1 to the Squid FMP extended that FMP indefinitely, there was no need to take this action for the Squid FMP. Those drafts were adopted for public hearing by the Council in October 1980 with hearings held in November. The Amendments were adopted in final form by the Council and submitted for NMFS approval in November 1980. Amendment 2 to the Mackerel FMP was approved by NMFS in January 1981 and Amendment 2 to the Butterfish FMP was approved by NMFS in February 1981.

In October 1980 the merger amendment, previously designated as Amendment 2, was redesignated Amendment 3. The Council adopted draft Amendment 3 to the Squid, Mackerel, and Butterfish FMP in July 1981 and hearings were held during September. The Council adopted Amendment 3 in October 1981 and submitted it for NMFS approval. NMFS review identified the need for additional explanation of certain provisions of the Amendment. The revisions were made and the revised Amendment 3 was submitted for NMFS approval in February 1982.

The Amendment was approved by NMFS in October 1982. However, problems developed with the implementation regulations, particularly with the Office of Management and Budget through that agency's review under Executive Order 12291. In an effort to have the FMP in place by the beginning of the fishing year (1 April 1983), the FMP, without the squid OY adjustment mechanism, or a revised Atlantic mackerel mortality rate, and retitled as the Atlantic Mackerel, Squid, and Butterfish FMP, was implemented by emergency interim regulations on 1 April 1983. By agreement of the Secretary of Commerce (Secretary) and the Council, the effective date of those emergency regulations was extended through 27 September 1983. The differences between the FMP and the implementing regulations resulted in a hearing before the House Subcommittee on Fisheries and Wildlife Conservation and the Environment on 10 May 1983.

Amendment 1 to the Atlantic Mackerel, Squid, and Butterfish FMP was prepared to implement the squid OY adjustment mechanism and the revised mackerel mortality rate. That Amendment was adopted by the Council on 15 September 1983, approved by NMFS on 19 December 1983, and implemented by regulations published in the *Federal Register* on 1 April 1984.

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Amendment 2 was adopted by the Council on 19 September 1985 and approved by NOAA 6 March 1986. Amendment 2 changed the fishing year to the calendar year, revised the squid bycatch TALFF allowances, put all four species on a framework basis, and changed the fishing vessel permits from permanent to annual.

Amendment 3 was adopted by the Council in two actions. The Atlantic mackerel overfishing definition was adopted by the Council at its October 1990 meeting. The *Loligo*, *Illex*, and butterfish overfishing definitions were adopted at the December 1990 meeting. This was done because the Northeast Fisheries Center proposed changes to the overfishing definitions proposed in the hearing draft for the squids and butterfish. The Center's concerns were incorporated in the version adopted at the December 1990 meeting.

Amendment 4, approved by NMFS 8 November 1991, authorized the Regional Director, Northeast Region, NMFS (Regional Director) to limit the areas where directed foreign fishing and joint venture transfers from US to foreign vessels may take place. Directed foreign fishing must be conducted seaward of at least 20 miles from the shore. Operations of foreign vessels in support of US vessels (that is, joint ventures) may operate anywhere in the Exclusive Economic Zone (EEZ) throughout the management unit unless specific areas are closed to them. The catch limitations were changed by requiring that, if the preliminary initial or final amounts differ from those recommended by the Council, the *Federal Register* notice must clearly state the reason(s) for the difference(s) and specify how the revised specifications satisfy the 9 criteria set forth for the species affected. Additionally, for Atlantic mackerel, the specification of OYs and other values may be specified for three years at one time. These annual values may be adjusted within any year and prior to the second and third years as set forth above. However, projecting specifications over several years should allow more orderly development of the fishery since the revisions to the specifications for the second and third years would be done by notice, rather than by regulatory measures. The joint ventures section was changed to allow the Regional Director may impose special conditions on joint ventures and directed foreign fishing activities. Such special conditions may include a ratio between the tonnage that may be caught in a directed foreign fishery relative to the tonnage that may be purchased over-the-side from US vessels and relative to the tonnage of US processed fish that must be purchased by the venture.

Amendment 5 was approved by NMFS 9 February 1996. It lowered the *Loligo* MSY, eliminated the possibility of directed foreign fisheries for *Loligo*, *Illex*, and butterfish, instituted a dealer and vessel reporting system, instituted an operator permitting system, implemented a limited access system for *Loligo*, *Illex* and butterfish, expanded the management unit to include all Atlantic mackerel, *Loligo*, *Illex*, and butterfish under US jurisdiction. Amendment 6 revised the definitions of overfishing for *Loligo*, *Illex,* and butterfish and allowed for seasonal management of the *Illex* fishery.

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.

1.1.2.2 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, and suggest conservation and enhancement measures. These new habitat requirements are also addressed in this Amendment.

1.1.2.3 Framework adjustment procedure

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. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.

2. Promote the growth of the US commercial fishery, including the fishery for export.

3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.

4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.

5. Increase understanding of the conditions of the stocks and fisheries.

6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

1.1.4 Management Unit

The management unit is all northwest Atlantic mackerel (*Scomber scombrus*), *Loligo pealei, Illex illecebrosus*, and butterfish (*Peprilus triacanthus*) under US jurisdiction.

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. Effective federal fishery management of Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish has occurred for the past two decades. The Council intends to continue to prevent overfishing and meet the purposes specified in the SFA.

1.2 PROPOSED AND ALTERNATIVE MANAGEMENT MEASURES

1.2.1 Proposed Management Measures

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

1. Implement a framework adjustment process.

2. Vessel size restrictions in the Atlantic mackerel fishery.

1.2.2 Alternative to Proposed Management Measures

1. Take no action.

2.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 DESCRIPTION OF THE STOCK

2.1.1 Species Description and Distribution

The distribution of Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish are described in section 5.1 of Amendment 5 and in section 2.2 of this amendment.

2.1.2 Abundance and Present Condition

The abundance and present condition of Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish are described in section 5.2 of Amendments 5 and 6 and in section 2.2 of this amendment.

2.1.3 ECOLOGICAL RELATIONSHIPS AND STOCK CHARACTERISTICS

2.1.3.1 Atlantic mackerel

Mackerel spawning occurs during spring and summer and progresses from south to north. The southern contingent spawns from mid-April to June in the Mid-Atlantic Bight and the Gulf of Maine and the northern contingent spawns in the southern Gulf of St. Lawrence from the end of May to mid-August (Morse 1978). Most spawn in the shoreward half of continental shelf waters, although some spawning extends to the shelf edge and beyond. Spawning occurs in surface water temperatures of 45-57 °F, with a peak around 50-54 °F (Grosslein and Azarovitz 1982).

All Atlantic mackerel are sexually mature by age 3, while about 50% of the age 2 fish are mature. Average size at maturity is about 10.5-11" FL (Grosslein and Azarovitz 1982). Growth is very rapid with fish reaching 7.9 in (20 cm) by their first autumn (Anderson and Paciorkowski 1978). The maximum age observed is 17 years (Pentilla and Anderson 1976).

Fecundity estimates ranged from 285,000 to 1.98 million eggs for southern contingent mackerel between 12-17" FL. Analysis of egg diameter frequencies indicated that mackerel spawn between 5 and 7 batches of eggs per year. The eggs are 0.04-0.05" in diameter, have one 0.1" oil globule, and generally float in the surface water layer above the thermocline or in the upper 30- 50'. Incubation depends primarily on temperature; it takes 7.5 days at 52 °F, 5.5 days at 55 °F, and 4 days at 61°F (Grosslein and Azarovitz 1982).

Mackerel are 0.1" long at hatching, grow to about 2" in two months, and reach a length of 8" in December, near the end of their first year of growth. During their second year of growth they reach about 10" in December, and by the end of their fifth year they grow to an average length of 13" FL. Fish that are 10-13 years old reach a length of 15-16" (Grosslein and Azarovitz 1982). MacKay (1973) and Dery and Anderson (1983) have found an inverse relationship between growth and year class size.

Mackerel are opportunistic feeders and prey most heavily on crustaceans such as copepods, krill, and shrimp. They also feed on squid, and less intensively on fish and ascidians (Langton and Bowman 1977).

Mackerel have been identified in the stomachs of a number of different fish. They are preyed upon heavily by whales, dolphins, spiny dogfish, silver hake, white hake, weakfish, goosefish, Atlantic cod, bluefish, and striped bass. They also comprise part of the diet of swordfish, red hake, Atlantic bonito, bluefin tuna, blue shark, porbeagle, sea lamprey, and shortfin, mako and thresher sharks (Langton and Bowman 1977).

2.1.3.2. *Loligo pealei*

Previous studies of the life history and population dynamics of this species assumed that *Loligo* died after spawning at an age of 18-36 months based on the analysis length frequency data (which suggested a "crossover" life cycle (Mesnil 1977, Lange and Sissenwine 1980). However, recent advances in the aging of squid have been made utilizing counts of daily statolith growth increments (Dawe *et al.* 1985, Jackson and Choat 1992). Preliminary statolith ageing of *Loligo* indicates a life span of less than one year (Macy 1992, Brodziak and Macy 1994). Consequently, the most recent stock assessment for *Loligo* was conducted assuming that the species has an annual life-cycle and has the capacity to spawn throughout the year (NMFS 1996a), as now appears typical of pelagic squid species studied throughout the world (Jereb *et al.* 1991). Because only a single cohort is available at any time, the stock is very vulnerable to recruitment overfishing.

2.1.3.3. *Illex illecebrosus*

The age and growth of *Illex* has been well studied relative to other squid species, being one of the few for which the statolith ageing method has been validated (Dawe *et al.* 1985). Research on the age and growth of *Illex* based on counts of daily statolith growth increments indicates a life span of one year (Dawe *et al.* 1985). *Illex* grow rapidly, achieving mantle lengths of 10 in (25 cm) by the end of the summer. The growth of males and females is nearly identical at sizes less than 8" mantle length. In larger individuals the males are slightly heavier at a given length than females. In spring and summer *Illex* commonly average 6-7" mantle length and weigh 2-4 oz. By late summer and early autumn they have increased to an average size of about 7-10" long and weigh 4-11 oz. Because only a single cohort is available at any time, the stock is very vulnerable to recruitment overfishing.

2.1.3.4. Butterfish

Butterfish spawning takes place chiefly during summer (June- August) in inshore waters generally less than 100' deep. The times and duration of spawning are closely associated with changes in surface water temperature. The minimum spawning temperature is approximately 60 °F. Peak egg production occurs in Chesapeake Bay in June and July, off Long Island and Block Island in late June and early July, in Narragansett Bay in June and July, and in Massachusetts Bay June to August (Grosslein and Azarovitz 1982).

Butterfish eggs, 0.027-0.031" in diameter, are pelagic, transparent, spherical, and contain a single oil globule. The egg membrane is thin and horny. Incubation at 65 °F takes less than 48 hours. Newly hatched larvae are 0.08" long and like most fish larvae are longer than they are deep. At 0.2" larval body depth has increased substantially in proportion to length, and at 0.6" the fins are well differentiated and the young fish takes on the general appearance of the adult. Larvae are found at the surface or in the shelter of the tentacles of large jelly fish (Grosslein and Azarovitz 1982).

Butterfish eggs are found throughout the New York Bight and on Georges Bank, and they occur in the Gulf of Maine, but larvae appear to be relatively scarce east and north of Nantucket Shoals. In 1973, from mid-June to early September, larvae were common in the plankton off Shoreham, NY. Post larvae and juveniles were common in plankton net samples taken in August in the vicinity of Little Egg Inlet, NJ. Juveniles 3-4" long have been taken in Rhode Island waters in late October (Grosslein and Azarovitz 1982).

Growth is fastest during the first year and decreases each year thereafter. Young of the year butterfish collected in October trawl surveys (at about 4 months old) average 4.8" long. Fish about 16 months old are 6.6", at about 28 months old fish are 6.8", and at 40 months old they are 7.8". Maximum age is reported as six years. More recent studies showed that the population was composed of four age groups ranging from young of the year to over age three (Grosslein and Azarovitz 1982). Some butterfish are sexually mature at age one, but all are sexually mature by age two (Grosslein and Azarovitz 1982).

2.1.4 ESTIMATES OF MAXIMUM SUSTAINABLE YIELD

2.1.4.1 Atlantic mackerel

The MSY estimate used in previous Amendments to this FMP was 134,000 mt, based on the long-term equilibrium catch projections presented by Anderson (1985). Anderson (1985) also examined the stock recruitment relationship for mackerel. He found a relationship between year class size at age 1 and the spawning stock biomass that produced that year class, which indicated that low spawning stock levels had a high probability of producing poor year classes. Although there was no distinct separation between levels of spawning stock biomass which have typically produced good or poor year classes, a level of about 700,000 mt appeared appropriate based on stock and recruitment data available at that time.

For example, during 1962-1984, the estimated spawning stock biomass was 634,000 mt or less during 15 of those 23 years (averaging 391,000 mt per year), and only 4 of the 15 year classes produced were above median size (740 million fish at age 1). In the remaining 8 years, spawning stock biomass was 721,000 mt or higher (averaging 1,145,000 mt per year) and 7 of the 8 year classes produced were above median size. All year classes were above median size when spawning stock biomass was 763,000 mt or higher. Anderson (1985) concluded that there seemed to be a stock recruitment relationship sufficient to be of guidance for management purposes. From the standpoint of ensuring a high probability of good recruitment, Anderson (1985) suggested maintaining a spawning stock biomass of 700,000 mt or higher, although the Council later chose to modify this to 600,000 mt.

The Council considered a re-examination of the stock recruitment relationship by the MAFMC Scientific and Statistical (S&S) Committee appropriate given that an updated S-R time series was available from the 1991 stock assessment. The S&S Committee found the median year class size for the 28 year Atlantic mackerel stock-recruitment time series to be 1.277 billion fish. During the 17 of 28 years when spawning stock biomass (SSB) was less than 900,000 mt, only 35% (6 of 17) of the ensuing year classes were observed to be above the median. The majority of year classes (65%) produced when SSB was less than 900,000 mt fell below the median. Conversely, 82% of the year classes were above the median recruitment level when SSB exceeded 900,000 mt. The S&S Committee concluded that a minimum of SSB threshold of 900,000 mt should replace the original estimate of 600,000 mt (MAFMC 1994). Hence, the Council chose to increase the minimum SSB threshold level for Atlantic mackerel to 900,000 mt in Amendment 5 to the FMP.

Recent analyses conducted by Applegate *et al.* 1998 provide revised estimates of MSY and B_{MSY} for Atlantic mackerel. Biological reference points based on MSY were derived for Atlantic mackerel with an age-based production model. Spawning stock biomass (SSB) and recruitment (R) were derived from virtual population analysis (1962-1993). A Ricker SSB-R relationship was fit to the entire time series of VPA estimates, and model residuals were resampled for 2,500 bootstrap solutions. MSY, B_{MSY}, and F_{MSY} were calculated from each bootstrap solution and estimates of yield per recruit and SSB per recruit.

The median bootstrap estimate of MSY was 326,000 mt, with an 80% confidence interval of 230,000-440,000 mt. MSY estimates were generally less than a provisional estimate from surplus production modeling (424,000 mt), but substantially greater than the previous estimate of long-term potential yield (134,000 mt), which was based on the analysis of YPR and average recruitment. The median estimate of B_{MSY} was 890,000 mt, with an 80% CI of 660,000-1,560,000 mt. The B_{MSY} estimate is slightly lower than the current SSB threshold (900,000 mt) which was based on the discontinuous distribution of recruitment, which was much greater when SSB exceeded 900,000 mt. The median estimate of F_{MSY} was 0.45 with an 80% CI of 0.25-0.80 (Applegate *et al.* 1998).

2.1.4.2 *Loligo*

Sissenwine and Tibbetts (1977) estimated MSY to be about 44,000 mt, based on the assumptions of a moderate stock-recruitment relationship, an annual recruitment of about 1.5 billion individuals and a life span of 18-36 months. Initial yield per recruit calculations based on an annual life cycle for *Loligo* indicated that for an estimated cohort of average size (2.2 billion squid), a maximum yield of 36,000 mt could be realized (NMFS 1994). More recently, NMFS (1996) estimated the long-term potential yield (LTPY) for *Loligo* to be 21,000 mt. The maximum optimal yield for the stock was estimated to be 26,000 mt (NMFS 1996a).

2.1.4.3 *Illex*

Lange (1984) estimated MSY for *Illex* to be 40,000 mt. In the most recent assessment, NMFS (1996) estimated LTPY for *Illex* to be about 14,600 mt. The biomass dynamics model used also provided an estimate of Max OY of 21,000 mt for *Illex*. MSY for *Illex* was estimated to be 24,000 mt by NMFS (1996).

2.1.4.4 Butterfish

A preliminary estimate of MSY was 21,500 mt (Murawski and Waring 1978). This estimate assumed certain mesh sizes were used in the fishery and an average level of annual recruitment to the stock. These conditions may not be completely met. Mesh sizes used by domestic vessels frequently vary from that which theoretically will produce MSY. A realistic estimate of MSY, based on the present mix of gear in the fishery, may be between 15,000-19,000 mt. The best conservative estimate of MSY under current fishery conditions is approximately 16,000 mt. This is the MSY estimate used in previous Amendments to the FMP. It is also the "long-term potential catch" projected by USDC (1984).

2.2 Description of Habitat

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.

Atlantic mackerel, *Scomber scombrus L.*, is a fast swimming, pelagic schooling species distributed in the Northwest Atlantic from the Gulf of St. Lawrence to Cape Lookout North Carolina (Sette 1943, 1950; Anderson 1976; MAFMC 1994). While there are two separate spawning contingents in the Northwest Atlantic, (Sette 1950), since 1975, all mackerel in this area have been assessed as a single unit stock (Anderson 1982) and are considered one stock for management purposes.

The long-finned squid, *Loligo pealei*, is a pelagic schooling species of the molluscan family Loliginidae. It is distributed in continental shelf and slope waters from Newfoundland to the Gulf of Venezuela, with commercial abundances occurring from southern Georges Bank to Cape Hatteras.

The short-finned squid, *Illex illecebrosus*, is a pelagic species of the family Ommastrephidae, the oceanic squids. *Illex* is distributed on the western north Atlantic from the Labrador Sea to Florida Straits (Roper *et al.* 1998). In the western Atlantic, it ranges from Greenland, Labrador and Newfoundland southward to Florida.

The Atlantic butterfish, *Peprilus triacanthus*, is a fast-growing, short-lived, pelagic fish that forms loose schools, often near the surface (Schreiber 1973, Dery 1988, Brodziak 1995a). Butterfish range from Newfoundland and the Gulf of St. Lawrence to the Atlantic and Gulf coasts of Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras (Bigelow and Schroeder 1953, Haedrich 1967, Horn 1970a, Powell *et al.* 1972, Cooley 1978, Scott and Scott 1988, Brodziak 1995a, Klein-MacPhee, *in review*).

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 (Briggs 1974). 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 2500 square mile system of large interconnecting sounds behind the Outer Banks of North Carolina (Freeman and Walford 1974 a-d, 1976 a and b).

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 (Freeman and Walford 1976 b-d).

The continental shelf (characterized by water less than 650 ft in depth) extends seaward approximately 120 miles off Cape Cod, narrows gradually to 70 miles off New Jersey, and is 20 miles wide at Cape Hatteras. 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 Atlantic mackerel

2.2.1.1.1 Range

Northwest Atlantic mackerel are primarily found in the open sea (although rarely beyond the continental shelf) from Black Island, Labrador (Parsons 1970) to Cape Lookout, North Carolina (Figure 1; Collette and Nauen 1983) with eggs, larvae and juveniles also found at varying levels of abundance in bays and estuarine areas from New Jersey north through New England and into Canadian waters (see also Sette 1950).

While there are two major spawning contingents in the Northwest Atlantic (Sette 1950), since 1975 all mackerel in this area have been assessed as a single unit stock (Anderson 1982) and are managed as a single transboundary stock. Sette (1950) described northern and southern population contingents of Atlantic mackerel in the northwest Atlantic with different spring and autumn migration patterns and summer distributions. Various methods have attempted to discriminate the two contingents in the northwest Atlantic, including meristic analyses (MacKay and Garside 1969), comparison of parasitic fauna (Isakov 1976), genetic variability (Maguire *et al.* 1987) and differences in otoliths (Gregoire and Castonguay 1989; Castonguay *et al.* 1991). While there were some significant differences, overlaps in character distributions have prevented the development of a useful discrimination method.

During the winter, Atlantic mackerel apparently overwinter in deep water of the continental shelf from Sable Island Bank, off Nova Scotia to the Chesapeake Bay region and in spring move inshore and northeast, reversing this pattern in the fall (Sette 1950; Leim and Scott 1966; MacKay 1967; Berrien 1982). In April and early May the fish form the two spawning aggregations, i.e., a southern contingent that spawns off New Jersey and New York and a northern contingent that spawns in the Gulf of St. Lawrence.

As fish from the southern contingent move northeast along the coast, they are joined by the schools from the northern contingent also moving inshore. The overwintering area and timing of migration varies annually, probably influenced by meteorological events or regional conditions with low spring temperatures significantly delaying the timing, extent and duration (Murray *et al.* 1983; Murray 1984). In fact, the seasonal cycle in temperature in the waters of the Mid-Atlantic and Southern New England (well-mixed water column in winter with temperatures less than 39 °F (4 °C) near the coast to greater than 46 °F (8 °C) near the shelf edge; warming surface layers in spring and gradual warming from south [to 77 °F; 25 °C] to north [to about 64 °F; 18 °C] and subsequent fall cooling) are certainly important environmental factors influencing migration and distribution (Overholtz *et al.* 1991a). This is supported by field studies that have shown that mackerel are intolerant of temperatures less than 41-43 °F (5-6 °C) or greater than 59-61°F (15-16°C; Overholtz and Anderson 1976) and laboratory studies that have confirmed that as temperatures departed from preferred ranges (45-60 °F; 7.3-15.8 °C) swimming speeds of adult mackerel increased, reflecting thermal avoidance (Olla *et al.*1975, 1976). By late April and May, the southern contingent is distributed off New Jersey and Long Island moving into the western side of the Gulf of Maine by June and July, returning to the shelf edge probably between Long Island and Chesapeake Bay by October (Sette 1950; Berrien 1982).

The northern fraction, by late spring, has moved inshore off southern New England, mixing temporarily with the southern contingent before migrating eastward along the coast of Nova Scotia, and moving into the Gulf of St. Lawrence where they spawn in June and July. Some fish however, remain along the coasts of Maine and Nova Scotia throughout the summer. This contingent again mixes with fish from the southern group in late fall in the Gulf of Maine before moving to the outer shelf between Sable Island Bank and Long Island to overwinter (Sette 1950; Parsons and Moores 1974; Moores *et al.* 1975). Temperature may not be as limiting for this contingent since D'Amours and Castonguay (1992) found that mackerel occurred in June in eastern Cape Breton Island at 37 °F (2.8 °C), 8 °F (4 °C) colder than the 45 °F (7 °C) isotherm proposed by Sette (1950) as the thermal barrier to northern migration.

2.2.1.1.2 Status of the stock

Total domestic landings, including commercial and recreational, of Atlantic mackerel in the Northwest Atlantic were 32,100 metric tons (mt) in 1993, 16% less than 1992 landings (Anderson 1995; Figure 2). Canadian landings totaled 26,900 mt in 1993, a record since 1986, whereas United States commercial and recreational landings in 1993 were only 4,500 and 500 mt, respectively (Anderson 1995). Recent improvements in recruitment and reduced average annual landings enabled the Atlantic mackerel stock to recover from low biomass levels in the late 1970's (Anderson 1995; Figure 2).

During 1973-1977, Total Allowable Catches (TAC) were set for the southern spawning contingent in Northwest Atlantic Fisheries Organization (NAFO) Subareas 5 and 6 and for the northern contingent. However, there is no evidence for genetic differences between the contingents (MacKay 1967) and distinctions have not been made to determine individual contingent contributions to the total population (ICNAF 1975). As a result, Atlantic mackerel have been managed as a unit stock since 1975 (Anderson 1982).

Atlantic mackerel landings reached a peak in the early 1970's of approximately 882 million lbs (400,000 mt) but were drastically reduced to 66.2 milllion lbs (30,000 mt) in the late 1970's (Anderson 1995; Figure 2). Throughout 1980-1988, landings increased to an average 182.4 million lbs (82,700 mt) until Total Allowable Level of Foreign Fishing (TALFF) regulations for distant water fleet fishing activities in the Northwest Atlantic were eliminated in 1992 and landings subsequently decreased to 70.6 million lbs (32,000 mt) in 1993 (Anderson 1995).

Northeast Fisheries Science Center fall and spring trawl survey data and assessment analyses indicate Atlantic mackerel stock biomass levels increased from 300,000 mt to 1.6 million mt in the years 1962 - 1969, however, levels decreased to an average 776,000 mt throughout 1977-1981 (Anderson 1995; Figure 2). Stock biomass increased steadily throughout the 1980's and in 1990, levels increased to approximately 3 million mt, which is the current estimated biomass level (Anderson 1995; Figure 2). Spawning stock biomass (50% of age 2 and 100% of age 3 and older mackerel) increased from 600,000 mt in 1982 to more than 2 million mt in 1990, and has remained at or above that level since.

Regulations on landings of Atlantic mackerel were enforced in 1976 in hopes of reducing fishing effort to ensure reproductive success in the population by keeping spawning stock levels above devastating levels. Recruitment has increased since 1976-1980 and strong year classes were evident in 1982, 1987, 1988, and 1990-1993 (NMFS 1991, 1996). The Stock Assessment Review Committee (SARC) in 1991 determined that due to increased Atlantic mackerel recruitment in recent years and reduced mortality rates, biomass levels have increased and currently, the fishery remains in an under-exploited state (NMFS 1991, 1996).

2.2.1.1.3 Habitat requirements by life history stage

The following information on eggs, larvae, juvenile, and adult mackerel habitat requirements is taken directly from the document "Essential Fish Habitat Source Document, Atlantic mackerel, *Scomber scombrus,* L.: Life history and Habitat Requirements" (Studholme *et al.* 1998). This Studholme et al. (1998) document is referred to hereafter as the Atlantic mackerel EFH background document. Most of the Tables and Figures from Studholme et al. (1998) are included in this FMP. This Studholme et al. (1998) Mackerel 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.

An extensive literature review and synthesis has provided detailed information on the life history and habitat requirements of Atlantic mackerel (Table 1). The review is primarily limited to U.S. waters; however, due to the intermixing of the two contingents, some information also relates to fish in Canadian waters.

2.2.1.1.3.1 Eggs

Eggs are 0.4-0.5 in. (1.09-1.36 mm) in diameter, have one oil globule 0.1-0.15 in. (0.26-0.37 mm) in diameter and are pelagic.

Habitat requirements

The eggs are pelagic in water over 34 ppt (Fritzsche 1978), floating in surface waters above the thermocline or in the upper 33 to 49 ft (10 to 15 m; Sette 1943; Berrien 1982). Incubation time depends primarily on temperature: at 52 °F (11 °C), 7.5 days; at 55 °F (13 °C), 5.5 days and at 61 °F (16 °C), 3.6 days (Worley 1933). Lanctot (1980) had similar results: at 52 °F (11 °C), 8 days; at 55 °F (13 °C), 5.8 days and at 61 °F (16 °C), 3.9 days.

Based on the 1978-1987 NMFS Northeast Fisheries Science Center's (NEFSC), Marine Resources Monitoring, Assessment, and Prediction (MARMAP) offshore ichthyoplankton surveys, eggs were collected at near surface temperatures ranging from 41to 73 ° F (5 °C to 23 °C) with the largest proportion between about 45 and 61 °F (7 °C and 16 °C; Figure 3). In April, the highest abundances were collected from 45 to 48 °F (7 to 9 °C); in May, from 48 to 54 °F (9 to 12 °C); in June, from

50 to 54 °F (10 to 12 °C); while the few collected in July and August were at a wide range of temperatures (52 to 73 °F; 11 to 23 °C) (Figure 3). This is consistent with findings by Berrien (1978) who reported that for May 1966, the weighted mean surface temperatures for all eggs collected from Martha's Vineyard to Chesapeake Bay was 52 °F (11.0 °C), (range 43-35; 6.3-16.9 °C) with 97% collected at 48 to 57 °F (8.7 to 13.8 °C). Sette (1943) for 1932 collections, reported a weighted mean of 52 °F (10.9 °C) surface temperature with 98% occurring from 48 to 56 °F (9.0 to 13.5 °C). Mortality may be influenced by acclimation temperatures of adult fish (Lanctot 1980). Worley (1933) found minimal mortality at 61 °F (16 °C) which corresponded to capture temperature of the adults. Lockwood *et al.* (1977) found mortalities less than 20% between 49 and 59 °F (9.4 and 15.1 °C). Ware and Lambert (1985) also found that egg mortality rates of mackerel from St. George's Bay, Nova Scotia were highly correlated with the rate of warming during the spawning season.

Salinities may also affect survival. Peterson and Ausubel (1984) attributed high egg mortality to unusually low salinities (23 ppt) in Long Island Sound as compared with usual values of 25-27 ppt.

Eggs were collected at depths in the water column ranging from 33 to 1280 ft (10 to 325 m); the majority were collected from 98 to 230 ft (30 to 70 m; Figure 3). In April, the highest numbers of eggs were collected at depths of 33-98 ft (10 - 30 m); in May from 98-164 ft (30 - 50 m); in June, July and August, at depths of 98-230 ft (30 - 70 m; Figure 3). Ware and Lambert (1985) found that mackerel eggs in St. George's Bay tended to concentrate near the surface, particularly under light winds and decline exponentially with depth with the rate of decline a function of egg diameter and temperature gradient in the top 16 ft (5 m).

Distribution and abundance

The MARMAP offshore ichthyoplankton surveys found eggs from offshore waters off Chesapeake Bay to George's Bank and the Gulf of Maine (Figure 4). Egg production progressed northward from April through May, June and July as would be expected based on the spawning/migratory patterns of adults. For example, egg production in April extended from Chesapeake Bay to coastal New Jersey and along the south shore of Long Island: in May from the shelf waters off New Jersey to Nantucket, the southern edge of Georges Bank and the western Gulf of Maine: in June off southern Rhode Island, in the region of Massachusetts Bay and the western Gulf of Maine. By July, some eggs were collected along Georges Bank while by August, few, if any, eggs were found. Highest densities (eggs/108 ft^2; eggs/10 m^2) were in May (greater than 39,000) and June (greater than 53,000). This pattern of production and distribution is consistent with previous reports (Sette 1943; Bigelow and Schroeder 1953; Collette in prep.). Eggs have been collected from early June to mid-August on the southern side of the Gulf of St. Lawrence (Sette 1943) and this area is considered an extremely productive spawning ground (Colette in prep.).

2.2.1.1.3.2 Larvae

Atlantic mackerel average about 0.12 to 0.13 in (3.1 to 3.3 mm) standard length (SL) at hatching and have a large yolk sac; the eyes are large and unpigmented (Sette 1943, Bigelow and Schroeder 1953, Colton and Marak 1969, Berrien 1975, Ware and Lambert 1985, Scott and Scott 1988). The 50% threshold for the onset of feeding is 0.15 in (3.8 mm; Ware and Lambert 1985). At about 0.16-0.24 in (4-6 mm) the yolk sac is absorbed by which time there is a considerable change in body pigmentation (Berrien 1975). Larvae undergo major changes in body form and Sette (1943) describes a transition stage between the larval and post-larval stages (about 0.35-0.39 in; 9-10 mm) where fins are in various stages of development.

Habitat requirements

Based on the MARMAP surveys, larval distribution occurs at water column temperatures ranging from 43-72 °F (6 to 22 °C) with the largest proportion between about 46 and 55 °F (8 °C and 13 °C; Figure 5). In May, the majority of larvae were found at 46 to 50 °F (8 to 10 °C); in June at 46 to 52 °F (8 to 11 °C); in July at 46 °F (8 °C) and 50 to 52 °F (10 to 11 °C); and in August at 48 °F (9 °C) and 54 to 55 °F (12 to 13 °C; Figure 5). For larvae collected during May, June and August 1966, Berrien (1978) indicated that surface water temperatures ranged from 54 to 69 °F (12.3 to 20.7 °C) with 96% occurring from 57 to 62 °F (13.7 to 16.8 °C). Ware and Lambert (1985) found that larval mortality rates (about 42%/d) were positively correlated with temperature.

Larvae were collected at depths ranging from 33 to 427 ft (10 to 130 m; Figure 5). With the exception of July when 50% were collected at a depth of 230 ft (70 m), larvae were primarily distributed at depths less than 164 ft (50 m; Figure 5). Sette (1943) reports that larvae vertically migrate diurnally from the surface at night to the thermocline during the day. Ware and Lambert (1985) found that in St. George's Bay, recently-hatched larvae were collected at depths of 16-33 ft (5-10 m) and as they grew they moved progressively closer to the surface during the day; between 0.11-0.31 in (3-8 mm), median depth increased at a rate of 2.2 ft/d (0.7m/d).

Distribution and abundance

The 1977-1987 MARMAP offshore ichthyoplankton surveys also found larvae in waters less than 43 ft (13m) from waters off Chesapeake Bay to the Gulf of Maine although more were concentrated offshore of Delaware Bay to Massachusetts Bay from inshore waters to the seaward limits of the survey (Figure 6). Larvae were collected from May through August with the highest average mean density (greater than 93/ft^2; 10,000/10 m^2) occurring in June ranging from inshore to offshore from southern New England to the Hudson Canyon with considerable numbers collected north of Cape Cod. This was north of where larvae were most abundant(greater than 19/ft^2; 2000/10 m^2) in May. Mean densities were low in July (less than 1/ft^2; 102/10 m^2) with few, if any, (less than 0.3/ft^2; 32/10 m^2) collected in August. Berrien (1978) reported that in May 1966, larvae were caught between Chesapeake Bay and Oregon Inlet NC across the continental shelf while by June larvae had spread from Martha's Vineyard to Currituck Beach, NC. The largest abundance was off Montauk Point, NY. By June, most larvae occurred to the north, while in August few were caught. This pattern also corresponds with previous reports by Sette (1943).

2.2.1.1.3.3 Juveniles

Post-larvae gradually transform from planktonic to swimming and schooling behavior at about 1.2 to 1.9 in (30 to 50 mm; Sette 1943). Fish reach a length of about 1.9 in (50 mm) in about two months at which time they closely resemble adults and reach 7.9 in (20 cm) in December after about one year of growth (Sette 1943; Bigelow and Schroeder 1953; Anderson and Paciorkowski 1980; Berrien 1982; Collette in prep.). Kendall and Gordon (1981) show somewhat faster larval and juvenile growth rates based on daily growth increments from otoliths taken from fish collected in the Middle Atlantic Bight, i.e. about 2.8 to 3.1 in (70 to 80 mm) in two months; however, these were not verified by comparison with fish of known age. Ware and Lambert (1985) found that in St. Georges Bay, Nova Scotia, at 59-63 °F (15-17 °C), growth rates of juveniles (greater than 0.59 in; 15 mm) averaged 0.03 in./d (0.73 mm/d) from birth to metamorphosis, similar to the estimates by Kendall and Gordon (1981). Using daily growth rings, D'Amours *et al.* (1990) estimated that young mackerel from the northern contingent would grow faster earlier in their first growing season which would be consistent with Sette's (1950) conclusions. However, Simard *et al.* (1992) calculated that growth curves of juvenile Atlantic mackerel, based on otolith samples from the northern and southern spawning groups were not significantly different at least for up to 90 days in age.

Habitat requirements

Based on the 1964-1997 NEFSC bottom trawl surveys, juveniles in the fall were caught at temperatures ranging from 39 to 72 °F (4 to 22 °C), with the majority (greater than 55%) occurring at 50 °F (10 °C). In the winter 90% were collected at 41-43 (5-6 °C), ranging from 37-54 °F (3-12 °C; Figure 7). Distribution temperatures were a little broader in spring (39-63 °F; 4-17 °C) and summer (39-66 °F; 4-19 °C). Although the majority of juveniles (greater than 60%) were still found at 41-43 °F (5-6 °C) in the spring, by summer distribution had shifted to higher temperatures with greater 40% collected at 46 °F (8 °C) and 40% at 55 °F (13 °C; Figure 7).

In the fall, the majority of juveniles (greater than 77%) were at depths of 66-99 ft (20-40 m) ranging from surface to 1050 ft (320 m); in the winter greater than 60% were at slightly deeper depths (164-230 ft; 50-70 m) while by spring they were widely dispersed through the water column (surface to 1115 ft; 340 m) but concentrated (greater than 75%) at depths ranging from 99 to 297 ft (30 to 90 m; Figure 8). By summer, fish were higher in the water column (surface to 690 ft; 210 m) with about 94% distributed from 66 to 164 ft (20-50 m) in two peaks (Figure 8).

Distribution and abundance

Collections of Atlantic mackerel from the 1964-1997 NEFSC bottom trawl surveys indicate that the distributions of juveniles (less than and equal to 9.8 in; 25 cm) ranged from Cape Hatteras to George's Bank, southwestern Nova Scotia and the Gulf of Maine (Figure 9a-d), and was similar to adults. In spring, juveniles tended to be distributed further inshore than adults, which were distributed along the outer edge of the Continental Shelf (Figures 9a-d). In fall, a few juveniles were collected in the near coastal waters of the Mid-Atlantic and southern New England, particularly eastern Long Island, (Figure 9c). The mean number of fish caught was highest in summer for juveniles (351/station), with more collected in the spring than in the fall reflecting the movements of the southern spawning contingent inshore. The greatest abundance in spring occurs in the oceanic waters between Chesapeake Bay and southern New England (Figure 9a), as the fish move north. Winter and summer distributions are presented as presence/absence data (Figure 9b, 9d) precluding a discussion of abundances.

2.2.1.1.3.4 Adults

By the end of their second year, fish reach about 10 in (26 cm)and after five years about 13 in (33 cm; Anderson 1973; Isakov 1973; Stobo and Hunt 1974). Fish that are 6 years old can reach a length of 15.3 to 15.4 in (39 to 40 cm). Based on studies of Canadian mackerel, MacKay (1967) theorized that growth is population density dependent, i.e. that abundant year classes grow more slowly than less abundant year classes, although Moores *et al.* (1975) did not find this to be true for Newfoundland fish. Overholtz (1989) found the 1982 cohort to be one of the slowest growing on record; it is one of the largest recruiting year-classes recorded. Large differences in mackerel growth suggest that year-class size partially influences the initial pattern of growth during a cohort's first years (Overholtz *et al.* 1991b). Thus, early growth may be related to year-class size, while stock size may be more influential after the juveniles join the offshore adults (Overholtz *et al.* 1991a; Collette in prep.).

There is some variation in estimates of size and age at maturity. Based on samples of Atlantic mackerel collected from 1987-1989 by the NEFSC groundfish surveys, median length at maturity (L_{50}) was 10.1 in (25.7 cm) for females and 10.2 in (26.0 cm) for males; median age (A_{50}) was 1.9 years for both (O'Brien *et al.* 1993). By age 3, 99% of the females and 97% of the males were mature (O'Brien *et al.* 1993). Fish collected in Newfoundland waters from June-September 1970-1973 had higher values for L_{50} of 13.4 in (34 cm) and 13.8 in (35 cm) for males and females respectively (Moores *et al.* 1975). MacKay (1967) reported first spawning for mackerel occurred at age 2 and lengths greater than 11.8 in (30 cm) for fish collected in May-July 1965-1966 from the Gulf of St Lawrence and coastal Nova Scotia and Massachusetts. These differences in median maturity may be due to the slower growth of larger year classes that may delay spawning from one to three years (MacKay 1973, Overholtz 1989). Consequently, both year-class size and adult stock size may be important factors regulating growth in Atlantic mackerel (Overholtz 1989, Overholtz *et al.* 1991b).

Reproduction

Spawning occurs during spring and summer and progresses from south to north as the surface waters warm and fish migrate (Sette 1943). There are two spawning contingents; a southern group that spawns primarily in the Mid-Atlantic Bight and Gulf of Maine from mid-April to June and a northern contingent that spawns in the southern Gulf of St Lawrence from the end of May to mid-August (Berrien 1982). The southern contingent begins spring spawning migration by moving inshore between Delaware Bay and Cape Hatteras, usually between mid-March and mid-April depending to some extent on water temperature (Berrien 1982). The northern contingent begins to move inshore off southern New England usually in late May, mixing temporarily with part of the southern contingent before migrating eastward along the coast of Nova Scotia, where they are joined by other mackerel schools from offshore before moving into the Gulf of St. Lawrence to spawn (Berrien 1982). Small fish (<30cm) lag behind larger fish and spawn later (Berrien 1982).

The majority of the spawning occurs in the shoreward half of continental shelf waters, although there is some spawning on the shelf edge and beyond (Berrien 1982; Collette in prep.). Sette (1943) described the area bordered by southern New England and the Middle Atlantic states as the most important spawning grounds for mackerel. Current information indicates that the oceanic bight between Chesapeake Bay and southern New England is the most productive area. The Gulf of St Lawrence is somewhat less so although the southern side is considered extremely productive for the northern contingent (MacKay 1973) while the Gulf of Maine and coast of outer Nova Scotia are the least (Sette 1950; Collette in prep.). Some open bays, i.e. Cape Cod Bay and Massachusetts Bay are sites of some importance with spawning fish abundant or common from May to July and August (Table 2). While according to Wheatland (1956), spawning occurs rarely in Gardiner's Bay and Long Island Sound, recent assessments of relative abundance of eggs and larvae in these areas show that both life stages are highly abundant and abundant in April and May (Table 2). Well-enclosed bays, especially those receiving considerable river inflow such as Chesapeake Bay and Delaware Bay show little evidence of spawning (Table 3).

Factors controlling spawning time are unclear. Morse (1980) indicated that the regularity in spawning shown by Ware (1977), points to an internal control or constant external stimulus, e.g., photoperiod changes, which ensures that peak hatching occurs at the time of maximum zooplankton abundance. Based on field investigations (Nichols and Warne 1993), and laboratory observations (Walsh and Johnstone 1992) there appears to be no diel periodicity in spawning with no significant peaks either during the day or night. Sette (1943) noted that temperature <7 °C is a limiting factor in migration which subsequently affects timing of spawning in specific locations. Based on the Northeast Fisheries Science Center (NEFSC) 1977-1987 MARMAP ichthyoplankton surveys, spawning does not begin until temperatures reach -7-8 °C, with most occurring between 9 and 14 °C (Berrien 1982; Collette in prep.). Sette (1943) stated that peak spawning occurs within that range at around 10-12 °C at salinities >30ppt. These temperatures were in the preferred range (7-16 °C) determined for adult mackerel in the laboratory (Olla et al. 1975, 1976). Thus spawning season is progressively later as water temperatures warm and fish migrate from south to north.

Atlantic mackerel are serial, or batch, spawners with estimates of total fecundity ranging from 285,000 to 1.98 million eggs for southern contingent mackerel between 12.2 and 17.3 in (31 and 44 cm) FL (Morse 1980). Based on a very limited sample of northern contingent mackerel, fecundity estimates ranged from 211,000 to 397,000 eggs for 13.8 and 15.7 in (35 and 40 cm) females respectively (MacKay 1973). Analysis of egg diameter frequencies indicate that five to seven egg batches are spawned by each female (Morse 1980).

Habitat requirements

Based on the 1964-1997 NEFSC bottom trawl surveys, adults in the fall were found in slightly narrower range of temperatures than juveniles (39-61 °F; 4-16 °C) with greater than 80% caught from 48-54 °F (9-12 °C; Figure 10). Winter distribution was similar to the juveniles with nearly 70% at 41-43 °F (5-6 °C), ranging from 37-55 °F (3-13 °C) (Figure 10). Spring ranges were similar (36-57 °F; 2-14 °C), but adults were distributed more evenly through a temperature band of 41-55 °F (5-13 °C) with less than 25% at 55 °F (13 °C; Figure 10). By summer, fish were found at temperatures ranging from 39-57 °F (4-14 °C) with greater than 30% at 50-52 °F (10-11 °C) and greater than 35% at 57 °F (14 °C; Figure 10). These temperatures are within the ranges previously reported for mackerel. In addition, Bigelow and Schroeder (1953) indicate that the highest temperature at which mackerel are commonly found is 68 °F (20 °C) while commercial catches are sometimes taken at 7 °F (7 °C). In the northern Gulf of St. Lawrence, concentrations of mackerel were found at 39 °F (4 °C); however, the overall probability of occurrence inshore was higher when near-bottom temperatures were greater than or equal to 45 °F (7 °C; Castonguay *et al.* 1992).

As stated previously in the migration section, field studies have shown that mackerel are intolerant of temperatures less than 41-43 °F (5-6 °C) or greater than 59-61 °F (15-16 °C; Overholtz and Anderson 1976) and laboratory studies that have confirmed that as temperatures departed from preferred ranges (45-60 °F; 7.3 to 15.8 °C) swimming speeds of adult mackerel increased, reflecting thermal avoidance (Olla *et al.*1975, 1976). Again, temperature may not be as limiting for the northern contingent since D'Amours and Castonguay (1992) found that mackerel occurred in June in eastern Cape Breton Island at 37 °F (2.8 °C), 8 °F (4 °C) colder than the 45 °F (7 °C) isotherm proposed by Sette (1950) as the thermal barrier to northern migration.

Based on the 1964-1997 NEFSC bottom trawl surveys, adults in the fall were spread from 33-1115 ft (10 to 340 m); however greater 50% were caught at 198-264 ft (60 to 80 m; Figure 11). By winter, while fish were still found at depths of 33-891 ft (10-270 m), about 50% were swimming at depths of 66 to 99 ft (20 to 30 m; Figure 11). By spring fish were broadly dispersed from the surface to as deep as 1254 ft (380 m); however, about 25% were at depths of 528 to 561 ft (160 to 170 m; Figure 11). By summer, schools had again moved upward in the water column, swimming at depths of 33 to 594 ft (10 to 180 m) with greater than 60% at depths of 164 to 230 ft (50 to 70 m; Figure 11). This depth range is broader than reported by Bigelow and Schroeder (1953) who stated that while mackerel can swim as deep at 604 ft (183 m), in spring, summer and into fall they swim at depths of 151 to 180 ft (46 to 55 m) or less. According to Sette (1950) larger fish tend to swim deeper than smaller ones.

In the northern Gulf of St. Lawrence, vertical distribution was greatest at 50 and 114 ft (15 and 35 m) with mackerel occurrences positively correlated with downwelling events and the onshore advection of warm surface waters (Castonguay *et al.* 1992).

Distribution and abundance

Collections of Atlantic mackerel from the 1964-1997 NEFSC bottom trawl surveys indicate that the distributions of adults (greater than or equal to 10 in; 26 cm) ranged from Cape Hatteras to George's Bank, southwestern Nova Scotia and the Gulf of Maine, and was similar to juveniles (Figures 12a-d). Adults tended to be distributed further offshore than the juveniles, along the outer edge of the Continental Shelf (Figure 12a-d). In fall, adults were absent near coastal waters of the Mid-Atlantic and southern New England, particularly eastern Long Island (Figure 12c). The mean number of fish caught was highest in winter for adults (106/station), with more collected in the spring than in the fall reflecting the movements of the southern spawning contingent inshore. The greatest abundance in spring occurs in the oceanic waters between Chesapeake Bay and southern New England (Figure 12a), as the fish move north. Winter and summer distributions are presented as presence/absence data (Figure 12b,12d) precluding a discussion of abundances.

2.2.1.1.4 Importance of Atlantic mackerel in state waters

Although Atlantic mackerel are an offshore pelagic species, eggs, larvae, and juveniles are found to varying degrees in estuaries and bays of New England and the Mid-Atlantic. The primary data source for Atlantic mackerel in state waters is NOAA's Estuarine Living Marine Resources Program (ELMR; Tables 2 and 3), while not as quantitative as the NEFSC trawl data it does describe the Atlantic mackerel spatial (Tables 2) and temporal (Table 3) relative abundance by life stage and month in the various coastal estuaries from Waquoit Bay, Massachusetts to James River, Virginia (Figures 13a-e).

While Atlantic mackerel may be important in other states' water, 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 makes it possible to compare them. Therefore, it will only be used to confirm ELMR data. These, data generally agree with ELMR presence/absence data for these estuaries. Data collected from other states' seine and trawl surveys, as it becomes available in a comparable format, will be incorporated in future iterations of this FMP.

2.2.1.2 *Loligo*

2.2.1.2.1 Range

Loligo are found from Newfoundland to the Gulf of Venezuela, however, principal concentrations occur from Georges Bank to Cape Hatteras (Figure 14; Brodziak 1995b). *Loligo* are generally found at water temperatures of at least 48 °F (9 °C; Lange and Sissenwine 1980). The species undergoes seasonal migrations that appear to be related to bottom water temperatures; they move offshore during late autumn to overwinter along the edge of the continental shelf and return inshore during the spring and early summer (Middle Atlantic Fishery Management Council 1996). During winter and early spring, when inshore waters are coldest, the population concentrates along the outer edge of the continental shelf where waters are 48-55 °F (9-13 °C). The inshore movement to the shelf areas takes place when water temperatures are rising (Black *et al.* 1987), and begins in the south and proceeds northward along the coast (Middle Atlantic Fishery Management Council 1996). A northerly extension of the range has been noted in summer (Black *et al.* 1987).

2.2.1.2.2 Status of the stock

The Northwest Atlantic, Cape Hatteras to the Gulf of Maine, commercial landings of long-finned squid, *Loligo pealei*, were 12,459 mt in 1996, a 33% decrease over the 1995 landings of 18,500 mt, and a 45% decrease from the 1994 landings of 22,500 mt (Figure 15) (NMFS 1996a, NEFSC unpublished data). Of the 1993 landings of 22,300 mt, 56% were taken in the Middle Atlantic Bight between Hudson Canyon and Baltimore Canyon and 50% were caught in the winter from January through March (NMFS 1996a).

Annual landings of *Loligo pealei* by the distant water fleet from North Carolina to Maine were highest from 1972-1976 with a peak of 37,600 mt in 1973 (Lange 1982). Foreign fishing regulations were enforced in 1977 (Middle Atlantic Fishery Management Council 1996) and during the following three years, landings decreased to an average 15,000 mt, then increased slightly in 1980-1984, but fell again to 15,000 mt in 1985-1987 (NMFS 1996a). Directed foreign fishing was eliminated in 1987 and commercial landings continued to fluctuate throughout the late 1980's and early 1990's. Annual domestic landings of *Loligo* averaged 17,800 mt in 1987-1992 (Brodziak 1995b) and were taken primarily in the winter fishery in offshore waters of the New York Bight (NMFS 1996a).

Long-term data from the Northeast Fisheries Science Center fall and spring bottom trawl surveys indicate fluctuations in seasonal biomass as well. In the fall of 1973-1976, *Loligo pealei* stock biomass averaged 136.7 million lbs (62,000 mt; NMFS 1996a). It was during this time period when the peak of 82.9 million lbs (37,600 mt) was landed in the commercial fisheries. Stock biomass in the spring of 1972-1976 was also above average with estimates of 22,000 mt. However, biomass decreased in the spring and fall of 1977-1982 to 10,000 and 33,000 mt, respectively, and during this time, commercial landings also declined (NMFS 1996a). During the next nine years, spring and fall biomass levels remained relatively above average with few periods of low abundance.

Throughout 1992-1994, biomass decreased to considerably lower levels than those during 1989-1991. Average spring and fall biomass levels in 1992-1994 were 12,000 and 45,000 mt, respectively, and the spring 1994 level was almost a record low (NMFS 1996a). Stock biomass levels in the fall of 1992 and spring of 1993 were estimated to be 35-50% below the historical average (MAFMC 1995) even though the number of pre-recruits per tow were the highest ever in the fall of 1992 (Brodziak 1995b). Currently, the *Loligo pealei* stock in the Northwest Atlantic from Cape Hatteras to the Gulf of Maine has a medium biomass level which is almost fully exploited (NMFS 1996a).

2.2.1.2.3 Habitat Requirements by Life History Stage

The following information on eggs, larvae, juveniles, and adult *Loligo* habitat requirements is taken directly from the document "Essential Fish Habitat Source Document, Long-finned squid, *Loligo pealei*,: Life History and Habitat Requirements (Cargnelli *et al.* 1998). Most of the Tables and Figures from Cargnelli *et al.* (1998) are included in this FMP. This Cargnelli *et al.* (1998) *Loligo* 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.

An extensive review and synthesis of the peer-reviewed literature has provided information on the habitat requirements and preferences of *Loligo*. This information is summarized in Table 4 (Cargnelli *et al.* 1998).

Pre-recruits and recruits are stock assessment terms used by NEFSC and correspond roughly to the life history stages juveniles and adults, respectively. *Loligo* pre-recruits are less than or equal to 8 cm and recruits are greater than 8 cm.

2.2.1.2.3.1 Eggs

The 0.04 in x 0.06 in (1 mm x 1.6 mm) eggs are encased in a gelatinous capsule as they pass through the female oviduct during mating. Each capsule contains about 150-200 eggs (Arnold *et al.* 1974, Gosner 1978, Middle Atlantic Fishery Management Council 1996) and is about 1.97-3.15 in (50-80 mm) long and 0.39 in (1 cm) in diameter (Gosner 1978, Lange 1982, Middle Atlantic Fishery Management Council 1996). During spawning the male cements bundles of spermatophores into the mantle cavity of the female, and as the capsule of eggs passes out through the oviduct, its jelly is penetrated by the sperm (Black *et al.* 1987). The egg capsules are laid on the bottom in clusters 19.7-23.6 in (50-60 cm) wide made up of hundreds of capsules (Gosner 1978, Griswold and Prezioso 1981). Each female lays 20-30 capsules (Lange 1982), and the number of eggs spawned per female varies from 950-8,500 (Haefner 1959), 3,500-6,000 (Summer 1971), 2,500-15,900 (Vovk 1972a) to 3,000-6,000 (Middle Atlantic Fishery Management Council 1996). Development time varies from 257-642 hours, depending on temperature: 26.7 days to hatching at 54-64 °F (12-18 °C), 18.5 days at 60-70 °F (15.5-21.3 °C), and 10.7 days at 60-73 °F (15.5-23.0 °C; Summers 1971).

Habitat requirements

Egg masses are commonly found attached to rocks and small boulders on sandy/mud bottom or aquatic vegetation such as *Fucus*, *Ulva lactuca*, *Laminaria* and *Porphyra* sp. (Arnold *et al.* 1974, Griswold and Prezioso 1981, Summers 1983). They are demersal, generally in shallow waters less than 164 ft (50 m) deep (Bigelow 1924, Griswold and Prezioso 1981, Lange 1982) and are found at temperatures of 50-73 °F (10-23 °C; McMahon and Summers 1971) and salinities of 30-32 ppt (McMahon and Summers 1971).

Distribution and abundance

The egg stage of *Loligo* were not sampled by the MARMAP offshore ichthyoplankton surveys.

2.2.1.2.3.2 Larvae

Little is known about the larval stages of *Loligo* (Middle Atlantic Fishery Management Council 1996) as they are not often found in the spawning areas. They are pelagic, found in near surface waters (McMahon and Summers 1971) and are referred to as paralarvae (Young and Harman 1988). Larvae 0.08-0.16 in (2-4 mm) in length have been caught in the Gulf of Maine (Bigelow 1924).

Habitat requirements

Larvae are pelagic, occurring near the surface (McMahon and Summers 1971, McConathy *et al.* 1980) at temperatures of 50-79 °F (10-26 °C) and salinities of 31.5-34.0 ppt (Vecchione 1981). Surface waters are important to hatchlings, and larvae move deeper as they grow older (Vecchione 1981).

Distribution and abundance

The larval stages of *Loligo* were not sampled by the MARMAP offshore ichthyoplankton surveys.

2.2.1.2.3.3 Juveniles

There are two juvenile stages: 'juvenile' is the stage after the paralarval stage ends and before the subadult stage begins, and 'subadult' is the stage before maturity is reached, when the morphological characteristics of adults are attained (Young and Harman 1988). The shift from inhabiting surface waters to demersal lifestyle occurs at 1.8 in (45 mm; Vecchione 1981). Off Martha's Vineyard, the juvenile life stage lasts about 1 month, and by November subadults migrate to the outer shelf areas where they remain until March (Summers 1968). Subadults are thought to overwinter in deeper waters along the continental shelf edge (Black *et al.* 1987). Young-of-the-year (subadults) are found with adults in mid-summer trawls (Summers 1968). Sexual maturity is reached at lengths of 3.1-4.7 in (8-12 cm), although most mature individuals are greater 3.9 in (10 cm; Macy 1980, Brodziak and Hendrickson 1997). The length at which 50% of individuals are sexually mature (L_{50}) is 6.3 in (16 cm; Brodziak 1995b).

Habitat requirements

Juveniles inhabit the upper 33 ft (10 m) of the water column over water 164-492 ft (50-150 m) deep (Mercer 1969, Vovk and Khvichiya 1980, Brodziak and Hendrickson 1997). They are found at surface water temperatures of 50-79 °F (10-26 °C; Vecchione 1981, Brodziak and Hendrickson 1997) and salinities of 31.5-34.0 ppt (Vecchione 1981).

Loligo pre-recruits (less than or equal to 3.2 in [8 cm] mantle length; ML) caught during NEFSC trawl surveys were taken at depths ranging from 0-693 ft (0-210 m). However, depth of occurrence varied seasonally in accordance with known inshore-offshore migrations. Most pre-recruits were taken at 230-396 ft (70-120 m) and 46-54 °F (8-12 °C) in winter, 66-429ft (20-130 m) and 50-55 °F (10-13 °C) in spring, 33 ft (10 m) and 55-64 °F (13-18 °C) in summer, and 33-132 ft (10-40 m) and 52-63 °F (11-17 °C) in winter.

Distribution and abundance

The NMFS bottom trawl surveys captured *Loligo* pre-recruits (greater than or equal to 3.15 in; 8 cm ML) during all seasons. In winter, pre-recruits were captured from Cape Hatteras to Nantucket Shoals, although the majority were found south of Long Island (Figure 16a). They were generally found offshore of the 30 ft depth contour, with highest concentrations in the vicinity of the 100 ft contour. They were distributed further inshore in the southern part of the range, presumably due to warmer water temperatures. In spring, the distribution stretched further to the south, with high concentrations south of Cape Hatteras, and to the north, with catches on Georges Bank and the Scotian Shelf (Figure 16b). Although the highest concentrations were still found near the 100 ft line, concentrations inshore of the 30 ft line were much higher than in winter, indicating that the spring inshore migration had commenced. In summer, highest concentrations were found nearshore; a number of extremely dense schools (greater than 10,000 squid/tow) were found nearshore from Delmarva to Buzzards Bay, MA. Very few were caught on Georges Bank and in the Gulf of Maine (Figure 16c). In autumn, squid were distributed throughout the continental shelf from the shore to the 100 ft line, although the highest concentrations were found nearshore (Figure 16d). This presumably indicates the beginning of the offshore migration.

Pre-recruits were caught at depths ranging from 0-693 ft (0-210 m), although this varied seasonally and in accordance with inshore-offshore migrations (Figure 17a). In winter, depths ranged from 66-660 ft (20-200 m), but most were caught between 230-400 ft (70-120 m). In spring, depths ranged from 33-700 ft (10-210 m), although most were caught at 66-430 ft (20-130 m), and the highest catch was at 130 ft (40 m). In summer, depths were much less variable, ranging from 0-363 ft (0-110 m), and 70% were found at 33 ft (10 m). In autumn, depths ranged from 33-500 ft (10-150 m), but most were caught at 33-130 ft (10-40 m), with the highest catch at 66 ft (20 m).

Pre-recruits were caught at a wide range of temperatures (Figure 17b). In winter, they were found at 41-55 °F (5-13 °C), although most were at 46-54 °F (8-12 °C). In spring, they were at 43-68 °F (6-20 °C), with most at 50-55 °F (0-13 °C). In summer, they were caught at 45-79 °F (7-26 °C), but most were at 55-64 °F (3-18 °C), with the highest catch at 64 °F (8 °C). In autumn, temperatures ranged from 45-81 °F (7-27 °C), with most at 52-63 °F (11-17 °C).

2.2.1.2.3.4 Adults

Historically, the lifespan of *Loligo* was believed to be 1-2 years (Summers 1971, Lange 1982). However, recent studies using statolith aging have demonstrated exponential growth and a lifespan of less than 1 year (Brodziak and Macy 1996). *Loligo* reach sizes greater than 16-20 in (40-50 cm) ML (mantle length; Vecchione *et al.* 1989, Brodziak 1995b), although most are less than 12 in (30 cm; Brodziak 1995b), and they exhibit sexual dimorphism for size, with males growing more rapidly and reaching larger size at age than females (Brodziak 1995b). They undergo seasonal migrations, moving offshore during late autumn to overwinter in warmer waters along the edge of the continental shelf, and returning inshore during the spring and early summer (Middle Atlantic Fishery Management Council 1996). Mature individuals enter inshore waters before immature ones (Macy 1982). In Massachusetts waters, larger individuals migrate inshore in April-May, while smaller individuals move inshore later in summer (Lange 1982). *Loligo* form large schools based on size prior to feeding (Macy 1980) and undergo diurnal vertical migrations, moving up in the water column aft night (Middle Atlantic Fishery Management Council 1996). This may be associated with the pursuit of food organisms such as euphausiids.

Reproduction

Historically, *Loligo* were believed to spawn from summer to early fall (Lange and Sissenwine 1980), although this varied among years and geographic locations. Brodziak and Macy (1996), however, reported that *Loligo* can spawn year round. Most eggs are spawned in May with hatching occurring in July (Summers 1971). Spawning occurs from August to September in the Bay of Fundy (Stevenson 1934), from May to August in New England waters (Macy 1980, Summers 1971), and from late spring to early summer in the Middle Atlantic (Lange and Sissenwine 1983, Black *et al.* 1987). Mesnil (1977) reported that spawning on the Scotian Shelf and Georges Bank occurs during early spring and late summer.

Spawning has been reported in the Gulf of Maine in Cobequid Bay and Massachusetts Bay (Bigelow 1924), the Bay of Fundy (Stevenson 1934), Minas Basin (Cohen 1976), along the eastern coast of Nova Scotia in St. Margaret's and Terrence Bays (Dawe *et al.* 1990), on Georges Bank (Mesnil 1977), and in the Middle Atlantic in Narragansett and Delaware Bays (Haefner 1959, Griswold and Prezioso 1981).

Habitat requirements

Adults inhabit the continental shelf and upper continental slope to depths of 1320 ft (400 m) (Vecchione *et al.* 1989), but depth varies seasonally. In spring they are found at depths of 363-660 ft (110-200 m; Serchuk and Rathjen 1974, Lange and Sissenwine 1980), in summer and autumn they inhabit inshore waters as shallow as 20-92 ft (6-28 m; Summers 1968, Serchuk and Rathjen 1974, Gosner 1978, Howell and Simpson 1994) and in winter inhabit offshore waters to depths of 1205 ft (365 m; Lange 1982). They are found on mud or sand/mud substrate (Howell and Simpson 1994), at surface temperatures ranging from 48-70 °F (9-21 °C) and bottom temperatures ranging from 46-61 °F (8-16 °C; Summers 1969, Lux *et al.* 1974, Serchuck and Rathjen 1974, Lange and Sissenwine 1980, Macy 1980, Brodziak and Hendrickson 1997).

Loligo recruits caught during NEFSC trawl surveys were taken at depths ranging from 0-990 ft (0-300 m). However, depth of occurrence varied seasonally in accordance with known inshore-offshore migrations. Most pre-recruits were taken at 165-400 ft (50-120 m) and 45-54 °F (7-12 °C) in winter, 330-500 ft (100-150 m) and 50-54 °F (10-12 °C) in spring, 33-66 ft (10-20 m) and 52-61 °F (11-16 °C) in summer, and 66-230 ft (20-70 m) and 50-57 °F (10-14 °C) in winter.

Distribution and abundance

The NMFS bottom trawl surveys captured *Loligo* recruits (greater than 3.6 in; 9 cm ML) during all seasons. Their seasonal distributions are identical to that of pre-recruits and illustrate well the spring and summer inshore and the autumn offshore migrations (Figures 18a-d).

Recruits were caught at depths ranging from 0-990 ft (0-300 m), although this varied seasonally and in accordance with inshore-offshore migrations (Figure 19a). In winter, depths ranged from 66-960 ft (20-290 m), although most were caught between 165-400 ft (50-120 m). In spring, depths ranged from 0-890 ft (0-270 m), but most were caught at 330-500 ft (100-150 m), and the highest catch was at 400 ft (120 m). In summer, depths were less variable, ranging from 0-360 ft (0-110 m), and >80% were caught at 33-66 ft (10-20 m). In autumn, depths ranged from 33-990 ft (10-300 m), but most were caught between 66-230 ft (20-70 m).

Recruits were caught at a wide range of temperatures (Figure 19b). In winter, they were found at 39-55 °F (4-13 °C), although most were at 45-54 °F (7-12 °C). In spring, they were found at 41-63 °F (5-17 °C), with >60% found at 50-54 °F (10-12 °C). In summer, they were caught at 43-79 °F (6-26 °C), but most were at 52-61 °F (11-16 °C), with the highest catch at 61 °F (16 °C). In autumn, temperatures ranged from 45-81 °F (7-27 °C), with most at 50-57 °F (0-14 °C).

2.2.1.2.4 Importance of *Loligo* in state waters

Although *Loligo* are a pelagic, schooling species located across the continental shelf and slope, they are also located in state waters. *Loligo* data are not located in ELMR. Currently, the only state data available to NMFS in a consistent electronic format is Massachusetts Inshore Trawl Survey, Rhode Island Division of Fish and Wildlife Bottom Trawl Survey of Narragansett Bay, 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. However, these data do confirm presence in state waters. The Council anticipates by the next series of FMP Amendments that address EFH, all state data will be consistent and available electronically for comparison. At that time, it is likely that EFH for *Loligo* will be designated in estuaries.

2.2.1.3 *Illex*

2.2.1.3.1 Range

Illex is distributed on the western north Atlantic from the Labrador Sea to Florida Straits (Roper *et al.* 1998). Until recently, *Illex illecebrosus* was believed to be distributed on both sides of the North Atlantic, as was once thought (Roper et al. 1998). This confusion seems to have been a result of misidentifications of the closely related species *I. coindetii* (which does seem to be distributed on both sides of the Atlantic), as *I. illecebrosus*. It is most abundant in the Newfoundland region, moderately abundant between Newfoundland and New Jersey (Wigley 1982), and is commercial exploited from Newfoundland to Cape Hatteras (Brodziak 1995c). There is overlap in the geographic distributions of *Illex* species in the northwest Atlantic Ocean *I. illecebrosus* and *I. oxygonius* (Roper and Mangold 1998; Roper *et al.* 1998). The species are morphologically similar and difficult to distinguish and identify.

Data from the NOAA/Canada DFO East Coast of North America Strategic Assessment Project indicate that during 1975-1994 *Illex* in the northwest Atlantic were distributed from Labrador to Cape Hatteras (Figure 20). The areas of highest abundance of the species are the southern edge of the Grand Bank, the Scotian Shelf, Georges Bank, and the Middle Atlantic Bight.

Illex are highly migratory, capable of long distance migrations of more than 1,000 miles (Brodziak 1995c). They undergo seasonal inshore-offshore migrations which may be related to temperature, food, or both (MAFMC 1995). They spend winters (January to March) in dense aggregations along the outer continental shelf and upper slope where water temperatures are relatively warm, 46-57 °F (8-14 °C). In the spring (April-May), when shelf waters begin warming, they migrate shoreward, and during summer and autumn are widespread throughout the entire New England and Middle Atlantic continental shelf (Wigley 1982). In late autumn they begin their return migration to the warmer, offshore waters at the edge of and beyond the continental shelf (MAFMC 1995), where spawning is believed to occur. The hypothetical migration path of *Illex* is summarized in Figure 21 (Black *et al.* 1987).

2.2.1.3.2 Status of the stock

In the EEZ, from Cape Hatteras to the Gulf of Maine, landings of *Illex illecebrosus* increased since 1988 to 18,012 metric tons (mt) in 1993 (NMFS 1996a). *Illex* in 1993 were primarily caught in the Mid-Atlantic Bight offshore waters (Brodziak 1995c) and as a result, domestic landings accounted for 87% of the total 1993 landings (NMFS 1996a). Commercial landings in 1996 totaled 16,969 mt, 21% more than the 1995 total of 14,058 mt, and 8% less than the 18,350 mt landed in 1994 (Figure 22; NEFSC unpublished data).

Domestic landings of *Illex illecebrosus* from Cape Hatteras to the Gulf of Maine averaged 19,000 mt in 1972-1982 but rapidly declined to 9,400 mt throughout the following decade (Brodziak 1995c). Total *Illex* landings, including domestic and foreign, during 1973-1982 averaged 70,954 mt and were primarily taken in Northwest Atlantic Fisheries Organization (NAFO) Subareas 2, 3, and 4 (NMFS 1996a). Peak landings of an average 90,000 mt were made during 1976-1980 and record highs occurred in 1979 (NMFS 1996a). Subsequently, in the early 1980's, the fishery collapsed in NAFO Subareas 3 and 4 and total landings, taken mostly from United States waters, decreased dramatically to an average 9,179 mt during 1983-1989 (NMFS 1996a). When directed foreign fishing was eliminated in 1987, the *Illex* fishery was restricted to the United States and Canada, however, since 1983 most landings (approximately 75%) have been taken from United States waters (NMFS 1996a).

Data from the Northeast Fisheries Science Center indicate stock biomass levels were lowest in 1982 and highest in 1986 but overall, biomass estimates were found to be inaccurate (NMFS 1996a). However, abundance indices determined by the Northeast Fisheries Science Center in 1993 were four times greater than the average during the 1980's (Brodziak 1995c). Generally, patterns of *Illex illecebrosus* abundance seem to be cyclical in which periods of extreme low and high abundance alternate (MAFMC 1995). For example, following the low abundance of *Illex* in the early 1970's and mid 1980's, peak landings were made in the mid to late 1970's and late 1980's (MAFMC 1995).

Presently, NAFO Subareas 3 and 4 remain without an *Illex* squid fishery and the *Illex illecebrosus* stock within the United States EEZ, from Cape Hatteras to the Gulf of Maine, has a medium biomass level which is almost fully exploited (NMFS 1996a). Furthermore, the NAFO Total Allowable Catch (TAC) for *Illex* is quite large and may exceed the capacity of the stock to sustain current biomass levels (NMFS 1996a).

2.2.1.3.3 Habitat requirements by life history stage

The following information on eggs, larvae, juveniles, and adult *Illex* habitat requirements is taken directly from the document "Essential Fish Habitat Source Document, Short-Finned Squid, *Illex illecebrosus*: Life History and Habitat Requirements (Cargnelli *et al.* 1998b). This Cargnelli *et al.* (1998b) document is referred to hereafter as the *Illex* EFH background document. Most of the Tables and Figures from Cargnelli *et al.* (1998b) are included in this FMP. This Cargnelli *et al.* (1998b) *Illex* 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.

An extensive review and synthesis of the peer-reviewed literature has provided information on the habitat requirements and preferences of *Illex* and appears in Table 5.

Pre-recruits and recruits are stock assessment terms used by NEFSC and correspond roughly to the life history stages juveniles and adults, respectively. *Illex* pre-recruits are less than or equal to 10 cm and recruits are greater than 10 cm.

2.2.1.3.3.1 Eggs

No Illex illecebrosus egg masses have ever been found in nature (O'Dor and Dawe 1998), It is believed that the eggs are spawned in the water column, in a gelatinous mass, 1.7-3.3 ft (0.5-1.0 m) in diameter (Perez 1994), containing 10,000-100,000 eggs (Durward *et al.* 1980). Females can produce up to 400,000 eggs (Perez 1994). The egg masses are pelagic (Durward *et al.* 1978, O'Dor and Durward 1979), probably located at midwater near the pycnocline (O'Dor and Balch 1985). Eggs are laid, enter the Gulf Stream, become buoyant, travel to the inshore boundary of the current and hatch in 9-16 days (Perez 1994).

Habitat requirements

Laboratory studies indicate that egg incubation lasted 16 days at 55 °F (13 °C), 12 days at 61 °F (16 °C), and 8 days at 70 °F (21 °C); normal development requires at least 55 °F (13 °C) up to at least 80 °F (26 °C) at which hatching occurs in 6 days (Balch *et al.* 1985). It is hypothesized that egg masses are transported to the north via the Gulf Stream current (O'Dor 1983, Rowell *et al.* 1985a), and hatching is thought to occur at the inshore boundary of the Gulf Stream (Perez 1994).

Distribution and abundance

The egg stage of *Illex* were not sampled by the MARMAP offshore ichthyoplankton surveys.

2.2.1.3.3.2 Larvae

Illex larvae may initially remain in the remains of the egg mass to utilize the nutrients for food (Durward *et al.* 1980) and continue to be transported northward via the Gulf Stream during late winter and early spring (Dawe and Beck 1985, Perez 1994, MAFMC 1995). In the laboratory, larvae hatch at 1.1 mm ML (Durward *et al.* 1980). They change from a paralarval stage to a transitional stage at approximately 5.0 mm ML, and to the juvenile stage at about 7.0 mm ML (Hatanaka 1986).

Habitat requirements

Larvae have been found in nature from 41-68 °F (5-20 °C; Vecchione 1979, Vecchione and Roper 1986, O'Dor 1983, Dawe and Beck 1985, Hatanaka et al. 1985), with maximum abundance in the Gulf Stream reported to be at temperatures greater than 62 °F (16.5 °C; Hattanaka et al. 1985), and salinities of 35-36 ppt (Vecchione 1979, Vecchione and Roper 1986, O'Dor 1983, Dawe and Beck 1985). Larvae are abundant in late January in the Gulf Stream/Slope Water, in the warm water (greater than 55 °F; 13 °C) above the thermocline (Amaratunga 1980a, Hatanaka *et al.* 1985). The convergence of the Gulf Stream and Slope Water creates an area of high productivity which is beneficial to the young for feeding (Perez 1994).

Distribution and abundance

The larval stage of *Illex* were not sampled by the MARMAP offshore ichthyoplankton surveys. However larvae have been collected in all seasons (Roper and Lu 1979) from south of Cape Hatteras to as far north as the tail of the Grand Bank (Dawe and Beck 1985, Hatanaka *et al.* 1985). Hatchlings have only been collected couth of Cape Hatteras (Dawe and Beck 1985, Rowell *et al.* 1985), suggesting that this may serve as the larval source for the entire stock (Hatanaka *et al.* 1985).

2.2.1.3.3.3 Juveniles

The onset of the juvenile stage is indicated by the separation of the proboscis into a pair of tentacles (Black *et al.* 1987). In late spring, at a size of around 4 in (10 cm) ML, juveniles begin to move onto the continental shelf into shallow waters off northern New England, Nova Scotia and Newfoundland (O'Dor 1983, Black *et al.* 1987, Perez 1994) where they may form large surface schools (MAFMC 1995). This time is spent feeding, and growth is rapid, approximately 0.06 in (1.5 mm) per day (Amaratunga 1980a). By late summer and early fall, juveniles attain sizes of 7.2-10 in (18-25 cm) ML, and begin to show signs of maturity (Wigley 1982). The size at which 50% of individuals are mature (L_{50}) is 8 in (20 cm) ML (Brodziak 1995c), although mean size at sexual maturity varies latitudinally and interanually, ranging from 7.9 to 8.5 in. (20 to 21.5 cm) ML in U.S. EEZ waters (Coelho and O'Dor 1993).

Habitat requirements

Pre-recruits were found at depths ranging from 33-1490 ft (10-450 m; Figure 23a). They inhabited shallower (i.e., inshore) waters in summer and autumn than in winter and spring. This corresponds well with the seasonal inshore-offshore migrations described above. In winter, >70% of Pre-recruits were found at 400 ft (120 m) and 530 ft (160 m), and in the spring most were caught from 100-760 ft (30-230 m). In summer, they were found much shallower, from 33-400 ft (10-120 m), and most were found between 66-260 ft (20-80 m), and in autumn they were found from 100-1490 ft (30-450 m), with most between 66-400 ft (20-120 m). Pre-recruits were found at temperatures ranging from 36-73 °F (2-23 °C; Figure 23b). In winter, >75% were caught at 54-55 °F (12-13 °C), in spring, about 70% were caught at 48-55 °F (9-13 °C), in summer about 80% were caught at 46-55 °F (8-13 °C), and in autumn about 70% were caught at 48-54 °F (9-12 °C).

Distribution and abundance

The NEFSC bottom trawl surveys captured *Illex* Pre-recruits (less than or equal to 4 in [10 cm] ML) during all seasons. The distribution pattern corresponds well to the inshore-offshore movements described in section 2.1 above. In winter, low catches were made from North Carolina to Georges Bank, but were highest in the Middle Atlantic region. All were caught at the 600 ft (100 fathom) depth contour (Figure 24a). The low numbers taken were most likely a result of most Pre-recruits being further offshore (e.g., in the Gulf Stream) where the survey did not sample. In the spring, catches were much higher and were made from south of Cape Lookout to the Scotian Shelf. Most catches were still at the 600 ft (100 fathom) line, but some were made on the continental shelf (Figure 24b), indicating the inshore migration of juveniles onto the shelf had begun. In summer, squid were caught from throughout the continental shelf, from the shoreline out to the 600 ft (100 fathom) line, and from North Carolina to Georges Bank. The highest catches were made south of Cape Cod and Long Island (Figure 24c). Catches in autumn indicate that the return migration to deeper waters had begun. In the Middle Atlantic almost all catches were made outside of the 180 ft (30 fathom) line, and most were taken at the 600 ft (100 fathom) line. Low numbers were found from a number of areas in the Gulf of Maine, and many were caught from throughout Georges Bank (Figure 24d).

2.2.1.3.3.4 Adults

Males undergo earlier maturation than females and appear to migrate south during the fall in advance of females (Black *et al.* 1987). Evidence for this includes a seasonal decline in the percentages of males collected on the continental shelf during autumn (Aramatunga 1980, Lange and Sissenwine 1983), which may be attributed to earlier emigration than females. Off Newfoundland, mature squid begin to move offshore in October-November (Hurley 1980), moving southward to the spawning areas in the warmer waters of the Gulf Stream (Dawe *et al.* 1981b). Spawning occurs a few months after maturity is reached (Squires 1967).

The life span of *Illex* is 1-1.5 years (Squires 1967, Wigley 1982). However, several recent studies utilizing statolith aging (Dawe *et al.* 1985). have shown the life span to be less than 1 year for bot the northern and southern portion of the stock (Dawe and Beck 1997, O'Dor and Dawe 1998). The species may achieve a maximum size of 33-35 cm ML and 700 g, with females achieving larger sizes than males (O'Dor and Dawe 1998, Hendrickson In press).

Reproduction

Illex is a semelparous, terminal spawner with a protracted spawning season. There have been no direct observations of spawning in nature, but in speculation about the timing and location is based on squid size and timing of advanced male maturity stages (O'Dor and Dawe 1998), back-calculated hatch dates from aging studies, and the collection of hatchling (Hendrickson pers. comm). *Illex* spawning takes place in the deep waters of the continental slope during winter (MAFMC 1995). Spawning likely occurs throughout the year (O'Dor and Dawe 1998) with most intense spawning generally occurring from December to March (Lange and Sissenwine 1980), but this varies among years and locations. Between Cape Canaveral, Florida and Charleston, North Carolina, spawning occurs during December to January (Rowell *et al.* 1985a, MAFMC 1995), while off Newfoundland, spawning has been reported from January through June (Squires 1967).

The principal spawning area is believed to be south of Cape Hatteras over the Blake Plateau (Black *et al.* 1987, MAFMC 1995), but other spawning occurs between the Florida Peninsula and central New Jersey at depths down to 990 ft (300 m; Fedulov and Froerman 1980, MAFMC 1995). Spawning probably occurs in the northern part of the Gulf Stream/Slope Water frontal zone (Dawe and Beck 1985, O'Dor and Balch 1985, Rowell et al 1985a).

Habitat requirements

Recruits were found at depths ranging from 33-1390 ft (10-420 m; Figure 25a), and inhabited shallower (i.e., inshore) waters in summer and autumn than in winter and spring. This corresponds well with the seasonal inshore-offshore migrations described for the species. In winter, >50% of recruits were found at 400 ft (120 m) and 690 ft (210 m). In the spring, they were found at a wide range of depths, with most at 230-920 ft (70-280 m). In summer, they were found much shallower, with most between 130-300 ft (40-90 m), and in autumn, they were found from 100-1220 ft (30-370 m), but most were at depths of less than 430 ft (130 m). Recruits were found at temperatures ranging from 40-66 °F (4-19 °C; Figure 25b). In winter, >80% were caught at 52-55 °F (11-13 °C), in spring, >60% were caught at 48-54 °F (9-12 °C), in summer >70% were caught at 41-48 °F (5-9 °C), and in autumn, >70% were caught at 46-54 °F (8-12 °C).

Distribution and abundance

The NEFSC bottom trawl surveys captured *Illex* recruits (greater than or equal to 4.4 in [11 cm] ML) during all seasons. As with Pre-recruits, the distribution pattern illustrates well the inshore-offshore movements of the species. In winter, low catches were made in the Middle Atlantic region at the 600 ft (100 fathom) depth contour (Figure 26a). The low numbers probably reflect the fact that at this time of year adults migrate to the Gulf Stream waters to spawn, and thus were not sampled. In the spring, catches were much higher and most were still at the 600 ft (100 fathom) line, although some inshore movement onto the continental shelf is evident (Figure 26b). In summer, recruits were caught throughout the continental shelf from the shoreline out to the 600 ft (100 fathom) line and from Pamlico Sound to Georges Bank and throughout the Gulf of Maine (Figure 26c). Catches in autumn, at least in the Middle Atlantic, indicate that the return migration to deeper waters had begun. In the Middle Atlantic most catches were made outside of the 180 ft (30 fathom) line, with the highest densities at the 100 fathom line. High numbers of recruits were found throughout Georges Bank and the Gulf of Maine (Figure 26d).

2.2.1.3.4 Importance of *Illex* in state waters

Although *Illex* are a pelagic, schooling species located across the continental shelf and slope, they are infrequently located in state waters. *Illex* data are not presented in ELMR. While *Illex* may be important in other states' water, currently, the only state data available to NMFS in a consistent electronic format is Massachusetts Inshore Trawl Survey, Rhode Island Division of Fish and Wildlife Trawl Survey of Narragansett Bay. These data will not be used to designate EFH within estuaries, because other states' data are not currently available in a format makes it possible to compare them. However, they do confirm the presence of *Illex* in estuaries. If the abundance of *Illex* in estuaries is significant, after all the data are compiled, then estuaries may be designated as EFH in future amendments to this FMP.

2.2.1.4 Butterfish

2.2.1.4.1 Range

Butterfish are fast-growing, short-lived, pelagic fishes that form loose schools, often near the surface (Schreiber 1973, Dery 1988, Brodziak 1995a). Butterfish range from Newfoundland and the Gulf of St. Lawrence to the Atlantic and Gulf coasts of Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras (Figure 27; Bigelow and Schroeder 1953, Haedrich 1967, Horn 1970a, Powell *et al.* 1972, Cooley 1978, Scott and Scott 1988, Brodziak 1995a, Klein-MacPhee, *in review*). They winter near the edge of the continental shelf in the Middle Atlantic Bight and migrate inshore in the spring into southern New England and Gulf of Maine waters. During the summer, butterfish occur over the entire Mid-Atlantic shelf from sheltered bays and estuaries out to about 660 ft (200 m). In late fall, butterfish move southward and offshore in response to falling water temperatures (Fritz 1965, Horn 1970a, Schreiber 1973, Waring 1975, Azarovitz *et al.* 1980, Klein-MacPhee, *in review*).

North of Cape Hatteras, butterfish have a seasonal inshore-offshore north-south migration in response to changing water temperatures; south of Hatteras there is a limited seasonal inshore-offshore migration (Caldwell 1961, Fritz 1965, Horn 1970a, Klein-MacPhee, *in review*). During the summer, butterfish move north and inshore to feed on planktonic fish, squid, crustaceans, and jellyfish, and to reproduce. They remain near the surface at depths of 73-180 ft (22-55 m) and often come close inshore; schools are frequently seen on shallow flats, sheltered bays, and estuaries (Bigelow and Schroeder 1953, Klein-MacPhee, *in review*). Butterfish are common in the lower Chesapeake Bay from March through November (Geer and Austin 1997, Murdy *et al.* 1997). They occur in the surf zone off Long Island from June through October (Schaefer 1967). They appear off Rhode Island by the last half of April and off Woods Hole by mid-May, although they are not abundant there until June. They appear on Georges Bank in early June, but are not abundant until late June or early July. They are found in the Gulf of Maine from late June-early July through fall (Bigelow and Schroeder 1953, Klein-MacPhee, *in review*). They occur in New Hampshire waters from July to October; peak abundance occurs in September (MAFMC 1995). Butterfish are common along the coast of Maine and, in some years, common along the coast of Nova Scotia bordering the Gulf of Maine (Bigelow and Schroeder 1953).

During the winter, the stock moves south and offshore; fish are found near the bottom preferring sand to muddy or rocky bottoms and have been caught to about 660 ft (200 m) deep in the Northwest Atlantic (Bigelow and Schroeder 1953, Klein-MacPhee, *in review*) and over 1160 ft (350 m) in the South Atlantic Bight (Barans and Burrell 1976). They are absent from nearshore waters off New Jersey from January through late April (Milstein and Hamer 1976). South of Delaware Bay, the offshore movement is not so extensive and some individuals move south in shallow water (Waring and Murawski 1982).

2.2.1.4.2 Status of the stock

A fishery for butterfish has existed since the late 1800's (Murawski and Waring 1979) and the average annual landings in US waters from 1920 to 1962 were 3,000 mt (Waring 1975). In 1963, distant water fleets from Japan, Poland, and the USSR began targeting butterfish from late autumn through early spring when the fish were concentrated offshore (Murawski and Waring 1979, MAFMC 1995). Annual landings increased to a record 19,500 mt in 1973 (Figure 28; Brodziak 1995a). Restrictions were placed on the foreign fisheries and landings subsequently decreased to 6,100 mt in 1977-1987. Directed foreign fishing was halted in 1987 and landings continued to decline to an average 2,500 mt in the domestic fishery in 1987-1992 (Brodziak 1995a, MAFMC 1995); the domestic fishery targeted butterfish from late spring through fall in inshore areas (Murawski and Waring 1979). Butterfish landings totaled 4,500 mt in 1993 (Figure 28) and came from primarily Southern New England (79% in Rhode Island ports) and the New York Bight. These landings were 60% higher than landings in 1992 and were comparable with record domestic catches made in 1987 (Brodziak 1995a). Butterfish biomass estimated from the NEFSC bottom trawl surveys has made several record lows and near record highs in the last decade (Figure 28). Despite these seasonal increases in biomass and pre-recruit indices, stock size has decreased and commercial landings remain low (NMFS 1994). Although the demand for butterfish has declined in recent years, the capacity for increased landings remains in an under-exploited fishery (Brodziak 1995a).

2.2.1.4.3 Habitat requirements by life history stage

The following information eggs, larvae, juveniles, and adult butterfish habitat requirements is taken directly from the document "Essential Fish Habitat Source Document, Atlantic Butterfish, *Peprilus triacanthus*: Life History and Habitat Requirements" (EFH butterfish team 1998). This EFH Butterfish Team (1998) document is referred to hereafter as the butterfish EFH background document. Most of the Tables and Figures from butterfish EFH background document are included in this FMP. This EFH butterfish team (1998) Atlantic butterfish 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 habitat environmental conditions where butterfish eggs, larvae, juveniles, and adults occur were summarized based on a literature survey and analyses of several fishery-independent databases (Table 6).

2.2.1.4.3.1 Eggs

Butterfish eggs are buoyant, transparent, and spherical (0.027-0.033 in; 0.68-0.82 mm) diameter; Martin and Drewry 1978, Elliott and Jiminez 1981). The incubation period is about 48 hrs at 64 °F (18 °C); 50% of eggs hatched at 72 hrs at about 59 °F (15 °C; Martin and Drewry 1978, Colton and Honey 1986). Eggs are found at 55-73 °F (12.8-22.5 °C) and 78-100% seawater (Martin and Drewry 1978). At hatching, butterfish are 0.067-0.070 in (1.68-1.75 mm); yolk absorption is complete at 0.100-0.106 in (2.48-2.64 mm; Colton and Honey 1963, Colton and Marak 1969).

Habitat requirements

Butterfish eggs are pelagic, found from the outer continental shelf to the lower, high salinity parts of estuaries in Middle Atlantic Bight. Eggs have been collected at 54-73 °F (12-23 °C) and salinities ranging from estuarine to full strength seawater (Table 6).

In the MARMAP Ichthyoplankton Survey (1978-87), eggs were collected on the continental shelf in 33 ft (10 m) of water nearshore to about 4125 ft (1250 m) of water offshore; most eggs were collected in water depths <660 ft (200 m; Figure 29a). Surface water temperatures where eggs were collected ranged from 43-79 °F (6-26 °C); most eggs were collected at 52-63 °F (11-17 °C; Figure 29b).

Distribution and abundance

Butterfish eggs have been reported off North Carolina (Smith *et al.* 1980, Rotunno 1992, Rotunno and Cowen 1997), in the Middle Atlantic Bight, on Georges Bank, and in the Gulf of Maine (MAFMC 1995, Rotunno and Cowen 1997), in Narragansett Bay, Salem Harbor (Herman 1963, Bourne and Govoni 1988, Elliott and Jiminez 1981), Raritan Bay (Croker 1965), and Chesapeake Bay (Lippson and Moran 1974).

During the MARMAP Ichthyoplankton Survey (1978-87), butterfish eggs were collected from Cape Hatteras to the northern Gulf of Maine (Figure 30). Eggs first appeared in ichthyoplankton collections in April (Figure 31a); by May, eggs were distributed along the edge of the continental shelf between Cape Hatteras and Georges Bank and inshore in the southern and middle mid-Atlantic (Figure 31b). As water temperatures increased on the shelf, eggs were found progressively closer to the coast from south to north. Eggs were most abundant and most frequently encountered in July (Figure 31d); they were most abundant in the Gulf of Maine in August (Figure 31e). By September, egg abundance had declined dramatically (Figure 31f); no eggs were collected between October and March.

2.2.1.4.3.2 Larvae

Butterfish larvae range from 0.104 in to 0.64 in (2.6-16 mm) SL (Martin and Drewry 1978). By 0.24 in (6 mm) they have the thin, deep body characteristic of adults and by 0.60-0.64 in (15-16 mm) they have a forked tail (Horn 1970a, Ditty and Truesdale 1983). By 0.40-0.60 in (10-15 mm), larvae are more nektonic than planktonic (Martin and Drewry 1978) and are caught in neuston nets (Powles and Stender 1976, Lux and Wheeler 1992). At this size, they begin to associate with jellyfish, *Sargassum*, and other flotsam (Mansueti 1963, Haedrich 1967, Horn 1970b, Thomas and Milstein 1973, Lippson and Lippson 1984). Metamorphosis is gradual as larvae progressively assume juvenile characters (Able and Fahay 1998). Larvae may undertake diel vertical migrations; more butterfish larvae were collected between 0-13 ft (0-4 m) at night than during the day (Kendall and Naplin 1981).

Habitat requirements

Butterfish larvae are pelagic, found from the outer continental shelf to the lower, high salinity parts of estuaries in Middle Atlantic Bight. Larvae have been collected at 39-82 °F (4-28 °C), occurring at salinities ranging from estuarine to full strength seawater (Table 6). Larvae may undertake diel vertical migrations (Kendall and Naplin 1981). Larger larvae (0.40-0.60 in; 10-15 mm) are more nektonic than planktonic; larger larvae and pelagic juveniles (less than 1.2 in; 30 mm) often associate with jellyfish, *Sargassum*, and other flotsam (Mansueti 1963, Haedrich 1967, Horn 1970b, Thomas and Milstein 1973, Lippson and Lippson 1984).

Larvae were collected on the continental shelf in 33 ft (10 m) of water nearshore out to about 5780 ft (1750 m) of water offshore; most larvae were collected in water depths <400 ft (120 m) (Figure 32a-b). Surface water temperatures ranged from 45-79 °F (7-26 °C); most larvae were collected at 48-66 °F (9-19 °C; Figure 32a-b).

Distribution and abundance

Butterfish larvae have been reported from the New York Bight and Georges Bank (Smith *et al.* 1980, Wilk *et al.* 1990, MAFMC 1995, Rotunno 1992, Rotunno and Cowen 1997), in Buzzards Bay(Lux and Wheeler 1992), Narragansett Bay (Herman 1963, Bourne and Govoni 1988, Elliott and Jiminez 1981), Raritan Bay (Croker 1965), and in the South Atlantic Bight as far south as Cape Kennedy (Fahay 1975, Powles and Stender 1976, Rotunno 1992, Rotunno and Cowen 1997). Larvae are not abundant in the South Atlantic Bight (<0.5% of total ichthyoplankton) and did not occur frequently (<10% of stations in 73 station coastal survey) (Fahay 1975).

During the MARMAP Ichthyoplankton Survey (1977-87), butterfish larvae were collected from Cape Hatteras into the Gulf of Maine (Figures 33). Larvae first appeared in ichthyoplankton collections in January (Figure 34a). From January through April, larvae were collected primarily off Cape Hatteras (Figure 34a-d). In May and June, larvae began to appear along the edge of the continental shelf between Cape Hatteras and Georges Bank and inshore in the southern Middle Atlantic Bight (Figure 34e-f). As water temperatures increased on the shelf, larvae were found progressively closer to the coast from south to north. Larvae were most abundant and most frequently encountered across the continental shelf in the Middle Atlantic Bight northward to Georges Bank in July and August (Figure 34g-h). The abundance of larvae declined sharply from September through November (Figure 34i-j). No larvae were collected in December.

2.2.1.4.3.3 Juveniles

Juvenile butterfish range from 0.64 in (16 mm) to about 4.8 in (120 mm) SL (Martin and Drewry 1978). They grow to 3.04-5.08 in (76-127 mm), or about half their adult size, during their first year (Hildebrand and Schroeder 1928, Klein-MacPhee, *in review*). Early spawned individuals are 3.04-4.08 in (76-102 mm) in the fall; late-spawned individuals are 2.04-3.04 in (51-76 mm) in the fall and 3.04-5.08 in (76-127 mm) the following spring (Martin and Drewry 1978). Young butterfish (less than 1.2 in; 30 mm) often live in the shelter of large jellyfishes during their first summer. Although this commensal association is not essential, it is a source of food and provides them some protection from predators (Mansueti 1963, Horn 1970b, 1975).

Habitat requirements

Juvenile butterfish are pelagic fishes that form loose schools, often near the surface (Schreiber 1973, Dery 1988, Brodziak 1995a). They are eurythermal (39.9-70.9 °F; 4.4-21.6 °C) and euryhaline (5-32 ppt) and are frequently found over sand, mud, and mixed fine-grained substrates (Table 6). During the summer, butterfish occur inshore where they remain near the surface; schools are frequently seen on shallow flats, sheltered bays, estuaries, and the surf zone (Bigelow and Schroeder 1953, Leim and Scott 1966, Schaefer 1967, Klein-MacPhee, *in review*). Smaller juveniles often aggregate under the bells of coelenterates (Mansueti 1963, Horn 1970b, 1975, Scott and Scott 1988), while larger juveniles are pelagic schoolers that may congregate near the bottom during the day and disperse upwards at night (Waring 1975). In the Gulf of Maine and Middle Atlantic Bight, butterfish move offshore during the winter; fish are found near the bottom over sand, mud, and rock substrates (Bigelow and Schroeder 1953, Klein-MacPhee, *in review*). South of Delaware Bay, where winter temperatures are warmer, the offshore migration is not as pronounced (Waring and Murawski 1982). In the South Atlantic Bight, butterfish are present throughout most of the year in nearshore waters (Keiser 1976).

In the NEFSC Bottom trawl Survey (1964-97), juvenile butterfish were collected on the continental shelf in 33 ft (10 m) of water nearshore out to about 1190 ft (360 m) of water offshore; most juveniles were collected in water depths <590 ft (180 m; Figure 35). Juveniles were distributed somewhat shallower than adults in all seasons. Bottom-water temperatures where juveniles were captured ranged from 37-82 °F (3-28 °C); most fish were collected between 45-68 °F (7-20 °C; Figures 36). Modal temperatures during spring and fall surveys were 50-57 °F (10-14 °C) for juveniles.

Distribution and abundance

Juvenile butterfish occur from Nova Scotia to the Atlantic and Gulf coasts of Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras (Bigelow and Schroeder 1953, Haedrich 1967, Horn 1970a, Powell *et al.* 1972, Cooley 1978, Scott and Scott 1988, Brodziak 1995a, Klein-MacPhee, *in review*).

During the NEFSC bottom trawl survey, juvenile butterfish were collected from the northern Gulf of Maine south to below Cape Lookout, South Carolina (Figure 37a-d). During the winter and spring, they were distributed along the outer continental shelf from southern New England to Cape Hatteras; they occurred along the coast near Cape Hatteras (Figures 37a,d). During the summer, juvenile butterfish were collected near the coast throughout the Middle Atlantic Bight and on Georges Bank (Figure 37b). During the fall, they were abundant across the shelf throughout the Middle Atlantic Bight and on Georges Bank (Figure 37c). During the SEAMAP bottom trawl survey, juvenile butterfish were collected from Cape Lookout, South Carolina to Cape Kennedy, Florida (Figures 38a-d). Catches were smallest during the winter and largest during the summer.

2.2.1.4.3.4 Adults

Adult butterfish range from about 4.8 in to 12.2 in (120-305 mm) SL (Hildebrand and Schroeder 1927); average length 6-9.2 in (150-230 mm; Klein-MacPhee, *in review*). The size where 50% of the population is sexually mature (L_{50}) on the Northeast Shelf is about 4.8 in (12 cm) FL for males and females (O'Brien *et al.* 1993), which corresponds to an age of 1+ (Horn 1970a, DuPaul and McEachran 1973). All individuals are mature at 2 years of age. At 2+ years of age, butterfish are about 6.8 in (17 cm) and at 3+, they are about 7.6 in (19 cm; Waring and Murawski 1982).

Reproduction

For butterfish collected on the Northeast Shelf between 1986-89, the median length at maturity (L_{50}) was 4.8 in (12 cm) TL for females and 4.56 in (11.4 cm) TL for males (O'Brien *et al.* 1993). Horn (1970a) reported that butterfish mature during their second summer (age 1) at 4.8-5.6 in (120-140 mm) SL. In Chesapeake Bay, butterfish begin to mature at age 1 (their second summer) and most individuals are mature by age 2 (their third summer) (DuPaul and McEachran 1973). In the New York Bight, ripe females 5.0-9.7 in (124-242 mm) FL were collected from 10-480 ft (3-145 m) of water from May through August; <5% of the ripe females were collected in Hudson-Raritan estuary (Wilk *et al.* 1990). Supposedly, butterfish are broadcast spawners (Horn 1970a), but no direct observations have been made (Klein-MacPhee, *in review*). Spawning occurs primarily in the evening or at night (Ferraro 1980).

Butterfish may spawn a few miles out to sea off Woods Hole and return inshore when they are spent (Klein-MacPhee, *in review*). Butterfish are usually reported to spawn offshore (e.g., Wang and Kernehan 1979), but eggs and larvae have been collected in coastal waters and most estuaries in the northern part of the Middle Atlantic Bight (Hildebrand and Schroeder 1928, Herman 1963, Martin and Drewry 1978, Lux and Wheeler 1992, Able and Fahay 1998). Early stage eggs have been collected in Narragansett Bay and Salem Harbor (Herman 1963, Bourne and Govoni 1988, Elliott and Jiminez 1981), Raritan Bay, NJ (Croker 1965), and in the lower portions of Chesapeake Bay (Lippson and Moran 1974), but not in Delaware Bay (Wang and Kernehan 1979). Butterfish may spawn during the evening in the upper part of the water column; more eggs were collected between 0-13 ft (0-4 m) at night in the Middle Atlantic Bight than during the day (Kendall and Naplin 1981).

Water temperatures appear to regulate reproduction as spawning dates are progressively later in the northern part of the range (Murawski *et al.* 1978, Rotunno and Cowen 1997); spawning probably does not occur below 59 °F (15 °C; Colton 1972). Spawning may occur year round in the South Atlantic Bight with a peak in spring (Fahay 1975, Able and Fahay 1998). Butterfish begin spawning in Chesapeake Bay as early as late May; peak spawning occurs in June and July

(Hildebrand and Schroeder 1928, Pearson 1941). Spawning in the Middle Atlantic Bight occurs from May through October (Smith *et al.* 1979); gonad weight of fish >6 in (15 cm) increases in March and April, reaches its maximum during June and July, and decreases in the fall (Kawahara 1977b). The principal spawning areas in Long Island Sound are in the eastern part; spawning occurs from June through late August with a peak in late July (Perlmutter 1939). In Narragansett Bay, butterfish eggs are found from June to August (Herman 1963). In Massachusetts Bay, spawn from June to August (Bigelow and Schroeder 1953). In the Gulf of Maine, butterfish spawning begins in May-June, peaks in July, and ends in August (Bigelow and Schroeder 1953; Smith *et al.* 1979). On the Scotian Shelf, spawning occurs from July to October (Markle and Frost 1985).

The spawning period may be more protracted in the Middle Atlantic Bight than previously thought. Rotunno (1992, Rotunno and Cowen 1997) estimated spawning times from a birthdate analysis of otoliths from butterfish up to about 2 in (50 mm) SL collected in the Middle Atlantic and South Atlantic bights. They found that spawning began in February and continued through at least late July. Spawning began in the south and progressed northward over time, which is consistent with the temporal and spatial distribution of larvae, and suggests that butterfish spawn as they migrate north and inshore on their annual migration in association with seasonal warming of waters on the Northeast Shelf.

Habitat requirements

Adult butterfish are pelagic fishes that form loose schools, often near the surface (Schreiber 1973, Dery 1988, Brodziak 1995a). They are eurythermal (39.9-70.9 °F; 4.4-21.6 °C) and euryhaline (5-32 ppt) and are frequently found over sand, mud, and mixed fine-grained substrates (Table 6). During the summer, butterfish occur inshore where they remain near the surface; schools are frequently seen on shallow flats, sheltered bays, estuaries, and the surf zone (Bigelow and Schroeder 1953, Leim and Scott 1966, Schaefer 1967, Klein-MacPhee, *in review*). In the Gulf of Maine and Middle Atlantic Bight, butterfish move offshore during the winter; fish are found near the bottom over sand, mud, and rock substrates (Bigelow and Schroeder 1953, Klein-MacPhee, *in review*). South of Delaware Bay, where winter temperatures are warmer, the offshore migration is not as pronounced (Waring and Murawski 1982). In the South Atlantic Bight, butterfish are present throughout most of the year in nearshore waters (Keiser 1976).

In the NEFSC Bottom trawl Survey (1964-97), adult butterfish were collected on the continental shelf in 33 ft (10 m) of water nearshore out to about 1190 ft (360 m) of water offshore; most juveniles and adults were collected in water depths <590 ft (180 m; Figure 39). Adults were distributed somewhat deeper than juveniles in all seasons. Bottom-water temperatures where adults were captured ranged from 37-82 °F (3-28 °C); most fish were collected between 45-68 °F (7-20 °C; Figures 40). Modal temperatures during spring and fall surveys were 50-57 °F (10-14 °C) for adults.

Distribution and abundance

Adult butterfish have been reported from Newfoundland to the Atlantic and Gulf coasts of Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras (Bigelow and Schroeder 1953, Haedrich 1967, Horn 1970a, Powell *et al.* 1972, Cooley 1978, Scott and Scott 1988, Brodziak 1995a, Klein-MacPhee, *in review*).

During the NEFSC bottom trawl survey, adult butterfish were collected from the northern Gulf of Maine south to below Cape Lookout, South Carolina (Figure 41a-d). During the winter and spring, they were distributed along the outer continental shelf from southern New England to Cape Hatteras; they occurred along the coast from Cape Hatteras to Maryland (Figure 41a,d). During the summer, adult butterfish were collected across the shelf throughout the Middle Atlantic Bight, on Georges Bank, and in the coastal Gulf of Maine (Figure 41b). During the fall, they were abundant on the shelf throughout the Middle Atlantic Bight, on Georges Bank, and in Massachusetts Bay (Figure 41c). During the SEAMAP bottom trawl survey, adult butterfish were collected from Cape Lookout, South Carolina to Cape Kennedy, Florida (Figure 42a-d). The size of the catches was similar throughout the year. Off South Carolina, butterfish are present in nearshore waters throughout most of the year (Keiser 1976).

2.2.1.4.4 Importance of butterfish in state waters

Although butterfish are an offshore pelagic species, eggs, larvae, and juveniles are found to varying degrees in estuaries and bays of New England and the Mid-Atlantic. The primary data source for butterfish in state waters is NOAA's Estuarine Living Marine Resources Program (ELMR; Tables 7 and 8), while not as quantitative as the NEFSC trawl data it does describe the butterfish spatial (Tables 7) and temporal (Table8) relative abundance by life stage and month in the various coastal estuaries from Waquoit Bay, Massachusetts to James River, VA(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.

Eggs and larvae are common in the high salinity zones of some estuaries in southern New England and the mid-Atlantic and in the mixing zone in Chesapeake Bay (Table 7). In the coastal bays and estuaries, butterfish eggs were recorded as far north as Penobscot Bay and as far south as Chesapeake Bay (ELMR database, NOAA/NOS, Stone *et al.* 1994). Eggs were abundant in Narragansett Bay and common in Massachusetts Bay, Cape Cod Bay, Waquoit Bay, Buzzards Bay, Long Island Sound, Gardiners Bay, Great South Bay, and Chesapeake Bay (Tables 7 and 8; Figure 43a).

In the coastal bays and estuaries of New England and the mid-Atlantic, butterfish larvae were recorded as far north as Penobscot Bay and as far south as Chesapeake Bay (ELMR database, NOAA/NOS, Stone *et al.* 1994). The larvae were common in Boston Harbor, Waquoit Bay, Buzzards Bay, Narragansett Bay, Long Island Sound, Gardiners Bay, Great South Bay, Great South Bay, and Chesapeake Bay (Table 7 and 8; Figure 43b).

Juvenile and adult butterfish are common to abundant in the high salinity and mixing zones of estuaries from Massachusetts Bay to the mid-Atlantic; they are rare to uncommon in the high salinity and mixing zones of estuaries in the central and northern Gulf of Maine and in the South Atlantic Bight (Table 7). They occur in high salinity and mixed salinity zones of most estuaries from the Gulf of Maine to Florida (Table 7; Figure 43c,d: Geer and Austin 1997, Murdy *et al.* 1997).

Juvenile and adult butterfish are common to abundant in the high salinity and mixing zones of estuaries from Massachusetts Bay to the mid-Atlantic; they are rare to uncommon in the high salinity and mixing zones of estuaries in the central and northern Gulf of Maine and in the South Atlantic Bight (Tables 7). Spawning adults were recorded from Massachusetts Bay south to the Chesapeake Bay, but were only common in Long Island Sound, Gardiners Bay, Great South Bay, and Chesapeake Bay (Figure 43e; Table 7).

In Long Island Sound, butterfish appeared in May; abundance peaked in September-October and declined in November. Juveniles composed 17% of the butterfish caught in May, 91% in September-October, and 73% in November. Juveniles showed up in surf zone off Long Island in July and were common from August through October (Schaefer 1967). In the Hudson-Raritan Estuary, juveniles were caught from spring through fall. Juvenile butterfish were collected in spring and fall by the Massachusetts inshore trawl survey, but catches were 1-2 orders of magnitude greater in the fall.

2.2.1.5 Previously provided state data

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

The Council, attempting to coordinate and obtain the best information available in Amendment 5, requested each State from North Carolina to Maine to identify the essential habitat under their jurisdiction. North Carolina, Virginia, New Jersey, New York, Connecticut, Massachusetts and Maine did not respond to the request. The following paragraphs are paraphrased from the responses of the State experts. Comments will specifically be solicited to update this information, from EFH identified state data contacts and coastal zone managers.

In Maryland (Casey pers. comm.) *Loligo pealei* is the primary squid in the Atlantic commercial fishery but is only caught incidental to other sought species. In 1992, commercial landings totaled 60,500 pounds with no discernable seasonality. Squid are caught throughout Maryland's coastal bays with *Loligo* being found along with the Brief squid (*Lolliguncula brevis*). They are only caught in small numbers, usually less than 100 per year. No *Illex* have been caught in Maryland's coastal bays and probably make up only a very small percentage of the total squid landings (Casey pers. comm.). In the coastal bays squid are found over muddy bottom where depths are greater than 4 ft. Much of these bays however, are only 6 to 8 ft deep. At night, schools of squid are attracted to bridge and pier lights in the Ocean City area (Casey pers. comm.).

In Maryland, Atlantic mackerel are caught by both commercial and recreational fishermen in the Atlantic ocean. No juvenile or adult mackerel have been observed in the coastal bays (Casey pers. comm.).

Butterfish are also an incidental catch of the Atlantic fishery off of Maryland. The majority of the landings occur in the late fall and early winter. Small numbers of juveniles are occasionally caught in the coastal bays. Juvenile butterfish are also found over muddy bottom where depths are greater than 4 ft (Casey pers. comm.).

In Delaware, nearly the entire Delaware Bay and the majority of the two smaller bays are utilized by squid, Atlantic mackerel, and butterfish for feeding areas, migratory routes, or nursery habitat

(Figures 7 through 11). Squid spawning areas in Delaware Bay were delineated using anecdotal information supplied by DNREC trawl program personnel based on observations of squid egg masses recovered during trawling operations (Cole pers. comm.).

Pennsylvania does not consider any waters of their Commonwealth to be essential habitat for *Loligo, Illex*, Atlantic mackerel, or butterfish (Snyder pers. comm.).

In Rhode Island, Macy (1980) found that *Loligo pealei* first appear in lower Narragansett Bay in April and then they rapidly move up the bay into warmer waters (Gray pers. comm.). They remain in Rhode Island waters until November when they head offshore (Jeffries *et al.* 1988 and Lynch, 1991). Every summer *Loligo* and its egg masses are common in shallow coves along the coast of Rhode Island (Griswold and Prezioso 1981). The egg masses have been seen attached to rocks, seaweed, submerged debris, pilings (Lynch 1994 and Gray 1994). In Block Island Sound, juvenile squid begin to appear in late June and remain until the end of October, with the greatest abundance occurring in July. Juveniles were found in surface and bottom temperatures that averaged 63 °F and 60 °F, respectively, from Block Island Sound (Hersey 1978). Juveniles collected from 1979-1991, have been found in temperatures ranging from 45 °F to 75 °F (Lynch 1992). Adult *Loligo* continued to be absent during the spring assessment in Narragansett Bay and Rhode Island Sound and have been collected in temperatures ranging from 45 °F to 75 °F (Lynch 1992).

Records of *Illex illecebrosus* landed in Rhode Island waters are rare (Gray pers. comm.). Prior to 29 June 1992, no *Illex illecebrosus* had ever been noted in Rhode Island coastal waters by the Rhode Island Division of Fish and Wildlife (Lynch 1992). In Rhode Island Sound, they were collected in a depth strata of 48 to 60 ft. They have also been collected in the lower Narrow River, over mud and silty sand (Gray 1994).

Squid, both *Loligo* and *Illex* are observed in New Hampshire, July through September, first appearing when they move into shallow water to deposit their egg cases. They are seen in both the near shore coastal waters as well as Great Bay estuary. No fishery occurs for them in State waters but some commercial catches take place in the nearby EEZ (Nelson pers. comm.). Landings for New Hampshire usually do not exceed 7,000 lbs/year. There are no New Hampshire habitat studies for squid.

Atlantic mackerel appearance in New Hampshire near shore waters is variable year to year. They typically arrive in May and remain present into June in sizeable numbers. Following this initial peak period of abundance they either remain in reduced, spotty schools throughout the summer or leave and reappear in October. While present in State waters they are a major component of the ½ day party boats and private boat recreational fishery. No habitat studies specific to mackerel have been conducted in New Hampshire waters (Nelson pers. comm.).

Butterfish may be found in New Hampshire waters during the summer/fall, July to October. Their peak abundance according to information from monthly environmental study samples occurs in September (Nelson pers. comm.). While no fishery exists for butterfish in State waters there are, however, incidental commercial catches in the EEZ that may approach 1,000 lbs/year. No habitat study has been done for butterfish in New Hampshire waters.

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 (Studholme *et al.* 1998, Cargnelli *et al.* 1998a-b; EFH butterfish team 1998) 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 mackerel, *Loligo*, *Illex*, and butterfish were developed in the EFH background documents and are included in this FMP as Tables 1, 4, 5, 6. Also included from the EFH background document are the ELMR data for mackerel and butterfish by life stage in major Atlantic coast estuaries (Tables 2,3,7,8; Figures 13a-e and 43a-e).The maps of the specific ELMR salinity zones are presented in Figure 44). 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 Sandy Hook. 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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, three data sets are available for determining Atlantic mackerel, and butterfish 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); and 3) ELMR data (Level 1). The only data sets available to evaluate *Loligo* and *Illex* are the NEFSC trawl survey (Level 2). The limited state data in the background documents (Studholme *et al.* 1998; Cargnelli *et al.* 1998a-b; EFH butterfish team 1998) were also evaluated and in general, agree with the ELMR data for mackerel and butterfish. Again, the limited, 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 of the states.

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 for mackerel and butterfish, and only NEFSC trawl survey for *Loligo* and *Illex*. 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 Atlantic mackerel and butterfish, 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, 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 subsampled. 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 data base on the distribution, abundance, and life history characteristics of important fishes and invertebrates in the Nation's estuaries. The Nation-wide data base is divided into five study regions of which Atlantic mackerel and butterfish are included in two (North Atlantic and Mid-Atlantic) of the three (Southeast) Atlantic study regions. The data base 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 main 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 mackerel and butterfish in the estuaries.

Currently, there are virtually no data for these four species south of Cape Hatteras. Although these species range south of Cape Hatteras, no EFH will be designated south of Cape Hatteras because these species are not overfished, and the vast majority of their populations are north of Cape Hatteras. 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. Much less effort is expended and less data collected in this survey in comparison to the much longer time series NEFSC trawl surveys. Reid *et. al.* (1998) details the SEAMAP program. SEAMAP data are only available for butterfish, however it will not be used to designate EFH at this time. The SEAMAP data can be evaluated by the Habitat Monitoring Committee during future iterations of EFH efforts.

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) 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 Atlantic mackerel, Loligo, *Illex*, and butterfish.

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 not supportable under the Interim Final Rule (1998) because Atlantic mackerel, *Loligo*, *Illex*, and butterfish are not overfished.

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 Atlantic mackerel, Loligo, *Illex*, and butterfish.

5. Finally, the use of some threshold or cutoff point, 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, 2, 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. Alternative 2 because these species are not overfished. Alternatives 3 and 4 may prove useful in the future, but were presently eliminated because of the lack of data (Studholme *et al.* 1998, Cargnelli *et al.* 1998a-b, EFH butterfish team 1998). Public comment on any of the above considered five alternatives, or any other means of identifying EFH was solicited during the public hearing process; 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 Technical Team, bluefish experts, Habitat Committee, Habitat Advisors, and Scientific and Statistical Committee all considered the five alternatives and concluded that the threshold or cutoff point (Alternative 5) was the most reasonable means for identifying and describing EFH for bluefish, and this same logic was applied to Atlantic mackerel, Loligo, *Illex*, and butterfish. 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 45-48). 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%m 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 the threshold or cutoff point, for each lifestage for each species (Figures 45-48):

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 the habitat related density maps, Level 2 data from the MARMAP ichthyoplankton and/or NEFSC trawl survey were binned into ten-minute square maps. (Actually the 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 highest 50%, 75%, 90%, and 100% of the catch were mapped separately for each life stage of Atlantic mackerel, *Loligo*, *Illex*, and butterfish (Figures 45-48).

Although this approach has some limitations for these species, it is a scientifically objective approach that is based on the best available information. Pelagic species such as these are not sampled well by bottom trawl type gear. The MARMAP survey is also biased low for eggs and larvae and is not available for *Loligo* or *Illex*. State and inshore surveys for the most part, either do not exist or are not in 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.

For the current amendment process, 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 75% of the catch, approach (for the offshore Level 2 data, NEFSC and MARMAP) because it is these species are not overfished and all life stages are common across the continental shelf throughout the range that is managed. The Council made the decision on the description of EFH (the area where the highest 75% of the total catch were collected) with the above factors in mind at the June Council meeting. The Council decided to use the highest 75% of the catch for all life stages of all four species for the designation of EFH since there was no readily apparent significant differences by life stage. There is not current information to support that any life stage appears specifically limiting in terms of an ecological, bottleneck-type, habitat association, and therefore, to maintain consistency the Council concluded there was no justification for different percentages 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 Atlantic mackerel, Loligo, *Illex*, and butterfish with the associated percentages of offshore EFH designation are in Figures 45-48.

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 Atlantic mackerel, Loligo, *Illex*, and butterfish are presented in Tables 9a-d, 10a-b, 11a-b, 12a-d. For example, Table 9b shows that the highest 75% of the catch of juvenile Atlantic mackerel were caught within 7% of the area (approximately 40 out of the 600 ten-minute squares), where Atlantic mackerel were caught, while the highest 75% of the area would encompass 400 out of the 600 ten-minute squares where Atlantic mackerel were caught. The logged catch analysis was not included in Tables 9-12 because its area is consistently between the area and catch analyses (Figure 49-52). 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 area that comprise the highest 75% of the catch where eggs, larvae, juvenile, and adult Atlantic mackerel, Loligo, *Illex*, and butterfish were caught in the MARMAP and/or NEFSC trawl surveys. The area and logged CPUE methods were not chosen because these are ubiquitous, pelagic species that are not overfished and with no obvious habitat associations. Distribution is often more associated with specific environmental factors (i.e., temperature and mackerel) than specific habitats.

EFH is not being designated for these species south of Cape Hatteras. They are not overfished and they are most abundant above Cape Hatteras. There are virtually no data presently available for these species south of Cape Hatteras. The SEAMAP data which have only been summarized for d butterfish in the EFH background documents. 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 Atlantic mackerel and butterfish in estuarine areas are the ELMR data (Tables 2 and 3, Figures 13a-e and 43a-e). The Council concluded that all estuaries where Atlantic mackerel and butterfish are listed as "common" or "abundant" will be designated as EFH (Table 13). While Atlantic mackerel and butterfish are not estuarine dependent, the ELMR data do show that juveniles and adults are "highly abundant," "common," and/or "abundant" in many New England and Mid-Atlantic estuaries, 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.

2.2.2.2 Specific description and identification of Atlantic mackerel, Loligo, *Illex*, and butterfish essential fish habitat

Atlantic mackerel

Eggs: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where Atlantic mackerel eggs were collected in MARMAP ichthyoplankton surveys (Figure 53a). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel eggs are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 13; Figures 13a, 44). Generally, Atlantic mackerel eggs are collected from shore to 50 ft and temperatures between 41 °F and 73 °F.

Larvae: Offshore, 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 through Cape Hatteras, North Carolina that comprise the highest 75% of the catch where Atlantic mackerel larvae were collected in the MARMAP ichthyoplankton survey (Figure 53b). Inshore, EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel larvae are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 13; Figures 13b, 44). Generally, Atlantic mackerel larvae are collected in depths between 33 ft and 425 ft and temperatures between 43 °F and 72 °F.

Juveniles: Offshore, EFH is the pelagic water found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where juvenile Atlantic mackerel were collected in the NEFSC trawl surveys (Figure 53c). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 13; Figures 13c, 44). Generally, juveniles Atlantic mackerel are collected from shore to 1050 ft and temperatures between 39 °F and 72 °F.

Adults: Offshore, 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 through Cape Hatteras, North Carolina, in areas that comprise the highest 75% of the catch where adult Atlantic mackerel were collected in the NEFSC trawl surveys (Figure 53d). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where adult Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 13; Figures 13d, 44). Generally, adult Atlantic mackerel are collected from shore to 1250 ft and temperatures between 39 °F and 61 °F.

Loligo

Pre-recruits: 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where pre-recruit *Loligo* were collected in the NEFSC trawl surveys (Figure 54a). Generally, pre-recruit *Loligo* are collected from shore to 700 ft and temperatures between 4 °F and 27 °F.

Recruits: 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where recruited *Loligo* were collected in the NEFSC trawl surveys (Figure 54b). Generally, recruited *Loligo* are collected from shore to 1000 ft and temperatures between 39 °F and 81 °F.

Pre-recruits and recruits are stock assessment terms used by NEFSC and correspond roughly to the life history stages juveniles and adults, respectively. *Loligo* pre-recruits are less than or equal to 8 cm and recruits are greater than 8 cm.

Illex

Pre-recruits: 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where pre-recruit *Illex* were collected in the NEFSC trawl surveys (Figure 55a). Generally, pre-recruit *Illex* are collected from shore to 600 ft and temperatures between 36 °F and 73 °F.

Recruits: 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where recruited *Illex* were collected in the NEFSC trawl surveys (Figure 55b). Generally, recruited *Illex* are collected from shore to 600 ft and temperatures between 39 °F and 66 °F.

Pre-recruits and recruits are stock assessment terms used by NEFSC and correspond roughly to the life history stages juveniles and adults, respectively. *Illex* pre-recruits are less than or equal to 10 cm and recruits are greater than 10 cm.

Butterfish

Eggs: Offshore, 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where butterfish eggs were collected in MARMAP ichthyoplankton surveys (Figure 56a). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where butterfish eggs are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 14; Figures 43a, 44). Generally, butterfish eggs are collected from shore to 6000 ft and temperatures between 52 °F and 63 °F.

Larvae: Offshore, 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 through Cape Hatteras, North Carolina areas that comprise the highest 75% of the catch where butterfish larvae were collected in the NEFSC trawl surveys (Figure 56). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where butterfish larvae are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia (Table 14; Figures 43b, 44). Generally, butterfish larvae are collected in depths between 33 ft and 6000 ft and temperatures between 48 °F and 66 °F.

Juveniles: Offshore, 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where juvenile butterfish were collected in the NEFSC trawl surveys (Figure 56c). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia (Table 14; Figures 43c, 44). Generally, juvenile butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37 °F and 82 °F.

Adults: Offshore, 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 through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where adult butterfish were collected in the NEFSC trawl surveys (Figure 56d). Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where adult butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia (Table 14; Figures 43d, 44). Generally, adult butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37 °F and 82 °F.

Finally, the MAFMC solicited input from the public and state personnel on where they perceive EFH should be designated for Atlantic mackerel, *Loligo*, *Illex*, and butterfish. Only one response in the form of a map was received from the state of Massachusetts and those comments were incorporated into the EFH maps. Additional comments on Figures 57 and 58 will be welcome in future iterations of this FMP.

2.2.2.2.1 Identification of Habitat Areas of Particular Concern

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 is not recommending any portions of EFH as HAPC for Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 that FMP and 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 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 15 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 16) 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 17). 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 18). 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish range

Commercial fishing gear used in 1995 for fisheries prosecuted from Maine to Virginia is characterized in Table 19. 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 Y. 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 20.

2.2.3.7 Fishing impacts to Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH

Atlantic mackerel, *Loligo*, *Illex*, and butterfish are pelagic species, with no strong associations to any particular substrate, submerged aquatic vegetation (SAV), or any other structural habitat (Studholme *et al.* 1998, Cargnelli *et al.* 1998a-b, EFH Butterfish Team 1998). Effort of mobile gear in federal and state waters throughout the entire Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 21).

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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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.

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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish habitat (Table 22). 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 Atlantic mackerel, *Loligo, Illex,* and butterfish. 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 Atlantic mackerel, *Loligo, Illex,* and butterfish by encouraging management of conflicting uses to assure access by the four 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 Atlantic mackerel, *Loligo, Illex,* and butterfish EFH, 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 Atlantic mackerel, *Loligo, Illex,* and butterfish 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 Atlantic mackerel, *Loligo, Illex,* and butterfish 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 Atlantic mackerel, *Loligo, Illex,* and butterfish. 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 Atlantic mackerel, *Loligo, Illex,* and butterfish 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 Atlantic mackerel, *Loligo, Illex,* and butterfish EFH

Many anthropogenic (caused by man) actions may threaten the integrity of Atlantic mackerel, *Loligo, Illex,* and butterfish EFH. These threats have been prioritized based on the following:

3

Atlantic mackerel, *Loligo, Illex,* and butterfish are pelagic schooling species located across the Continental Shelf, into the estuaries (Figures 1, 14, 20, 27). Most of the nearshore waters of the western Atlantic are designates as EFH for some or all of the species (Figures 53-56). A total of 31 estuaries for Atlantic mackerel and butterfish were designated as EFH. Some prey items for *Loligo,* e.g., menhaden, are estuarine dependent. Cumulative impacts from estuarine and land-based activities can have negative effects on Atlantic mackerel, *Loligo, Illex,* and butterfish EFH in nearshore and offshore waters.

Based on these considerations, threats that impact estuaries, inshore areas, and water quality are priority concerns in Atlantic mackerel, *Loligo, Illex,* and butterfish EFH (Table 22). 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 22.

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 Atlantic mackerel and butterfish EFH. Mitigating or compensating measures should be employed where filling is totally unavoidable. Project proponents must demonstrate that project implementation will not negatively affect Atlantic mackerel and butterfish, 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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., Atlantic mackerel and butterfish EFH).

E). Wildlife management projects should not adversely affect Atlantic mackerel and butterfish EFH. No impoundment of tidal wetlands or creation of islands should be authorized in Atlantic mackerel EFH.

F). Mosquito control in Atlantic mackerel and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH whenever feasible.

C). When wave energy is sufficient to preclude vegetative stabilization, stone revetments should be constructed in Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH. Revetments reduce reflected wave energy and provide habitat for benthic organisms.

D). Bulkheads, or shoreline hardening structures, should not be constructed in Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH when practicable alternatives exist.

E). Beach nourishment in Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH should only be considered when an acceptable source of borrow material is identified.

). When groin fields are considered acceptable for construction in Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH, low-profile design should be employed.

G). When jetties intercept sediments in Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH.

F). BMPs should be implemented to manage stormwater to minimize the discharge of contaminants that degrade Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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. com).

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 Atlantic mackerel, *Loligo, Illex*, and butterfish 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 Atlantic mackerel, *Loligo, Illex*, and butterfish EFH areas (MAFMC 1990).

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 Atlantic mackerel and butterfish 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 Atlantic mackerel and butterfish 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 Atlantic mackerel and butterfish 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 per cent 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. com.).

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 Atlantic mackerel and butterfish, 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish their EFH, or their food sources.

D). Construction of spoil containment islands should be avoided in Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 ft 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 ft 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 Atlantic mackerel and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 ft or more in height and greater than 15 acre-ft in capacity, or to dams six ft or more in height and greater that 50 acre-ft 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°, 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish. 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 Atlantic mackerel, *Loligo* EFH. Project proponents should demonstrate that project implementation will not negatively affect Atlantic mackerel, *Loligo*, *Illex*, and butterfish, 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 (1996).

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 Atlantic mackerel, *Loligo, Illex*, and butterfish 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. Thirty-one estuaries have been designated as Atlantic mackerel and butterfish EFH (Table 13 and 14).

The Mid-Atlantic region extends from New York through North Carolina. However, Mid-Atlantic Fishery Management Council manages species throughout their range, which for Atlantic mackerel, *Loligo, Illex*, and butterfish 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, Albemarle 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 31 estuaries (Tables 13 and 14; Figures 13 and 43) that were established as Atlantic mackerel and butterfish EFH, along with much of the inshore area of the Atlantic coast (Figures 53-56). Some of the *Loligo* prey species are estuarine dependent. Unquantified cumulative impacts to estuarine and inshore areas have potential impacts to the sustainability of the Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 23. 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 24 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 59), 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 Atlantic mackerel, *Loligo*, *Illex*, and butterfish 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 1996).

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 Atlantic mackerel

2.2.6.1.1 Feeding

Atlantic mackerel are opportunistic feeders that can ingest prey either by individual selection of organisms or by passive filter feeding (Pepin *et al.* 1988). Filter feeding occurs when small plankton are abundant and mackerel swim through patches with mouth slightly agape, filtering food through their gill rakers (MacKay 1979). According to MacKay (1979) particulate feeding is the principal feeding mode in the spring and fall while filter feeding predominates in the summer in the Gulf of St Lawrence. Moores *et al.* (1975) maintains that the diet of fish from Newfoundland suggests that particulate feeding occurs there throughout the season.

Larvae feed primarily of zooplankton (Collette in prep.). First-feeding larvae (0.140 in; 3.5 mm) collected from Long Island Sound were found to be phytophagous while slightly larger individuals (greater than 0.176 in; 4.4 mm) fed on copepod nauplii (Peterson and Ausubel 1984; Ware and Lambert 1985). Fish >0.2 in (5 mm) fed on copepodites of *Acartia* and *Temora* while diets of fish >0.24 in (6 mm) contained adult copepods (Peterson and Ausubel 1984). Larvae >0.256 in (6.4 mm) were cannibalistic, feeding on 0.14-.018 in (3.5-4.5 mm) conspecifics (Peterson and Ausubel 1984). Consumption rates of larvae average between 25 and 75% body weight per day. Larvae feed selectively, primarily on the basis of prey visibility (Peterson and Ausubel 1984). Fortier and Villeneuve (1996), studying larval mackerel from the Scotian Shelf, found that with increasing larval length, diet shifted from copepod nauplii to copepod and fish larvae including yellowtail flounder, silver hake, redfish and a large proportion of conspecifics. Predation was stage-specific: only the newly hatched larvae of a given species were ingested. However, piscivory was limited at densities of fish larvae $<0.1/m^3$ and declined with increasing density of nauplii and with increasing number of alternative copepod prey ingested.

Juveniles eat mostly small crustaceans such as copepods, amphipods, mysid shrimp and decapod larvae (Collette in prep.). They also feed on small pelagic molluscs (*Spiratella* and *Clione*) when available (Collette in prep.). Adults feed on the same food as juveniles but diets also include a wider assortment of organisms and larger prey items. For example, euphausid, pandalid and crangonid shrimp are common prey; chaetognaths, larvaceans, pelagic polychaetes and larvae of many marine species have been identified in mackerel stomachs (Collette in prep.). Bigelow and Schroeder (1953) found many Gulf of Maine mackerel feeding on *Calanus* as well as other copepods. Larger prey such as squids (*Loligo*) and fishes (silver hake, sand lance, herring, hakes and sculpins) are not uncommon, especially for large mackerel (Bowman *et al.* 1984). Under laboratory conditions, mackerel also fed on *Aglanta digitale*, a small transparent medusa common in temperate and boreal waters (Runge *et al.* 1987). While there is variability between the two size classes and between the two survey periods, copepods and euphausids and various crustaceans could be considered relative staples in the diet.

Immature mackerel begin feeding in the spring; older fish feed until gonadal development begins, stop feeding until spent and then resume prey consumption (Berrien 1982; Collette in prep.). Under experimental conditions in which larval fish (0.12-0.4 in; 3-10 mm in length) were presented as part of natural zooplankton assemblages, prey preference by mackerel was positively size selective and predation rates were not influenced by larval fish density (Pepin *et al.* 1987). Subsequent studies indicated that mackerel may achieve a higher rate of energy intake by switching to larger prey and increasing search rate as prey size and total abundance increase (Pepin *et al.* 1988). Filter feeding activity also increased with increasing prey density and Pepin *et al.* (1988) conjecture that feeding rates under natural conditions of prey abundance (0.1g wet weight/m^3) indicate that mackerel would not be satiated if foraging were restricted only to daylight.

2.2.6.1.2 Predation

Predation has a major influence on the dynamics of Northwest Atlantic mackerel (Overholtz *et al.* 1991b). In fact, predation mortality is probably the largest component of natural mortality on this stock, and based on model predictions, may be higher than previously thought (Overholtz *et al.* 1991b). Atlantic mackerel serve as prey for a wide variety of predators including other mackerel, dogfish, tunas, bonito, striped bass, Atlantic cod (small mackerel), and squid, which feed on fish <4-5.2 in (10 to 13 cm) in length (Collette in prep.). Pilot whales, common dolphins, harbor seals, porpoises and seabirds are also significant predators (Smith and Gaskin 1974; Payne and Selzer 1983; Overholtz and Waring 1991; Montevecchi and Myers 1995). Other predators include swordfish, bigeye thresher, thresher, shortfin mako, tiger shark, blue shark, spiny dogfish, dusky shark, king mackerel, thorny skate, silver hake, red hake, bluefish, pollock, white hake, goosefish and weakfish (Scott and Tibbo 1968; Maurer and Bowman 1975; Stillwell and Kohler 1982, 1985; Bowman and Michaels 1984).

2.2.6.2 *Loligo*

2.2.6.2.1 Feeding

The diet of *Loligo* changes with increasing size; small immature individuals feed on planktonic organisms (Vovk 1972a, Tibbetts 1977) while larger individuals feed on crustaceans and small fish (Vinogradov and Noskov 1979). Cannibalism is observed in individuals larger than 2 in (5 cm) (Whitacker 1978). Juveniles 1.6-2.4 in (4.1-6 cm) long fed on euphausiids and arrow worms, while those 2.4-4 in (6.1-10 cm) fed mostly on small crabs, but also on polychaetes and shrimp (Vovk and Khvichiya 1980, Vovk 1985). Adults 4.8-6.4 in (12.1-16 cm) long fed on fish (Clupeids, Myctophids) and squid larvae/juveniles, and those >6.4 in (16 cm) fed on fish and squid (Vovk and Khvichiya 1980, Vovk 1985). Fish species preyed on by *Loligo* include silver hake, mackerel, herring, menhaden (Langton and Bowman 1977), sand lance, bay anchovy, menhaden, weakfish, and silversides (Kier 1982). Maurer and Bowman (1985) demonstrated seasonal and inshore/offshore differences in diet: in the spring in offshore waters, the diet was composed of crustaceans (mainly euphausiids) and fish; in the fall in inshore waters, the diet was composed almost exclusively of fish; and in the fall in offshore waters, the diet was composed of fish and squid.

The NEFSC bottom trawl survey data on food habits demonstrates a similar ontogenetic shift in the diet of *Loligo*. During 1973-1980, the diet of 0.4-4 in (1-10 cm) long squid was composed primarily of crustaceans (23%), while fish were the most important prey item in the diet of 4.4-16 in (11-40 cm) long squid. During 1981-90, the diet of squid 0.4-4 in (1-10 cm) in length was composed of 42% cephalopods (i.e., squid), 26% fish, and 21% crustaceans, while the diet of larger squid, 4.4-16 in (11-40 cm) in length, was dominated by fish (39%) and cephalopods (22%).

2.2.6.2.2. Predation

Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980).

2.2.6.3 *Illex*

2.2.6.3.1 Feeding

Short-finned squid feed primarily on fish, cephalopods (i.e. squid) and crustaceans. Fish prey include the early life history stages of Atlantic cod, Arctic cod and redfish (Squires 1957, Dawe *et al.* 1997), sand lance (Dawe *et al.* 1997), mackerel and Atlantic herring (O'Dor *et al.* 1980, Wigley 1982, Dawe *et al.* 1997), haddock and sculpin (Squires 1957). *Illex* also feed on adult capelin (Squires 1957, O'Dor *et al.* 1980, Dawe *et al.* 1997), smelt and mummichogs (O'Dor *et al.* 1980). Cannibalism is significant, and *Illex* also feed on long-finned squid, *Loligo pealei* (Vinogradov 1984). Maurer and Bowman (1985) have demonstrated a seasonal shift in diet. When *Illex* are offshore in the spring, they primarily consume euphausiids, whereas they consume mostly fish and squid when they are inshore in the summer and fall. Individuals 2.4-4 in (6-10 cm) and 10.4-12 in

(26-30 cm) ate mostly squid, 4.4-6 in (11-15 cm) *Illex* ate mostly crustaceans and fish, and those 6.4-8 in (16-20 cm) ate mostly crustaceans. Perez (1994) also demonstrated an ontogenetic shift in diet, as short-finned squid consume less crustaceans and more fish as they grow larger.

The most important prey items of *Illex* from the NEFSC bottom trawl survey data on food habits were crustaceans, fish and cephalopods. During 1973-1980, the diet of 0.4-4 in (1-10 cm) long squid was made up of crustaceans (13%), nematodes (10%) and fish (4.5%), and the diet of 4.4-16 in (11-40 cm) long squid was composed of crustaceans (17%), cestodes (11%), fish (11%) and cephalopods (8%). During 1981-90, the diet of squid 4.4-16 in (11-40 cm) in length, was dominated by cephalopods (30%) and fish (23%).

2.2.6.3.2 Predation

Numerous species of pelagic and benthic fishes are known to prey extensively on *Illex*, including bluefin tuna (Butler 1971), silver hake and red hake (Vinogradov 1972). Other fish predators include bluefish (Maurer 1975, Buckel 1997), goosefish (Maurer 1975, Langton and Bowman 1977), four-spot flounder (Langton and Bowman 1977), Atlantic cod (Lilly and Osborne 1984), sea raven (Maurer 1975), spiny dogfish (Templeman 1944, Maurer 1975), and swordfish (Langton and Bowman 1977, Stillwell and Kohler 1985, Scott and Scott 1988). Mammalian predators include pilot whales (Squires 1957, Wigley 1982) and the common dolphin (Major 1986). Seabird predators include shearwaters, gannets and fulmars (Brown *et al.* 1981). Short-finned squid are known to exhibit a variety of defense mechanisms in order to reduce predation, such as camouflage coloration, (O'Dor 1983), schooling behavior, direction changes and ink release (Major 1986).

2.2.6.4 Butterfish

2.2.6.4.4 Feeding

Butterfish feed mainly on planktonic prey, including thaliaceans (primarily Larvacea and Hemimyaria), molluscs (primarily squids), crustaceans (copepods, amphipods, and decapods), colenterates (primarily hydrozoans), polychaetes (primarily Tomopteridae and Goniadidae), small fishes, and ctenophores (Fritz 1965, Leim and Scott 1966, Haedrich 1967, Horn 1970a, Schreiber 1973, Mauer and Bowman 1975, Tibbets 1977, Bowman and Michaels 1984, Klein-MacPhee, *in review*).

The food habits of butterfish collected on the Northeast Shelf during NEFSC bottom trawl surveys from 1973 to 1990 were similar to diets reported in the literature. The stomach contents were dominated by unidentified animal remains. Arthropods dominated the identifiable items, followed by urochordates (thaliaceans and larvaceans), plankton, annelids (probably polychaetes), chaetognaths (arrowworms), molluscs (probably squids), cnidarians (coelenterates, probably jellyfish), and fishes.

2.2.6.4.2 Predation

Butterfish are preyed on by many species including haddock, silver hake, goosefish, weakfish, bluefish, swordfish, sharks (hammerhead), and *Loligo* (Bigelow and Schroeder 1953, Scott and Tibbo 1968, Horn 1970a, Maurer and Bowman 1975, Tibbets 1977, Stillwell and Kohler 1985, Brodziak 1995a, Klein-MacPhee, *in review*).

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 five 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 Atlantic mackerel

The first set of recommendations is presented in the Atlantic mackerel EFH dcoument (Studholme *et al.* 1998) where Overholtz *et al.* (1991b) is cited. Based on the results of their model projections, unless the impacts of compensatory mechanisms are accounted for, evaluations of current stock status using the current standard assessment methodology may, in fact be optomistic and risky if catches are increased to high levels. Overhotz *et al.* (1991b) indicate that two advances would help to improve assessments: (1) An MSVPA to provide correctly scaled estimates of recruitment, and (2) a general prediction mortality model that would provide useful estimates of M2's for forecasting purposes. Other data that will be important include monitoring weights of individual fish to assess future changes, annual tracking of sexual maturity of age 2 and age 3 fish, additional food habits sampling at critical times and places and information on predation mortality of age-0 mackerel. Improved predation models that account for predator preference and prey abundance would allow for more accurate predictions of the impacts of these factors.

In addition, even though Atlantic mackerel 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. This could be addressed via new technologies such as microconstituent analysis of otoliths using inductively coupled plasma mass-spectrometry (ICPMS).

2.2.7.2 *Loligo*

The second set of recommendations comes from the *Loligo* EFH background document (Cargnelli *et al.* 1998a).

1. There is little biological information on the egg and larval stages. There is a need for more information on the location of spawning beds and the movement of larvae.

2. More information on growth rates and maturity are needed. For example, Brodziak and Macy (1996) demonstrated that growth rates are exponential, lifespans less than one year, and spawning occurs throughout the year. More data from geographically and temporally diverse studies are needed.

3. The commercially exploited population from Cape Hatteras to Georges Bank is considered a single stock unit. More information is needed on stock structure, including gene flow and levels of genetic differentiation among geographic areas.

2.2.7.3 *Illex*

The third set of research recommendations come from the *Illex* stock assessment (NMFS 1996a).

1. Total catch (U.S. EEZ and NAFO Subareas 2-4) should be incorporated into future surplus production model analyses for this unit stock.

2. Investigate effort standardization for individual vessels, or 2-digit vessel size classes.

3. A joint research program for this transboundary stock, involving US and Canadian scientists, would improve the biological basis for management and assessment.

4. Joint transboundary management measures should be considered.

5. The level of length frequency sampling is low (l sample of 50 lengths per 800 mt landed) and should be increased. Given the variability in mean weights, by month and statistical area, increased sampling effort is recommended to characterize the fishery, particularly if real-time management measures are implemented. Mean weights would be necessary to convert catch biomass to numbers for input to a Leslie-DeLury model. Industry participation in the collection of length frequency data should be explored through provisions of the mandatory logbook requirement. Voluntary collection of biological data at sea would help address sampling needs and foster industry/scientist communication.

6. Examine factors related to the formation of daily growth increments, such as temperature, light and vertical migration.

7. Increase knowledge of the stock structure by studying the range of the population throughout the year and determining spawning locations.

8. Establish a pilot study to collect *Illex* statoliths during research surveys to determine length-at-age and weight-at-age relationships for squid from Cape Hatteras to the Gulf of Maine.

9. Schedule the collection of at-sea observer data for trips targeting *Illex*, particularly aboard freezer boats, to evaluate fishery catch and discarding practices. Also investigate *Illex* bycatch in the silver hake fishery and other fisheries.

10. Determine whether abundance indices require adjustment factors for time of day in all survey years.

11. Illex has been reported to school by sex and size Record the sex and sexual maturity of squid caught during research surveys for use in determining differences in growth rates, and timing of spawning and mean length at sexual maturity of females, respectively, in the U.S EEZ.

12. If an *Illex* fishery develops south of Cape Hatteras, it would be desirable to characterize the species composition of the catch and to identify the extent of co-occurrence of other *Illex* species

off the southeastern U.S. coast.

2.2.7.4 Butterfish

The fourth set of research recommendations comes from the most recent butterfish stock assessment (NMFS 1994).

1. Given that butterfish is a short-lived species, new approaches to the assessment and management of the stock may be required. A more adaptive, real-time assessment/management system will be needed to attain full exploitation of the stock while, at the same time, ensuring that adequate levels of spawning stock are achieved. Examples of the types of assessment and management procedures that have proved successful for short-lived species are provided in the 1993 report of the ICES Working Group on Methods of Fish Stock Assessment (ICES 1993).

2. Data need to be collected to make reliable estimates of discards, particularly discards associated with the directed fishery. The design and/or implementation of the Sea Sampling program needs to be improved so that data are collected from all components of the fishing fleet. Data currently available from the NEFSC sea sampling program are not adequate because most of data appear to come from trips in which butterfish was not the target species.

3. The exploitation pattern and levels of discarding need to be estimated to allow revised computation of exploitation rates and biological reference points such as $F_{0.1}$ and F_{MSY}.

2.2.7.5 Fishing threats

The fifth 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, 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 designations 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 was fully described in section 7 of Amendment 5. 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 relatively important 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. McCay *et al.*1993 is largely based on two data sources. Landing statistics are from the National Marine Fisheries Service. Information about the ports is from interviews with key informants. The quality of the port descriptions, therefore, depends on the information supplied by the informants. The following port descriptions are taken from McCay *et al.* 1993 The port descriptions are brief summaries of the material in McCay *et al.* 1993 and readers with questions are encouraged to obtain the original document.

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. Galilee is located in Washington County, RI. Stonington is located in New London County, CT. Greenport, Shinnecock/Hampton Bays, and Montauk are located in Suffolk County, NY. Freeport is located in Nassau County, NY. Brooklyn is located in Kings County, NY. 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, Hampton, Norfolk, Newport News and Virginia Beach all fall into this category. Wanchese is located in Dare County, NC.

Chatham, Massachusetts

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. *Loligo* accounted for 2.38% of landed value in 1992, harvested by pound-nets (65%) and fish pots (37%).

Atlantic mackerel accounted for 0.45%, caught by fish pots (77%), draggers (5%), and sink gill nets (4.6%). Pound nets and fish pots or traps accounted for only 4.6% of the total landed value of species in Chatham in 1992. However, *Loligo* accounted for 31% of the fish pot value and 86% of the pound net revenue. Atlantic mackerel accounted for 12% of the fish pot value and 3% of the pound net revenue. Butterfish accounted for 0.33% of the fish pot value and 0.20% of the pound net revenue.

New Bedford, Massachusetts

The squids, mackerel, and butterfish are not important to New Bedford. *Loligo* squid made up 0.05% of the total landed value for New Bedford in 1992. The other species covered by this FMP accounted for less than 0.01%.

Loligo is caught during the spring months of April and May by inshore boats in Nantucket Sound, and more boats are now fishing for *Loligo* offshore, reported a New Bedford port agent. Even into late fall, he said, boats are targeting squid offshore. 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. The port agent reported that some of the small boats offload at sea to freezer boats from Rhode Island.

Newport, Rhode Island

Within Newport, there are three commercial fishing packing and distributing businesses. One mainly deals with draggers, gillnetters, and some scallopers, and brings in a great deal of groundfish. Another is a lobster house, but they also handle the trappers. There is also a trap company located in Newport. Species caught in traps are discussed below. The dealer that handles mostly draggers packs and distributes the majority of species of important to this study. The trap company also deals with these species but not in as large of quantities.

Approximately 15 large draggers were tied up at the fish house that deals with draggers during a recent visit (1992) to Newport. The fish house owner, the local port agent, and fishermen spoken with on this day said that having 15 boats in port at the same time was unusual, and had to do with a storm moving through the area. Most of the boats that offload at the Newport fish house are not from Newport. They are from other ports such as New Bedford, various Long Island ports, Cape May, and Pt. Judith. These boats are going primarily for squid at the time of our visit, which was in December. This particular fish house owner does not own any of the boats that offload at his dock.

The fishermen who make up the crews in Newport are not necessarily from Newport, but some local people from the area do work on the boats. Some crew members come from Point Judith, New Jersey, New York, and New Bedford. Typically, the owners of the boats do not work the boats. Often the owners used to fish but do not anymore. As with almost all of the ports, crews are paid on the share system.

The total value of landings in Newport for 1992 was $14.5 million. Lobster ranked first, accounting for 44% of landed value. *Loligo* ranked sixth.

Other Washington County Communities, RI (including Quonset Point)

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 spear fishery 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. As for commercial fishing, Quonset Point is port to five factory trawlers, two of which are from Rhode Island and three from Portland, Maine. The five trawlers range in length from 117 ft. to 155 ft., and they can hold 4 to 5 hundred thousand lbs. of frozen product per trip. This contrasts with wet boats which have a 150,00 thousand lb. capacity. The Rhode Island boats are owned by the president of a service and sales facility located at Quonset Point. The other three boats are owned by a man from Portland, Maine.

The service and sales facility located at Quonset Point started out with one boat about seven to eight years ago. The two boats owned by the president of the facility at Quonset Point were built specifically as freezer boats. These boats take one to two week trips. The three boats from Maine are converted supply boats and they may stay out as long as thirty days on some trips.

On occasion, the freezer trawlers engage in joint ventures with American boats. The smaller boats will fish and offload onto the freezer boats. The freezer boats have also in the past participated in joint ventures with Russian, Dutch and Polish boats.

The freezer boats target *Loligo* squid, *Illex* squid, butterfish, mackerel, whiting and sometimes scup. They may target herring but not normally.

The *Illex* squid season lasts from June to October, and the freezer boats average 12 day trips when they are working *Illex*. November to May is the *Loligo* season, and the trawlers average 30 days out while they are targeting *Loligo*. Mackerel is caught from December to April.

The freezer trawlers do not have any significant landings of butterfish. Butterfish is available year round, but they are only desirable from December to February because of their fat content.

The Quonset Point boats will fish from North Carolina up to the Canadian border although they rarely go that far north. They fish for *Illex* up to 600 ft (100 fathoms) off the coast of New Jersey. *Loligo* fishing is mostly done around Hudson Canyon and Block Canyon.

The fish is packaged on the boats in plastic bags and placed in aluminum trays. Fiberboard boxes are also used. The boxes hold approximately 27 to 28 pounds of fish and one boat can hold approximately 13,000 boxes, or 360,000 pounds of fish.

The freezer trawlers are at sea 280 days per year. October and May are the slow months. During this time, the crew works on boat maintenance and painting.

In 1992, the average cost of operating one of these boats for two years was $2,200,000, which covered fuel, maintenance, repairs and nets.

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The Rhode Island boats have from 9 to 11 crew members plus a captain and all of these crew are from the local area. The service and sales facility at Quonset Point employs twenty-two persons apart from the crews. This number includes office personnel and 'lumpers' who unload the boats.

Crew size increases during the *Loligo* squid season. During *Loligo* season the crew sorts the squid into six sizes and also sorts through the bycatch. *Illex* squid catches are much cleaner and do not require sorting through bycatch.

The crews are full-time workers and are paid on a share system. Individuals can make from $40,000 to $60,000 annually. Fuel costs comes off the top of the boat's catch. The boat takes about 52 or 58 percent and the crew takes about 42 or 48 percent. Food comes from the crew share.

Point Judith, RI

Point Judith 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 total value of fish landed in Point Judith in 1992 was $36.5 million. The top ten species by percent landed value in 1992 were lobster, *Loligo* squid (15%), angler, summer flounder, scup, butterfish (4%), winter flounder, yellowtail, and cod. Mackerel accounted for 1%.

Point Judith has a large fleet of trawlers, gillnetters, and lobster boats. While estimates vary, approximately 200 commercial boats dock in Point Judith, including 80 trawlers, 30 gillnetters, and 100 or so lobster boats.

One informant described Point Judith boats as diverse in their annual round and approach to the fisheries, as opposed to New Bedford boats which only go after groundfish. Point Judith boats which are not diverse are the freezer boats which only target fish for frozen markets -- the squids, butterfish, and mackerel. 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.

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, and ocean scallopers. People are mostly going for groundfish such as cod, haddock, and flounder.

Atlantic mackerel is seldom targeted because there is no market for it in Stonington. Atlantic mackerel accounts for 0.01% of the landed value of species and these are caught primarily by drift gillnets. One vessel specializes in *Loligo* squid. Other vessels will target squid when they appear in large numbers. *Illex* squid is seldom targeted because the market is limited since the *Illex* squid spoils rapidly. There is a market for butterfish but no vessel is specialized in catching it.

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.

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.

Freeport/Brooklyn area, NY

Freeport has 71 permitted vessels and Brooklyn has 33.

The total value of all species landed in the Freeport/Brooklyn area in 1992 was about $4 million. The most important fisheries in terms of landed value are surf clam (45%), *Loligo* squid (13%), summer flounder (11%), scup (10%), and lobster (6%). Butterfish accounted for 0.52% and mackerel 0.31%.

Bottom otter trawlers (48%) and surf clam dredges (45%) accounted for the majority of the landed value of species in the Freeport/Brooklyn area in 1992.

Belford, Point Pleasant, and Barnegat Light, 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.

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.

Point Pleasant is the largest of these three ports and arguably the most diverse. There are 51 core boats at Point Pleasant. They run the gamut from inshore gillnetters to scallop boats, draggers, longliners and lobster potters.

For the most part, all boats in these three ports are owner operated. 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.

Belford, NJ

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). Excluding ocean quahogs from the data, lobster is the most valuable (46% of landed value in 1992), followed by blue crab, summer flounder, menhaden, silver hake, and *Loligo* squid (4%). Excluding ocean quahogs from the data, butterfish accounted for 0.90% and mackerel 0.46% of the 1992 landed value.

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%), *Loligo* squid (14%), winter flounder (11%), and scup (9.3%).

Point Pleasant, NJ

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. 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 $16,000,000. The major species landed in 1992 (by percentage of landed value) were ocean quahog (38%), sea scallops (12%), surf clam (12%), *Loligo* squid (8%), and hard clam (6%). Butterfish accounted for 0.31% and mackerel 0.23%.

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 initially de facto, but now it is by choice.

Butterfish are caught with *Loligo* squid. If mixed with too much squid they are unmarketable. However, in general they are a somewhat marketable fish. That which is not marketable is sometimes consumed by the crew of the vessel.

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%). Butterfish contributed 1.76% and mackerel 1.40% in 1992.

Barnegat Light/Long Beach Island, NJ

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.

The larger region, including Barnegat Bay ports, had landings worth about $32 million in 1992. Major species, by percent of the landed value (excluding surf clams and ocean quahogs) were: sea scallops (28%), hard clams (17%), swordfish (13%), tuna (17%), and tilefish (8%). Butterfish accounted for 0.05%.

Cape May, NJ

Cape May is the most southerly town in New Jersey. The town is noted for its tremendous tourist and beach economy during the summer. While there are marinas in the town, there is little conflict for space with the commercial fishermen because the commercial docks are separated from the rest of the community.

Along one stretch of road lies most of the commercial fishing docks in the town. These include a surf clam dock and three commercial finfish docks.

All told, there are 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 with flash freezers. Many transient boats (57 in 1992) land in the Cape May/Wildwood area from places like Pt. Pleasant. and Port Judith, especially to take advantage of winter stocks of *Loligo* squid and to find safe harbor during storms.

For the Cape May/Wildwood area, the entire landed value for 1992 was about $37 million. Cape May landed about $30.4 million, Wildwood landed $4.5 million, and other ports in the Cape May area landed $2.3 million. Major species landed include sea scallops (28%), ocean quahog (11%), *Illex* squid (10%), *Loligo* squid (9%), and surf clams (8%). Mackerel contributed 1.56% and butterfish 0.62% in 1992. Other ports in this area and the statistics that follow include Cold Spring Harbor, near Cape May, and Sea Isle City, to the north. There are now two tilefish boats, two fish trap (pot) boats and one dragger working out of Sea Isle City, and tilefish and black sea bass are the species targeted.

Tilefish are not landed, 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.

Together with bottom sea scallop trawling, bottom fish otter trawling accounts for 39.33% of the total landed value of the Cape May/Wildwood area. Major species caught by bottom fish otter trawl are *Illex* squid, *Loligo* squid, summer flounder, and scup.

Loligo squid is targeted during the winter by the freezer trawlers. It is one of the largest landings and money makers, accounting for about 25% of the total landed value of all bottom fish otter trawl. The squid are hauled aboard and flash frozen into blocks of ice and kept in cold storage until they can be returned to port. The demand for *Loligo* squid is largely for an export market in flash frozen squid. They also market the squid to a lesser extent in the fresh fish markets in New York and Philadelphia. The domestic and foreign markets are growing slowly.

Illex squid is the largest summer fishery for the freezer trawlers. It is a relatively recent fishery because *Illex* is decomposes at higher temperatures. To handle large volumes of *Illex* it is necessary to have RSW capacity, and it is preferable to have flash freezers to ensure a better product. *Illex* is the biggest fishery for the bottom fish trawlers from Cape May, accounting for 27% of the total landed value of the gear in 1992. The market for *Illex* is predominantly aimed at Europe for flash frozen product. However, there is a growing market for processed *Illex* rings in the United States.

Butterfish is sometimes landed with squid. When mixed with large amounts of squid, it is unmarketable and is sometimes consumed by the captain and crew of the vessel. However, it is sometimes landed in appreciable quantities and can be marketed.

Although Atlantic mackerel is a low valued fish at Cape May, it is caught in substantial numbers and its value does increase under certain conditions. For example, a recent joint venture with the Russians allowed for an increased value in Atlantic mackerel landings in two ways. First, it increased the landings of Atlantic mackerel. Second, it opened a new market for the boats to sell their catch.

Atlantic City, NJ

Atlantic City's port is primarily clam boats. However it also has four boats potting for black sea bass year round. These are small boats between 34 and 40 ft. They could sea bass pot year round but the catch is higher from the spring to late fall. There is some gillnetting here for weakfish and bluefish in the spring and fall, but this is decreasing. One fishermen comes here from Barnegat Light every year to gillnet for sturgeon.

Shark River, NJ

Shark River, in Monmouth County, is a small port dominated by charter and party boats and private recreational boats. It has also been an important lobstering port and has had some gillnetting and dragging, as well.

Highlands & Atlantic Highlands, NJ

These Monmouth County ports are close to Sandy Hook; Atlantic Highlands is a sports fishing center. Highlands has sports fishing but also a small amount of lobstering and other fishing and -- together with Seabright -- an important bay fishery for hard clam sand soft clams.

Port Norris & other Cumberland County ports, NJ

Port Norris and other Cumberland County ports fringe the Delaware Bay and were traditionally the center of oystering. Oystering is negligible because of oyster diseases. Gillnetting and sports fishing for weakfish and other species, as well as blue crab potting, are becoming very important.

Ocean City, Maryland

Ocean City is currently the primary port for ocean fishing vessels in Maryland. Its boats are primarily smaller boats; they are either inshore boats or small trawler, day boats. Its harbor area is directly west of the inlet at the southern end of the city and is one and a quarter miles from the ocean.

The total landed value of fish and shellfish in Ocean City and environs in 1992 was about $8 million. The surf clam and ocean quahog fishery represented 62% of that total. Summer flounder (5%), black sea bass (5%), and butterfish (0.35%) are among the species of concern that are relatively important to the fisheries. As elsewhere in the region, the actual number of species landed and sold is extremely high: (70 species).

After the clam dredge, the most important gear type in terms of landed value was the pelagic longline (12.35%), closely followed by the otter trawl dragger (11.9%).

The trawlers (there are about six to ten of them here) are the larger boats of the port, ranging in size from 62 ft and 32 tons to 73 ft and 103 tons. None of the boats in Ocean City have refrigerated sea water. They chill the fish in ice salt water in barrels on the deck. The Ocean City draggers take a large variety of finfishes, topped by summer flounder (50%) and spiny dogfish (27.6%) in 1992. Horseshoe crabs make up an unusually large component of this catch, followed closely by weakfish. Black sea bass, butterfish, scup, *Loligo* squid, and Atlantic mackerel are of some importance.

Hampton Roads/Hampton, Virginia

Ninety-five different species were landed in the Hampton Roads area in 1992. Sea scallops (63%) and summer flounder (17%) were the two most important species in the Hampton Roads area in terms of landed value in 1992. Substantial quantities of *Loligo*, *Illex*, and mackerel were landed, but the quantities may not be reported because of data confidentiality constraints. Butterfish accounted for 0.03% of the value in 1992.

Scallop dredges (54%) and otter trawlers (20%) are the most important gear types in terms of landed value in Hampton Roads.

Atlantic mackerel, *Loligo* squid and *Illex* squid are discussed together in this section because there is one boat that lands in Hampton Roads and in Cape May that targets these three species. This fisherman is targeting *Loligo* now (Nov.-Dec.1993) and it is bringing a good price. This fisherman targets *Illex* squid during the summer. *Illex* squid does not bring as high a price but is abundant. Atlantic mackerel pass through the waters in the Hampton Roads area from about January to about February or March and this fisherman will use a midwater trawl to catch them. One informant referred to this as a high rise net used for mackerel and squid. This fisherman mostly fishes between Wachapreague, VA and Ocean City, MD. Charter boat captains often buy some of the squid for bait.

One informant said that *Loligo* squid used to be a bycatch with summer flounder with otter trawlers but no more because the larger net mesh used to catch summer flounder is too large to catch the squid.

Atlantic mackerel is caught primarily by draggers. A small amount are also caught by sink gill nets and pound nets. One informant said that fishermen used to catch it in February but the water is too warm for the mackerel now (1993). According to one informant, all of the fishermen will catch Atlantic mackerel if they are in the waters close to Hampton Roads but in the past few years the water has been too warm. One fisherman said, "It's good fishing when mackerel are here." Party boats especially like to go out for mackerel. Fishermen used to get 50-60 cents per pound for the Atlantic mackerel. "Unless it gets cold we won't see them this year."

Butterfish were 0.03% of the total 1992 landed value in Hampton Roads. Draggers land 57% of this catch and sink gill netters land 34%. Butterfish were 0.82% of the 1992 landed value for pound netters. Butterfish is an incidental catch to squid. Some fishermen in Hampton Roads catch both long butterfish and star butterfish (more diamond shaped with high dorsal fin and long pectoral fin). The star butterfish brings a higher price. These are caught with draggers and pound nets. The pound net fishery catches them primarily in July, August and September.

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 1800's. Many of the current residents of Wanchese are descendants of people who settled here in the late 1600's and early 1700's.

Wanchese is bounded on three sides by estuarine waters and is twenty minutes (by boat) from Oregon Inlet. Thus it is a convenient location for inshore and offshore boats. However, Oregon Inlet is sometimes impassable for the larger trawler boats and many of these boats from Wanchese will stay in Hampton, Virginia or New Bedford, Massachusetts during the winter months. 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 at the WSIP.

Summer flounder (21%) were the most important species in Dare County in 1991 in terms of landed value. In 1991 the value of all species landed in Dare County was over $11 million. Blue crabs (hard) are second in importance (11%), followed by weakfish (9%). Other species of interest landed in Dare County in 1991 were bluefish (4.02%), sea basses (3.41%), dogfish (1.00%), tilefish (0.53%), scup (0.41%), butterfish (0.31%), squid (0.29%), and Atlantic mackerel (0.12%).

The total landed value for the following species was $4,763,534 in 1992 (USDC 1993b): summer flounder, black sea bass, Atlantic mackerel, scup, weakfish, squids, tilefish, sharks/dogfish uncl., butterfish, bluefish, and whiting. Of these species, 45.03% of the landed value comes from gill netters and 34.05% of the landed value is from draggers. Pound netters bring in 13.5% of the landed value; handliners bring 5.43%; haul seiners bring 1.78%; trollers bring 0.07%; and less than 0.01% of the total landed value comes from crab pots.

Summer flounder is 40.81% of the total landed value for these species in 1992 and is the most important in terms of landed value in Wanchese. Weakfish is the second most valuable (24.35% of total value) followed by dogfish (14.50%).

3.0 ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

3.1 Preferred Measures to Attain Management Objectives

3.1.1 Framework Adjustment Process

The annual specification process is the primary mechanism for adjusting management measures to meet the objectives of the FMP. In addition to the annual review and modifications to management measures detailed in the FMP, 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 (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. Any other commercial or recreational management measures.
22. Any other management measures currently included in the FMP.
23. Set aside quota for scientific research.
24. Regional management.
25. Process for in season adjustment to the annual specification.

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 Atlantic Mackerel, Squid and Butterfish 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 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.

3.1.2 Vessel Size Restrictions in the Atlantic Mackerel Fishery

This Amendment would restrict the size of domestic harvesting vessels permitted in the Atlantic mackerel fishery. Vessels issued Atlantic mackerel permits are not to exceed 165 ft in length overall (LOA) and 750 gross registered tons or have shaft horsepower exceeding 3000 shp.

3.2 Revised Definitions of Overfishing

3.2.1. Atlantic mackerel

Overfishing for Atlantic mackerel will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (F=0.45), and the target is the tenth bootstrap percentile of F_{MSY} (F=0.25). To avoid low levels of recruitment, the threshold F decreases linearly from 0.45 at 890,000 mt SSB to zero at 225,000 mt SSB (1/4 B_{MSY}), and the target F decreases linearly from 0.25 at 890,000 mt SSB to zero at 450,000 mt SSB (½ B_{MSY}). Annual quotas will be specified which correspond to a target fishing mortality rate according to the control law. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}.

3.2.2 *Loligo pealei*

Overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Target F is defined as 75% of the F_{max} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy). Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}.

3.2.3 *Illex illecebrsosus*

Overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY} . The minimum biomass threshold is specified as ½ B_{MSY}.

3.2.4 Atlantic butterfish

Overfishing for Atlantic butterfish will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as l/2 B_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}. Quotas will be set annually by the Regional Director according to the FMP.

3.2.5 Rebuilding schedule

The Sustainable Fisheries Act (SFA) requires the Council to set the overfishing definition to meet a new standard (F_{MSY}). In addition, the resource must be rebuilt to the biomass associated with MSY, B_{MSY} in as short a period as possible. The rebuilding period is not to exceed 10 years, except where biology, environmental conditions or international agreements dictate otherwise.

NMFS (1997) issued a report listing the US stocks managed under the SFA which are overfished or approaching an overfished condition. None of the species managed under this FMP were designated as being overfished and therefore none of them require rebuilding at the current time.

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 would not be implemented to address inter-annual 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. The maximum F threshold is specified as F_{msy}. The minimum biomass threshold is specified as ½ the MSY level.

Applegate *et al.* (1998) recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for Atlantic mackerel. For Atlantic mackerel, maximum sustained yield (MSY) and the biomass that produces MSY in the long-term (B_{MSY}) were most recently estimated by Applegate *et al.* 1998. F_{MSY} was estimated to be 0.4 and B_{MSY} was estimated to be 890,000 mt (237.00 million lbs). These values form the basis of the definition of overfishing for Atlantic mackerel. The maximum fishing mortality rate is defined as $F_{MSY}=0.45$ and the biomass threshold is defined as ½ B_{MSY} or 445,000 mt.

Applegate *et al.* (1998) recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for *Loligo* squid. F_{MSY} could not be estimated for *Loligo* based on an analytical assessment. In the absence of analytical estimates of MSY-based reference points for *Loligo*, Applegate *et al.* 1998 recommended using F_{max} as a proxy for F_{MSY}. When an estimate of

F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. A proxy for B_{MSY} may be inferred from the time series of area swept biomass. Biomass is expressed as area-swept estimates from NEFSC trawl surveys, and are combined for the spring and fall, because Loligo live less than a year and current quotas are annually based. Applegate *et al.* 1998 assumed that a sub-annual species that has not been badly depleted is likely to grow to B_{MSY} levels occasionally. A proposed proxy for B_{MSY} was based on the 75th percentile of annual biomass estimates, which is 80,000 mt. The proposed biomass threshold for *Loligo* is the lowest biomass level that the stock has demonstrated the capacity to rebuild from, which is 30,000 mt.

Applegate *et al.* (1998) recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for *Illex* squid. SAW 21 (NMFS 1996a) estimated the long-term potential yield (24,000 mt) based on a surplus production model estimate of MSY. F_{MSY} was estimated to be F=0.75. The biomass target should be equal to B_{MSY} (39,300 mt), based on guidance for choosing a minimum biomass threshold in the National Standard 1 guidelines and on choosing targets for stocks with moderate uncertainty in the estimate of F_{MSY}. For *Illex* squid, Applegate *et al.* (1998) recommended a minimum biomass threshold that is equal to l/2 B_{MSY} (19,650 mt) and a fishing mortality target that is 75 percent of the estimate of F_{MSY} or F=0.56.

Applegate *et al.* 1998 recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for butterfish. NMFS (1980) recommended using $F_{0.1}$ as a proxy for F_{MSY} in the estimation of MSY. Assuming that the fishery used an effective mesh size of 3.4 in (85 mm), NMFS (1980) estimated MSY to be 21,600 mt. The use of smaller mesh sizes in the fishery would however reduce MSY. NMFS (1980) estimated MSY at about 16,000 mt for a fishery using the current mesh size. Under these conditions F_{MSY} is equal to F=1.01. This mortality rate should serve as the maximum fishing mortality threshold. The fishing mortality rate target should be set equal to 75% of F_{MSY}. The panel also recommends that the overfishing definition for butterfish include a biomass target equal to MSY and a minimum biomass threshold equal to ½ B_{MSY}.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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 5 and 6. There is no additional information available to change this analysis at the present time.

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.

A complete description of the ports and their reliance on various species, including Atlantic mackerel, squid and butterfish is given in Section 3.4. The purpose of this FMP has been to provide a framework for the orderly development of the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries while preventing overfishing. Therefore, most if not all of the fishing communities along the US east coast have been positively impacted by the FMP. There were likely be some fishermen who may have caught *Loligo*, *Illex*, or butterfish that did not qualify for the moratorium under Amendment 5 and were reduced to catching bycatch quantities. This issue was discussed in section 9.2.2 of Amendment 5 to the FMP.

Another issue with Amendment 5 was that the limited entry provisions reduced the possibility that fishermen would enter the fishery that never participated in these fisheries. The most frequently mentioned group of fishermen identified in this category are those that have been negatively impacted by the severely overfished condition of the groundfish resources. They are seeking alternative species. However, it was the Council's conclusion that the harvesting capacity of the fleet that will qualify for the moratoria plus the fleet that will harvest the bycatch allowance can take the maximum optimum yields for the species involved and no extra capacity is needed in the fishery. The major benefit to be realized through implementation of recent Amendments to this FMP is that overfishing and over-capitalization in these fisheries will be avoided in the future.

The proper management of the stock complexes managed under this FMP through implementation of the management measures described in recent Amendments have been beneficial to the commercial and recreational fishing communities of the Atlantic Coast. By preventing overfishing of the stocks and overcapitalization of the industry, positive benefits to the fishing communities have and will continue to be realized.

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 any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade. 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.

The commercial fishery for Atlantic mackerel is primarily prosecuted with otter trawls (see Amendment 5 and NMFS 1996b). The fishery is managed through the specification of annual quotas. No management measures are in place which would cause discarding of Atlantic mackerel in the commercial fishery. The most recent stock assessment for Atlantic mackerel concluded that discards in the Atlantic mackerel fishery are insignificant in recent years (NMFS 1996b). Therefore, discards in the commercial Atlantic mackerel fishery in SAW-20, as in previous assessments, were not estimated.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to characterize catch and discards in the commercial Atlantic mackerel fishery. Trips which caught and landed 1000 lbs or more of Atlantic mackerel are characterized in Table 26. A total of 13 species was taken in association with Atlantic mackerel. Overall, 12.6 % of the weight caught on these trips was discarded. Atlantic mackerel and Atlantic herring accounted for 58.8% and 33.9% of the total weight caught, respectively. Atlantic mackerel discard rates were moderate (16% of total weight of mackerel caught) and accounted for roughly 75% of the total weight discarded. The discard rates for individual species ranged form zero for silver hake to 72% for black sea bass. However, the total weight of species other than Atlantic mackerel and herring accounted for less than 10% of the total weight caught.

The degree to which the 37 trips sampled in NMFS sea sampling program accurately describe discards in the commercial Atlantic mackerel fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1997 to characterize discards. The catch disposition for each species taken on trips that landed 10,000 lbs or more of Atlantic mackerel, based on unpublished 1997 vessel trip reports (submitted by fishermen as required by the FMP), is given in Table 27. Overall, only 1.5% of the total weight landed was reported as discarded. Atlantic mackerel accounted for 88.4% of the total weight landed on 254 trips that landed 10,000 lbs or more of Atlantic mackerel. The discard rate for Atlantic mackerel on these trips, based on VTR data, was low (1.4%). The only species with high discard rates were striped bass (100%) and blueback herring (48.9%). However, the total weight caught for both species was very small. Overall, discarding in the commercial Atlantic mackerel appears to be minimal based on unpublished NMFS VTR data.

There is also a significant recreational fishery for Atlantic mackerel. Estimates of recreational catch and discard in the recreational fishery for mackerel are available from the MRFSS. MRFSS data indicate that the percentage of Atlantic mackerel taken in the recreational fishery that are released after capture (MRFSS Type B2) is generally less than 12% of the total caught in most years (Table 28). In addition, the majority of the fish released alive are expected to survive after release, and therefore, are not defined as bycatch under the new SFA. There are no recreational management measures for Atlantic mackerel which cause discarding. The limited amount of discarding that does occur in the recreational fishery is due to fishermen preference and behavior and is unrelated to management of the resource.

The commercial fishery for *Loligo* is primarily prosecuted with otter trawls (see Amendment 5 and NMFS 1996a). The fishery is managed through the specification of annual quotas. No management measures are in place which would cause discarding of *Loligo* in the commercial fishery. The most recent stock assessment indicated that discards of *Loligo* in the commercial fishery do occur, however limited data are available to quantify the extent of discarding by vessels targeting *Loligo*. The most recent assessment reported that only two winter sea sampling trips which targeted *Loligo* were available for analysis. The percentage of *Loligo* discarded by weight ranged from 4-19%. For both trips, the reason given for discarding was that the squid discarded were below marketable size. The assessment was uncertain if the levels of discarding from these trips were representative of the winter squid fishery overall. Additional discard data were available from the Massachusetts Division of Marine Fisheries for the Nantucket and Vineyard Sound Fishery collected during May of 1990-1992. These data indicated that less than 2% by weight of *Loligo* taken in this fishery were discarded. Based on the limited data presented in the most recent assessment, it appears that discarding of *Loligo* does occur, but not because of regulations within the FMP. While the data are limited, the levels that occur appear to be relatively low and are related to marketability. The need for improved estimates of discards in the commercial *Loligo* fishery was one of the primary research needs recognized in the most recent assessment (NMFS 1996a). This research recommendation should receive a high priority among the research planned by the NEFSC and will require additional funding above current levels.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to characterize catch and discards in the *Loligo* squid fishery. Trips which caught and landed 100, 500, and 1000 lbs or more of *Loligo* squid are characterized in Tables 29a-c. The lack of data from the directed *Loligo* fishery in the NMFS sea sampling program is confirmed by the 1996 data presented in Tables 29a-c. *Loligo* accounted for a minority fraction of the total weight caught in these trips, even at the 1000 lb threshold. At the 100 and 500 lb thresholds, the trips appear to be directed at *Illex* squid or Atlantic mackerel. At the 1000 lb threshold, the trips appear to be directed at Atlantic mackerel.

A total of 30 species was taken in addition to *Loligo* in 198 trips which landed at least 100 lbs of *Loligo*. Overall, 6.6% of the weight caught on these trips was discarded. Atlantic mackerel and *Illex* squid accounted for 17.5% and 64.4% of the total weight caught, respectively. *Loligo* discard rates were very low (1.0% of total weight of *Loligo* caught).

A total of 19 species was taken in addition to *Loligo* in 77 trips which landed at least 500 lbs of *Loligo*. Overall, 15.4% of the weight caught on these trips was discarded. Atlantic mackerel and *Loligo* squid accounted for 56.8% and 24.3% of the total weight caught, respectively. Atlantic mackerel accounted for most of the total weight discarded (64%). *Loligo* discard rates were very low (1.1% of total weight of *Loligo* caught).

A total of 13 species was taken in addition to *Loligo* in 41 trips which landed at least 1000 lbs of *Loligo*. Overall, 20 % of the weight caught on these trips was discarded. Atlantic mackerel and *Loligo* squid accounted for 17.5% and 64.4% of the total weight caught, respectively. *Loligo* discard rates were very low (0.1% of total weight of Loligo caught).

The degree to which the 41 trips sampled in NMFS sea sampling program which landed at least 1000 lbs of *Loligo* accurately characterize discards in the directed *Loligo* fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1997 to characterize discards. The catch disposition for each species taken on trips that landed 2,500 lbs or more of *Loligo* based on unpublished 1997 vessel trip reports (submitted by fishermen as required by the FMP) is given in Table 30. Overall, only 1.5% of the total weight landed was reported as discarded. *Loligo* accounted for 61.1% of the total weight landed on 2,098 trips. The discard rate for *Loligo* based on VTR data was low (0.2%). Species with high discard rates were yellowtail flounder (79.3%), Atlantic herring (59.8%), chub mackerel (50.9%),sea robins (80.6%), spiny dogfish (79.7%), skates (87.7%), sandbar sharks (50%), and horseshoe crabs (65.2%).

The issue of scup discards in the *Loligo* fishery was a major issue that was identified in the development of this amendment. As noted above, coverage of the directed *Loligo* fishery by the NMFS sea sampling program is poor. However, the available data indicated that scup discards rates were 66-67% for the sea sampling data that was examined. However, the total amount of scup taken on these trips was low (6,000 - 7,000 lbs), accounting for only 0.9% - 4.9% of the total weight landed on the trips sampled. As noted above, the sea sampling data available for the directed *Loligo* fishery is limited and increased at-sea coverage of the directed *Loligo* fishery is needed to accurately characterize discards in this fishery. In contrast to estimates of scup discard rates on tows which landed *Loligo* based on sea sampling data, discarding of scup in the directed *Loligo* fishery appears to be minimal based on unpublished NMFS VTR data. Unpublished NMFS VTR data for trips which landed 2500 lbs or more of *Loligo* squid indicate that only 2.4% of the scup caught was discarded. Thus, in contrast to the NMFS sea sampling data, the NMFS VTR data indicate that scup discarding in the *Loligo* fishery does not appear to be significant.

One existing management measure in the FMP designed to reduce the catch and subsequent discard of small unmarketable squid was the imposition of gear restrictions in the *Loligo* fishery. During the development of Amendment 5, the Council's industry advisors reported that some fishermen used liners so small that they retained *Loligo* below marketable size and the *Loligo* were then discarded. The result was biological and economic waste. The imposition of gear restrictions was intended to eliminate the use of very small liners in the *Loligo* fishery. In addition, minimum size limits for *Loligo* were rejected by the Council during the development of Amendment 5 to avoid potential discard problems that would have been created by the imposition of this management measure.

The advisors reported that 1 7/8" mesh codends were in general use in the fishery (by the fishermen that do not use the very small liners). They stated that the 1 7/8" mesh allowed the very small *Loligo* to escape so they can grow to a marketable size. The incorporation of this management option in Amendment 5 was the direct response of concerns raised by fishermen in the industry. It was intended to decrease biological and economic waste due to the harvest of non-marketable animals and ultimately to result in higher yield per recruit. This measure provides that the minimum mesh size may be adjusted as part of the annual quota setting process. If future research shows that another size is more appropriate, the minimum mesh requirement may be adjusted without a plan amendment.

The commercial fishery for *Illex* is primarily prosecuted with otter trawls (see Amendment 5 and NMFS 1996a). The fishery is managed through the specification of annual quotas. No management measures are in place which would cause discarding of *Illex* in the commercial fishery. The most recent stock assessment for the species indicated that discards were not available for directed *Illex* trips. However, anecdotal information from industry suggested that discarding of *Illex* is minimal. This conclusion is also supported by confidential observer data collected during foreign and joint venture fishing operations for *Illex* in the late 1980's which indicated that discarding of Illex was negligible in comparison to landings (NMFS 1996a). NMFS (1996a) concluded that, in general, *Illex* tend to school by size, and targeting of larger squid by the fishery, suggests low discard rates.

The 1996 NMFS sea sampling data, the most recent at-sea observation data available to characterize catch and discards in *Illex* fishery, support the above conclusion. Trips which caught and landed 1000 lbs or more of *Illex* are characterized in Table 31. A total of 13 species was taken in association with *Illex* on these trips. Overall, only 1.4 % of the weight caught on these trips was discarded. *Illex* accounted for 95.3% of the total weight caught. *Illex* discards were very low (<0.01% of total weight of *Illex* caught). The discard rates for the other species were also very low.

In addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1997 to characterize discards. The catch disposition for each species taken on trips that landed 5,000 lbs or more of *Illex* , based on unpublished 1997 vessel trip reports (submitted by fishermen as required by the FMP), is given in Table 32. Overall, only 0.2% of the total weight landed was reported as discarded. *Illex* accounted for 92.5% of the total weight landed on 222 trips that landed 5,000 lbs or more of *Illex*. The discard rate for *Illex* on these trips was very low (<0.01%). Overall, discarding in the *Illex* fishery appears to be very minimal based on unpublished NMFS VTR data.

The commercial fishery for butterfish is also primarily prosecuted with otter trawls (see Amendment 5 and NMFS 1994) and is managed through the specification of annual quotas. No management measures are in place which would cause discarding of butterfish in the commercial fishery. The most recent stock assessment for indicated that discards of butterfish do occur in the commercial fishery, however limited data are available to quantify the extent of discarding by vessels targeting butterfish (NMFS 1994). Discarding of butterfish on non-directed trips appears to be high, ranging from 69-100%. However, the data suggested that the available sea sample data are not representative of the directed fishery for butterfish. NMFS (1994) concluded that further evaluation of the precision and design of the sea sampling program in adequately characterizing butterfish discards in the directed fishery is needed before attempting to estimate the absolute magnitude of discards. As in the case for *Loligo*, this research recommendation will require additional funding above current levels to accomplish.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to characterize catch and discards in the butterfish fishery. Trips which caught and landed 100 and 500 lbs or more of butterfish are characterized in Tables 33a-b. The lack of data from the directed butterfish fishery in the NMFS sea sampling program is confirmed by the 1996 data presented in Tables 33a-b. Butterfish accounted for a minority fraction of the total weight caught in these trips, even at the 500 lb threshold. At both the 100 and 500 lb thresholds, the trips appear to be directed at *Illex* squid since, *Illex* accounted for 92.2% and 87.0% of the total caught for each threshold, respectively. A total of 19 species was taken in addition to butterfish in 72 trips which landed at least 100 lbs of *Loligo*. Overall, only 0.5% of the weight caught on these trips was discarded. A total of 10 species was taken in addition to butterfish in 26 trips which landed at least 500 lbs of butterfish. Overall, only 1.0% of the weight caught on these tows was discarded.

The degree to which the trips sampled in NMFS sea sampling program which landed at least 100 or 500 lbs of butterfish accurately characterize discards in the directed *Loligo* fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1997 to characterize discards. The catch disposition for each species taken on trips that landed 500 lbs or more of butterfish based on unpublished 1997 vessel trip reports (submitted by fishermen as required by the FMP) is given in Table 34. Overall, only 2.0% of the total weight landed was reported as discarded. Butterfish accounted for only 18.0% of the total weight landed on 1,573 trips. The discard rate for butterfish, based on VTR data, was low (2.6%). Species with high discard rates (>50%) were Atlantic herring (64.0%), sea robins (73.4%), spiny dogfish (57.7%), and skates (62.8%).

An additional measure imposed in Amendment 5 to the FMP designed to minimize discards in the squid and butterfish fisheries was the creation of a non-moratorium bycatch allowance. Amendment 5 created a limited access program for the squids and butterfish. To avoid discarding of squid and butterfish taken by non-moratorium vessels during the prosecution of other fisheries, a non-moratorium bycatch permit category was created. A vessel that does not qualify for a *Loligo*/butterfish or *Illex* moratorium permit may land *Loligo*, *Illex*, and/or butterfish if (1) it possesses an incidental catch permit, (2) fishes with a net legal in the directed fishery, (3) lands no more that 2,500 pounds of *Loligo* and/or butterfish or 5,000 pounds of *Illex* per trip, and (4) the operator of the vessel files the appropriate trip reports. The bycatch allowance may be adjusted by the Regional Administrator based on the recommendation of the Council. This management measure was implemented specifically to minimize discarding of these species in non-directed fisheries.

The amount of discarding in the commercial fisheries for these species should be also be minimized since capping the fishery at 1996 levels avoided overfishing of the squids and butterfish. Also, state and federal mesh regulations already in effect for other species (i.e., summer flounder, weakfish, black sea bass, etc.) will reduce the bycatch of small butterfish. In addition, this amendment includes framework provisions described in Section 3.1.1 to deal with discard problems in the future should they arise. Specifically, if a discard problem is identified, gear restrictions could be implemented to reduce discard mortality. All of these factors will result in the minimization of bycatch and discard mortality in the commercial fisheries for these species, to the extent practicable. Therefore, National Standard 9 is satisfied.

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.

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.

None of the measures (recreational or commercial) should affect the vessel operating environment, gear loading requirements or create derby style fisheries. 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.

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.

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 Atlantic mackerel, squid and butterfish fisheries are presented in section 7 (Description of Fishing Activities) of Amendments 5. 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 5.

3.5.1 Additional Characterization of the Recreational and Party/Charter Fisheries

MRFSS catch data by mode indicates that for the 1988-1997 period (Table 35), most Atlantic mackerel (in numbers) were caught by party/charter and private and rental boats in the North Atlantic and Mid-Atlantic regions. Few Atlantic mackerel were caught in the South Atlantic, while those that were taken were caught mostly from shore. The percentage of Atlantic mackerel caught by party/charter boats was 8.3 and 59.8 in the North and Mid-Atlantic regions, respectively. For the same time period, most Atlantic mackerel (weight) were landed by private and rental boats in the North Atlantic (79.6%) and party and charter boats in the Mid-Atlantic (74.6%) regions.

3.5.1.1 1990 survey of charter and party boats

To provide additional information on the party and charter boat 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 a number of important Mid-Atlantic fisheries. A mailing list was compiled from the NMFS vessel permit files, including all vessels which indicated they were involved in party and charter activities (permit Category 2). The list included 402 vessels. Consultation with Council members yielded concerns that a number of vessels did not hold federal permits, and would not be included in the survey. Representatives from New Jersey, New York, and Virginia supplied the Council with lists supplementing the NMFS permit files, and an additional 190 questionnaires were mailed.

A total of 592 surveys were sent out to 13 east coast states (Table 36). 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 37). 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 37). 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 38). 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 personally 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 39. 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 40, 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

3.6.1 Analysis of Vessel Size Restrictions in the Atlantic Mackerel Fishery

Biological, Economic and Social Impacts

This Amendment would restrict the size of domestic harvesting vessels permitted in the Atlantic mackerel fishery. Vessels issued Atlantic mackerel permits are not to exceed 165 ft LOA and 750 gross registered tons or have shaft horsepower exceeding 3000 shp.

The Atlantic Mackerel, Squid, and Butterfish FMP was developed in the early 1980's to provide for the orderly development of the US Atlantic mackerel, squid and butterfish fisheries. Recently, Amendment 5 to the FMP revised the management programs for the species complex and included moratoria on new entrants to the squid and butterfish fisheries. At the time that Amendment 5 was developed, the Atlantic mackerel stock was considered to be underutilized. As a result, the Council was concerned that limiting entry to the Atlantic mackerel fishery would discourage US harvesters and/or processors from further developing the fishery. However, it was also concerned that if the fishery were to expand without some safeguards, the fishery could rapidly become overcapitalized. The Council included in Amendment 5 a provision that when landings of Atlantic mackerel by US commercial vessels first reach 50% of the Allowable Biological Catch (ABC), the Secretary would immediately announce in the *Federal Register* a control date for possible entry limitation into the fishery. When Amendment 5 was submitted for Secretarial review, it was determined not to be appropriate for the Secretary to implement a control date as a management measure within an FMP. As a result, the Secretary removed this measure from the Amendment as was noted in the Preamble to the Proposed Rule for Amendment 5.

A new definition of overfishing was approved in Amendment 5 which significantly lowered the ABC for Atlantic mackerel. Although the stock is considered to be at a high level of abundance and relatively lightly exploited, considerable uncertainty exists about the current abundance of the Atlantic mackerel stock. Council analyses conducted during the development of Amendment 5 revealed that the hold capacity of vessels possessing Atlantic mackerel permits approached 50,000 mt. Given this harvest capacity, the uncertainty about Atlantic mackerel stock size, and the significant reduction in ABC, the Council again concluded that control of additional entry into the Atlantic mackerel fishery is appropriate. The Council's most recent action in this regard was the publication of a control date in the *Federal Register* (September 12,1997) which notified the public that future access to the commercial Atlantic mackerel fisheries may be restricted.

The Council considered entry limitation of commercial vessels into this fishery as part of this Amendment. The purpose of this action was to control the rate of capitalization of this fishery and promote the diversification of existing fishermen and currently permitted vessels into the Atlantic mackerel fishery. The Council examined a number of options relative to limiting entry into the mackerel fishery during the development of this amendment and decided to limit the size of vessels permitted in the harvest sector the commercial Atlantic mackerel fishery. The current proposal would allow for the orderly development and expansion of the mackerel fishery. The vessel size limit is based on concerns about the rapid over-capitalization of the mackerel fleet by the entry of large vessels with significant harvest potential. The Council is concerned about this issue because analyses (presented below) indicate that the current fleet of vessels in the Northeast have more than enough fishing harvesting capacity to take the sustainable harvest of Atlantic mackerel.

In 1996, a total of 2979 vessels possessed Atlantic mackerel, squid and butterfish permits. Based NMFS weighout data, 527 vessels reported landing Atlantic mackerel in 1996. Thus only about 18% of the permit holders landed any Atlantic mackerel in 1996. Thus a potential pool of 2979 vessels would qualify for any type of limited access permit proposed by the Council based on the 1996 permit holders. It is estimated that 2452 of these vessels would have had no mackerel landings in 1996. A primary concern of the Council in the consideration of limited entry for Atlantic mackerel is to identify vessels in this pool of 2452 vessels which would be large enough to actually participate in the directed mackerel fishery. This analysis is necessary to determine if the vessels currently in the fishing fleet of the Northeast US have the ability to harvest the current allowable harvest for Atlantic mackerel.

To identify the attributes necessary for vessels to participate in the directed mackerel fishery, a threshold analysis of total pounds of Atlantic mackerel landed by vessel for 1996 was conducted. The first threshold considered was one pound of mackerel in 1996, or all vessels in Tier 1. A total of 527 vessels landed 34.6 million pounds of Atlantic mackerel in 1996. Vessels were grouped by ton class (TC) as follows :TC 1= < 5 GRT, TC 2=5-50 GRT, TC 3= 51-150 GRT, and TC 4=150 GRT. In addition, vessel lengths were grouped in 10 ft increments as an additional measure of vessel size. Over 98 % of all vessels which landed Atlantic mackerel in 1996 were greater than 5 GRT and about 76% were greater than 40 ft in length.

Also considered were the following thresholds of pounds per vessel in 1996: 50,000, 100,000 and 200,000 pounds. A total of 69 vessels landed greater than 50,000 pounds of Atlantic mackerel in 1996. These vessels accounted for 94.2 % of the total Atlantic mackerel landings from ME-VA in 1996. The average catch per vessel was 472,810 pounds. Only about 10% of these vessels were less than or equal to 50 GRT. Conversely, about 90 % of the vessels at this threshold were TC 3 and 4 vessels and were greater than 50 ft in length.

A total of 54 vessels landed greater than 100,000 pounds of Atlantic mackerel in 1996. These vessels accounted for 91 % of the total Atlantic mackerel landings from ME-VA in 1996. The average catch per vessel was 585,050 pounds. About 96 % of the vessels at this threshold were TC 3 and 4 vessels and 94% were greater than 60 ft in length.

A total of 39 vessels landed greater than 200,000 pounds of Atlantic mackerel in 1996. These vessels accounted for 85.2 % of the total Atlantic mackerel landings from ME-VA in 1996. The average catch per vessel was 757,029 pounds. About 97 % of these vessels were greater than 70 ft in length and were in TC 3 and 4.

Based on the threshold analyses above, it would appear that to operate in the directed mackerel fishery, vessels of at least 50 ft in length and greater than 50 GRT would be required. Thus to address the question of identifying potential directed offshore mackerel fishery participants from the current Northeast fleet the potential pool of vessels which met these criteria were identified.

As noted earlier, the number of vessels holding mackerel, squid and butterfish permits (the permit was combined for all four species before limited entry for the squids and butterfish) in 1996 was 2979. To make the run as updated as possible, the vessel permit and attribute (length and GRT) data for March 1998 were examined. When the open access commercial Atlantic mackerel permit was split from the combined mackerel, squid and butterfish permit, only 1759 vessels obtained the Atlantic mackerel permit. This represents a significant decline in permit holders compared to the number of vessels that previously held the combined permit prior to 1997. In 1996 there were

1232 vessels holding Atlantic mackerel permits with no mackerel landings. Of this total, about there were 300 TC 3 and 4 vessels and 340 vessels of at least 50 ft in length would qualify. In summary, there were about 300-340 vessels in this category which are potential directed mackerel vessels.

There were 5837 vessels holding a valid Northeast Regional permits as of March 1998, however, 4078 vessels of this total that did not possess commercial Atlantic mackerel permits as of March 1998. Within this pool of vessels there were 658 vessels which met the criteria of 50 ft in length or greater and 518 vessels in TC 3 and 4. Thus between 518 and 658 vessels in This category would meet the criteria to participate in the directed mackerel fishery.

In summary, a potential pool of approximately 1000 vessels exist that represent potential new entry into the directed mackerel fishery. Assuming these vessels were to land the same amount, on average, as those vessels which landed greater than 50,000 pounds of mackerel in 1996, then the potential harvest of these additional vessels is estimated to be 472,810,000 lbs (214,465 mt). Assuming the same level of landings by the current fleet would yield a total potential harvest of about 507 million pounds(230,000 mt) . Domestic allowable harvest in 1998 was specified at 176,368,000 pounds (80,000 mt).

This analysis illustrates that significant harvest potential exists within the Northeast fleet of vessels and that the current fleet could take the current quota specification for Atlantic mackerel. The analysis assumes that vessels less than 50 ft in length or 50 GRT could not operate in the directed mackerel fishery. Clearly these vessels would land some amount of mackerel and some of these vessels could land significant amounts. Thus the estimate of potential harvest capacity above for vessels not currently active in the mackerel fishery must be viewed as a minimum estimate of potential harvest of Atlantic mackerel.

Based on Northeast Regional Office permit data, there was only one vessel which possessed an Atlantic mackerel permit in 1997 that exceeded the vessel size restrictions proposed in this Amendment. However, this vessel submitted a vessel trip report that indicated that it did not fish in the Atlantic mackerel fishery in 1997.

3.6.2 Analysis of revised definitions of overfishing

Biological, Economic and Social Impacts

Overfishing for Atlantic mackerel will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (F=0.45), and the target F is the tenth bootstrap percentile of F_{MSY} (F=0.25). To avoid low levels of recruitment, the threshold F decreases linearly from 0.45 at 890,000 mt SSB to zero at 225,000 mt SSB (1/4 B_{MSY}), and the target F decreases linearly from 0.25 at 890,000 mt SSB to zero at 450,000 mt SSB (½ B_{MSY}). Annual quotas will be specified which correspond to a target fishing mortality rate according to the control law. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}. Quotas will be set annually by the Regional Director according to the FMP.

MSY, B_{MSY} and F_{MSY} are proposed to define overfishing biological reference points for Atlantic mackerel. For Atlantic mackerel, maximum sustained yield (MSY) and the biomass that produces MSY in the long-term (B_{MSY}) were most recently estimated by Applegate *et al.* (1998). F_{MSY} was estimated to be 0.45 and B_{MSY} was estimated to be 890,000 mt. These values form the basis of the definition of overfishing for Atlantic mackerel. The maximum fishing mortality rate is defined as $F_{MSY}=0.45$ and the minimum stock biomass is defined as 1/4 B_{MSY} or 225,000 mt. The target fishing mortality rate is defined as the tenth bootstrap percentile of F_{MSY} when SSB is greater than 890,000 and decreases linearly to zero as SSB approached ½ B_{MSY}.

A control rule was developed from the age-based MSY-based reference points and uncertainty in the estimate of F_{MSY} (Applegate *et al.* 1998). When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (0.45), and the target F is the tenth bootstrap percentile of F_{MSY} (0.25). To avoid low levels of recruitment, the limit F decreases linearly from 0.45 at 890,000 mt SSB to zero at 225,000 mt SSB (1/4 B_{MSY}), and the target F decreases linearly from 0.25 at 890,000 mt SSB to zero at 450,000 mt SSB (½ B_{MSY}). The most current estimates of SSB and F (1994) indicate that SSB is well above B_{MSY} and F is well below F_{MSY} (NMFS 1996b). The target mortality rates account for uncertainty in the estimate of F_{MSY}.

As noted above, The most recent estimate of Atlantic mackerel stock biomass was estimated to be 2.1 million mt, well above the target biomass of 890,000 mt. The annual quota specification in the current FMP is based upon a catch associated with a fishing mortality rate of $F_{0.1}$. NMFS (1996a) estimated $F_{0.1}$ to equal 0.27. The proposed target fishing mortality rate in this amendment is 0.25, a slight reduction from the previous value of $F_{0.1}$ (0.27). Adoption of the proposed target F would result in a quota specification slightly lower than the current value. The catch associated with a fishing mortality rate of $F_{0.1}$ would be 405,000 mt given the most recent estimates of stock size. The catch associated with the target fishing mortality rate of $F=0.25$ proposed in this amendment would be 369,000 mt, or an 8.8% reduction.

From a biological perspective, the proposed definition of overfishing for Atlantic mackerel is more conservative than the current definition. This should have positive biological impacts for the mackerel stock since overfishing and stock depletion are less likely to occur under the new definition.

Overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded. When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY} . The minimum biomass threshold is specified as ½ B_{MSY}. Quotas will be set annually by the Regional Director according to the FMP

Applegate *et al.* (1998) recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for *Loligo* squid. F_{MSY} could not be estimated for *Loligo* based on an analytical assessment. In the absence of analytical estimates of MSY-based reference points for *Loligo*, Applegate *et al.* 1998 recommended using F_{max} as a proxy for F_{MSY}. A proxy for B_{MSY} may be inferred from the time series of area swept biomass. Biomass is expressed as area-swept estimates from NEFSC trawl surveys, and are combined for the spring and fall, because Loligo live less than a year and current quotas are annually based. Applegate *et al.* 1998 assumed that a sub-annual species that has not been badly depleted is likely to grow to B_{MSY} levels occasionally. A proposed proxy for B_{MSY} was based on the 75th percentile of annual biomass estimates (80,000 mt). The proposed minimum biomass threshold for *Loligo* is the lowest biomass level that the stock has demonstrated the capacity to rebuild from (30,000 mt).

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Applegate *et al.* (1998) recommended A proposed control law based on F_{max} (NMFS 1996a) is (presented in their Figure 74). The overfishing limit is F_{max} (0.36) when the stock is greater than 80,000 mt and decreases linearly to zero at 30,000 mt. Target F is defined as 75% of the F_{max} (0.27; as proposed by Restrepo *et al.* 1998) when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy). However, the proposed control law needs better information than is currently available to work as intended. Given the short life-history of *Loligo* and the potential for rapid changes in biomass among years, the application of multi-year biomass estimates to the proposed control law could risk stock depletion if the estimated average biomass is greater than the annual biomass level. On the other hand, using multi-year biomass estimates could also forego substantial yields when the estimated average biomass is less than the annual biomass level.

Given the lack of current (within year) estimates of stock biomass for *Loligo*, the Council proposes to assume average biomass conditions as described by NEFSC and apply the target F to specify the annual quota according to the current FMP. This would imply a target fishing mortality rate of F= 0.135. The quota associated with this fishing mortality, assuming average biomass conditions in the upcoming year, would be approximately 21,000 mt based on analyses presented in NMFS (1996). Maximum OY, defined by the overfishing threshold, would be specified as the catch associated with F_{max}, which NMFS (1996) estimated to be 26,000 mt. Thus the new definition of overfishing would not change the specification of OY or MAX OY for the 1999 fishing year relative to the current definition of overfishing.

Overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as l/2 B_{MSY}. Quotas will be set annually by the Regional Director according to the current FMP.

Applegate *et al.* (1998) recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for *Illex* squid. SAW 21 (NMFS 1996a) estimated the long-term potential yield (24,000 mt) based on a surplus production model estimate of MSY. F_{MSY} was estimated to be F=0.75. The biomass target should be equal to B_{MSY} (39,300 mt), based on guidance for choosing a minimum biomass threshold in the National Standard 1 guidelines and on choosing targets for stocks with moderate uncertainty in the estimate of F_{MSY}. For *Illex* squid, Applegate *et al.* (1998) recommended a minimum biomass threshold that is equal to l/2 B_{MSY} (19,650 mt) and a fishing mortality target that is 75 percent of the estimate of F_{MSY} or F=0.56.

In the most recent assessment of the *Illex* stock, SAW 21 (NMFS 1996a) classified the *Illex* stock as fully-exploited. US *Illex* landings ranged from 14,000 mt in 1995 to 18,344 mt in 1994. The preliminary estimate of US *Illex* landings in 1997 is 13,631 mt. The most recent estimates of fishing mortality for *Illex* ranged from 0.29 in 1990 to 0.46 in 1993 (NMFS 1996a). Average biomass for the same period ranged from 38,900 mt in 1993 to 40,200 mt in 1991 (NMFS 1996a).

Overfishing for Atlantic butterfish will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as l/2 B_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{msy}. Quotas will be set annually by the Regional Director according to the FMP.

Applegate *et al.* 1998 recommended using MSY, B_{MSY} and F_{MSY} to set overfishing definition biological reference points for butterfish. NMFS (1980) recommended using $F_{0.1}$ as a proxy for F_{MSY} in the estimation of MSY. Assuming that the fishery used an effective mesh size of 3.4 in (85 mm), NMFS (1980) estimated MSY to be 21,600 mt. The use of smaller mesh sizes in the fishery would however reduce MSY. NMFS (1980) estimated MSY at about 16,000 mt for a fishery using the current mesh size. Under these conditions F_{MSY} is equal to F=1.01. This mortality rate should serve as the maximum fishing mortality threshold. The fishing mortality rate target should be set equal to 75% of F_{MSY}. The overfishing definition for butterfish includes a biomass target equal to MSY and a minimum biomass threshold equal to ½ B_{MSY}. B_{MSY} has not been estimated for butterfish.

Butterfish were last assessed at SAW 17 (NMFS 1994). SAW 17 recommended that catch levels for butterfish should not exceed 7,200 mt. The current exploitation rate and stock size is unknown.

NMFS weighout data indicate that US Atlantic mackerel landings increased to 15,712 mt in 1996 (valued at $4.6 million) and then declined slightly to 15,406 mt in 1997 (valued at $9.5 million). The proposed Atlantic mackerel overfishing definition will not affect current fishing patterns for this species. Therefore, it is not expected that significant changes in revenues or production costs for the vessels participating in the Atlantic mackerel fishery will occur from the implementation of the new overfishing definition.

In 1997, Atlantic butterfish landings totaled 2,797 mt. The proposed Atlantic butterfish overfishing definition will not affect current fishing patterns for this species. Therefore, it is not expected that significant changes in revenues or production costs for the vessels participating in the Atlantic butterfish fishery will occur from the implementation of the new overfishing definition.

Based on NMFS weighout data, the 1997 total commercial landings for *Loligo* were estimated at 16,203 mt (Table 1). Given the 1992-1997 historical landings for *Loligo* , the annual quota of 21,000 mt would be lower than the commercial landings for two of the years in the time series (1993, and 1994), and higher than the commercial landings for the remaining years. *Loligo* is an annual species subject to inter-annual variability in abundance. Therefore, for comparison purposes the annual quota corresponding to the proposed definition of overfishing is compared to the 1997 landings and to the average landings for the 1992-1997 fishing period in order to obtain the potential effects of the new quota. Average landings for the 1992-1997 period were estimated at 18,309 mt. The new *Loligo* overfishing definition will result in a lower annual quota given the 1994 fishing pattern, and in a higher annual quota given the average 1992-1997 fishing pattern. Revenue changes as a consequence of the new quota derived from the new overfishing definition for *Loligo* can be generated to assess the economic effect of the proposed alternative.

Since no study has estimated the ex-vessel demand function for *Loligo*, changes in revenues will be estimated assuming the 1997 ex-vessel value for *Loligo*. Based on unpublished NMFS weighout data (Maine through Virginia) the 1997 ex-vessel value for *Loligo* was estimated at $1,636/mt. An annual quota of 21,000 mt would result in a decrease in landings from the 1994 level of 1,577 mt. In this case the revenue reduction from the implementation of this alternative would be $2,579,972 (1,577 mt x $1,636/mt). On the other hand, an annual quota of 21,000 mt would result in an increase in landings from the 1992-1997 average of 2691 mt. In this case the revenue increase from the implementation of this alternative would be $4,402,476 (2691 mt x $1,636/mt).

Based on NMFS weighout data, the 1997 total commercial landings for *Illex* were estimated to be at 13,632 mt (Table 1). Given the 1992-1997 historical landings for *Illex* , the annual quota of 18,000 mt would be slightly lower than the commercial landings for two of the years in the time series (1993 and 1994), and higher than the commercial landings for the remaining years. *Illex* is an annual species subject to inter-annual variability in abundance. Therefore, for comparison purposes the annual quota corresponding to the proposed definition of overfishing is compared to the 1997 landings and to the average landings for the 1992-1997 fishing period in order to obtain the potential effects of the new quota. Average landings for the 1992-1997 period were estimated at 16,474 mt. The new *Illex* overfishing definition will result in a lower annual quota given the 1994 fishing pattern, and in a higher annual quota given the average 1992-1997 fishing pattern. Revenue changes as a consequence of the new quota derived from the new overfishing definition for *Illex* can be generated to assess the economic effect of the proposed alternative.

Since no study has estimated the ex-vessel demand function for *Illex*, changes in revenues will be estimated assuming the 1997 ex-vessel value for *Illex*. Based on unpublished NMFS weighout data (Maine through Virginia) the 1997 ex-vessel value for *Illex* was estimated at $447/mt. An annual quota of 18,000 mt would result in a decrease in landings from the 1994 level of 344 mt. In this case the revenue reduction from the implementation of this alternative would be $153,768 (344 mt x $447/mt). On the other hand, an annual quota of 18,000 mt would result in an increase in landings from the 1992-1997 average of 1526 mt. In this case the revenue increase from the implementation of this alternative would be $682,122 (1526 mt x $447/mt).

Table 3.6.1.2.1. *Illex*, *Loligo* and Atlantic butterfish commercial landings (mt) from Maine to Virginia.

Year	*Illex*	*Loligo*	Atlantic butterfish
1992	17,827	18,172	2,754
1993	18,012	22,269	4,430
1994	18,344	22,577	3,361
1995	14,059	18,172	2,754
1996	16,969	12,459	3,489
1997	13,632	16,203	2,797
Average	**16,474**	**18,309**	**3,264**

3.6.3 Rebuilding Schedule

The Sustainable Fisheries Act (SFA) requires the Council to set the overfishing definition to meet a new standard (F_{msy}). In addition, the resource must be rebuilt to B_{msy} in a time frame as short as possible, taking into account the biology of the fish, needs of communities, and recommendations of international organizations. The rebuilding period is not to exceed 10 years, except where the biology, environmental conditions or international agreements dictate otherwise.

Biological, Economic and Social Impacts

Since none of the species managed in this complex are designated as overfished (NMFS 1998), then no stock rebuilding is necessary. The Council has been in a unique situation in the management of these fishery resources. Prior to the passage of extended jurisdiction in 1977, these species were heavily exploited by foreign distant water fleets off the US east coast. With passage of the Magnuson Act, the foreign fisheries for the species complex came under strict control through the development of an FMP. Since then the foreign fisheries were eliminated and the domestic fisheries expanded in a controlled manner. The result has been the avoidance of overfishing and overcapitalization.

3.6.4 MANAGEMENT COSTS

There will be no new management costs associated with this Amendment since the permitting and quota setting processes are already in effect. The impacts of options are presented in Section 9.2 of this Amendment.

3.6.5 EFFECT ON ENDANGERED SPECIES AND ON THE COASTAL ZONE

The relationships among this Amendment and various existing applicable laws and policies are fully described is section 9.3 of Amendment 5. Section 9.3.3.1 of Amendment 5 addressed marine mammals and endangered species, while 9.3.4.2 dealt with Coastal Zone Management Program consistency. Since the new definitions of overfishing are more conservative and will result in lower annual quotas relative to previous specifications, the possible interactions with and negative effects on marine mammals should be less than in those analyzed in Amendment 5. By reducing the chance of overfishing of these species, the chances that their populations will be reduced due to fishing will be greatly diminished. This should have a positive effect on marine predators, including whales and dolphins, which depend, in part, on these species as prey. The overall effect on marine mammals should be positive relative to the current specifications.

3.6.6 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. Management of these species are in the EEZ only.

3.6.7 LIST OF AGENCIES AND PERSONS 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, and Virginia through their membership on the Council. In addition to the States that are members of this Council, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and North Carolina were also consulted through the Coastal Zone Management Program consistency process.

3.6.8 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 NMFS requires the preparation of a Regulatory Impact Review (RIR) for all regulatory actions that either implement a new FMP or significantly amend an existing plan. The RIR is prepared by the Regional Fishery Management Councils with assistance from the 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 Atlantic mackerel , squid and butterfish fisheries can be found in section 7.0 of Amendment 5 to the FMP. 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. However, lack of data precludes this type of analysis. 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 PROPOSED 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 Proposed Actions

Amendment 8 would: 1) revise the definitions of overfishing for each species in the management unit and 2) establish a framework mechanism to allow timely adjustments to management measures as necessary in the future and 3) restrict the size of domestic harvesting vessels permitted in the Atlantic mackerel fishery. Vessels issued Atlantic mackerel permits are not to exceed 165 ft length overall (LOA) and 750 gross registered tons or have shaft horsepower exceeding 3000 shp. The purpose of this summary is to briefly describe the expected economic impacts of the preferred actions considered in this Amendment.

4.4.2 Summary of Impacts of the Alternatives to the Amendment

Alternative 1 (Take no action) will not allow for the FMP to come into 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-Florida) the total commercial value for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish was estimated at $26.8 million in 1997 (NMFS unpublished weighout data). 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 Atlantic mackerel, *Loligo* and *Illex* squid and butterfish from overfishing and allow for management practices that account for variations in the fishery among others. 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 Atlantic mackerel, *Loligo* and *Illex* squid and butterfish 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 Atlantic mackerel, *Loligo* and *Illex* squid and butterfish. 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 2,500 commercial vessels landed Atlantic mackerel, *Loligo* or *Illex* squid or butterfish in 1996 along the Atlantic coast. In addition to this, it is estimated that approximately 2000 party/charter vessels may have been active and/or caught Atlantic mackerel in recent years. 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> The economic effects of the proposed actions on commercial entities are discussed to the extent possible under the social and economic impacts section (section 3.1.4). For the commercial sector, the implementation of the definitions of overfishing and vessel size limitation are not be expected to reduce annual gross revenues (for all affected entities combined). Therefore, the economic analysis conducted in section 3.1.4.1.6 indicates that this decrease in revenues will

not result in a reduction in annual gross revenue of more than 5% of the 1997 estimated value of the fishery for the affected business entities. The recreational entities are not expected to experience any change in annual gross revenue as a result of the proposed actions.

(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 likely that annual gross revenues for entities involved will not change as a result of this amendment.

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 Atlantic mackerel, squid, and butterfish 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 6,000 ft (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 ft. 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 data base.

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

No reason to change this section at this time.

5.1.4.2 Impact of federal regulations on state management activities

No reason to change this section at this time.

5.1.4.3 Coastal zone management program consistency

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

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

The FMP was reviewed relative to CZM programs of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, 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, Richard J. Seagraves, Dr. Thomas B. Hoff, and Valerie M. Whalon. In addition Dr. Jeffrey Cross of NMFS Sandy Hook and Timothy Goodger of NMFS Oxford contributed greatly to the EFH information.

8.0 AGENCIES AND ORGANIZATIONS

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 - MAFMC Atlantic Mackerel, Squid and Butterfish Committee, 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 Atlantic mackerel, *Scomber scombrus*.

Life Stage	Size and Growth	Geographic Location
Eggs [1]	Diameter: 1-1.3 mm, avg. = 1.1 mm. 1 oil globule, avg. 0.3 mm diameter. In Gulf of St. Lawrence egg size decreased over time and in relation to ambient temperature (avg. diam. = 1.3 mm in June, 1.1 mm in August).	Offshore waters of Chesapeake Bay to southern side of Gulf of St. Lawrence with majority on shoreward side of continental shelf. Varying abundances in bays and estuaries from New Jersey to Canada. Highest abundances in May, June in southern New England - mid-Atlantic region.
Larvae [2]	Larvae average 3.1-3.3 mm SL with large yolk sac. Postlarvae are 11-50 mm. Teeth present at 192 h after hatching.	Larvae (<13 mm) occur primarily in offshore waters from Chesapeake Bay to southern Gulf of St. Lawrence. Similar to distribution of eggs, some larvae also collected in open bays and estuaries. Highest abundances in May offshore from Delaware Bay to Hudson Canyon; by June, highest abundance ranges from Hudson Canyon north to southern New England and north of Cape Cod.
Juveniles [3]	Postlarvae transform from planktonic to swimming and schooling behavior at ~30-50 mm; reach 50 mm in ~2 months; 20 cm after 1 y (rates may be faster in mid-Atlantic: ~70-80 mm in 2 months). Northern contingent fish may grow faster in 1st year than southern contingent, but may not be significantly different for first 90 days.	Southwestern Nova Scotia, Gulf of Maine, Georges Bank to Cape Hatteras - distribution changes seasonally. Late summer/fall primarily along western shores of Gulf of Maine, around Cape Ann, inshore areas of New England (includes estuaries in Rhode Island, Connecticut), eastern Long Island. In spring, although common offshore, some are further inshore than adults and found in some Mid-Atlantic estuaries until fall.
Adults [4]	Males/females grow at same rate, reaching maximum age of ~20 y, with maximum fork length of ~47 cm. Reach 26 cm by second year, 33 cm by fifth year. By age 6, may be 39-40 cm. Spring weight for 35 cm fish is ~0.5 kg; fall is 0.6 kg. Growth may be population density dependent; year class size partially influences initial growth during cohort's first years.	Two major contingents in NW Atlantic. Fish overwinter in deep water of shelf from Nova Scotia to Cape Hatteras. In spring, two groups formed: fish from southern group move inshore & northward along coast, joined by northern group moving inshore. By late Apr./May southern group found off New Jersey, Long Island, moving to western Gulf of Maine by summer, returns to shelf edge between Long Island - Chesapeake Bay in Oct. Northern group mixes briefly with southern group late spring off New England, migrates east along Nova Scotia into Gulf of St. Lawrence; some fish remain along Maine/Nova Scotia coast. By late fall, this contingent mixes with southern group in Gulf of Maine before returning to outer shelf.
Spawning Adults [5]	L_{50} for females = 25.7 cm, males = 26.0; A_{50} for both = 1.9 y. By age 3, 99% of females, 97% of males mature. Newfoundland fish have higher L_{50} values: females = 34 cm, males = 35 cm. Gulf of St. Lawrence, coastal Nova Scotia, Massachusetts fish spawn first at age 2, lengths >30 cm. Differences in median maturity may be due to slower growth of larger year classes that may delay spawning from one to three years.	Spawning progresses from south to north. Southern contingent spawns in Mid-Atlantic Bight and Gulf of Maine mid-Apr.-June, northern in southern Gulf of St. Lawrence May-Aug. Most spawning in shoreward half of continental shelf, some on shelf edge and beyond. Most productive between Chesapeake Bay/southern New England, less in Gulf of St. Lawrence, Gulf of Maine, Nova Scotia coast. Some spawning in open bays, e.g. Cape Cod, Massachusetts Bays; less in enclosed bays, e.g. Chesapeake, Delaware Bays.

Table 1 (continued). Summary of life history and habitat parameters for Atlantic mackerel, *Scomber scombrus*.

Life Stage	Habitat	Temperature	Salinity
Eggs [1]	Eggs pelagic, distributed at depths ranging from 10-325 m, majority from 30-70 m; depth varies with season, egg diameter, thermocline.	Eggs collected at 5-23°C, highest abundance from ~7-16°C with range related to season. In May, weighted mean surface temperature = 11°C for eggs from Martha's Vineyard. Egg mortality rates (~41%/d) correlated with rate of warming during spawning season since acclimation temperature of adults related to egg mortality. Mortality <20% from 9.4-15.1°C. Incubation temperature dependent: 7.5 d at 11°C to ~3 d at 20°C. Temperatures must be > ~7°C for development.	Although eggs are collected in waters ranging from estuaries (18-25 ppt) to full seawater (>30 ppt), mortality is higher at lower salinites (<25 ppt).
Larvae [2]	Most distributed at depths from 10-130 m, usually at <50 m. Depth varies diurnally, also with age and with thermocline; i.e., newly hatched larvae found between 5-10 m during the day, however, as they grow they're at depths closer to the surface.	Hatching occurs ~90-120 h at average temperature of 13.8°C. Yolk sac stage complete by 137 h at this temperature. Larvae collected at 6-22°C; highest abundance at 8-13°C. Changes in abundance at different temperature ranges related to season; i.e., increasing from May through August. Larval mortality rates (~35-42%/d) may be partially correlated with temperature.	Although larvae are occasionally collected in open bays and estuaries at salinities <25 ppt, the largest abundances are found in higher salinities of >30 ppt in offshore waters. Mortality may be related to salinities of ≤ 23 ppt.
Juveniles [3]	Depth varies seasonally. Offshore in fall most abundant at ~20-40 m, range from 0-320 m. In winter, 50-70 m. Spring, although dispersed through water column, concentrated 30-90 m. Move higher in summer to 20-50 m, range from 0-210 m.	At 15-17°C growth rates of fish >15 mm averaged 0.73mm/. Juveniles found from 4-22°C, most at 10°C. Temperature distribution offshore changes seasonally as average temperature ranges increase: in winter/spring, most found 5-6°, in summer at 8-13°C. Similar associations inshore: Massachusetts, 11° in spring, 9 and 13° in fall; Rhode Island, 19° in summer, 11 and 15°C in fall.	Juveniles found in some inshore bays and estuaries as well as offshore at salinities > 25 ppt.
Adults [4]	Depth changes seasonally, perhaps influenced by prey availability. Fall: 10-340 m, >50% at 60-80 m. Winter: ~50% at 20-30 m. Spring: down to 380 m, ~25% at 60-170 m. Summer: >60% at 50-70 m. Larger fish deeper than smaller ones. Distribution may also be correlated with downwelling events and onshore advection of warm surface water.	Seasonal temperature cycles influence migration/distribution. Field studies: intolerant of temperatures <5-6°C or >15-16°C. Lab: prefer 7-16°, lethal at <2° or >28.5°. Offshore distribution varies with seasonal temperature changes. Fall: >80% at 9-12°. Winter: ~70% at 5-6°. Spring >25% at 13°. Summer: >30% at 10-11°, >35% at 14°. MA: spring most at 14°, fall at 10° and 15°. In northern Gulf of St. Lawrence, adults in colder temperatures (4°); however, probability of occurrence higher when temperatures ≥7°C.	Found in open sea although occasionally in open bays with lower salinity limits of ~25 ppt.
Spawning Adults [5]		Spawning begins when temperatures ≥7°C (peak 9-14°C) and progresses from southern to northern waters during adult migration.	Peak spawning occurs at salinities >30 ppt.

Table 1 (continued). Summary of life history and habitat parameters for Atlantic mackerel, *Scomber scombrus*.

Life Stage	Prey	Predators	Notes
Eggs [1]			
Larvae [2]	50% threshold for first feeding is 3.8 mm, all larvae feeding by 4.5 mm. Diet related to larval size: first feeding larvae may be phytophagous; individuals >4.4 mm feed on copepod nauplii; >5 mm, copepodites; >6 mm adult copepods. Diets of larger larvae shift to include fish larvae: yellowtail flounder, silver hake, redfish; >6 mm are cannibalistic on smaller conspecifics which may make up as much as 20% of larval fish consumed. However, piscivory is density dependent; i.e., limited at densities of fish larvae <0.1 m^3 and declines with increasing density of nauplii, switching to copepods.	Mackerel >6 mm are cannibalistic on smaller conspecifics of 3.5-4.5 mm.	Calculated mean digestive times ~1-2 h; to maintain rapid growth rates larvae must feed continually for about 15 h/d. Diet may reflect most abundant food items capable of being ingested due to width of mouth gape. Factors influencing mortality include zooplankton abundance, wind driven surface currents, epizootics in addition to temperature and appropriate food supply.
Juveniles [3]	Principal prey include small crustaceans, such as copepods, euphausiids, amphipods, mysid shrimp, decapod larvae. Also small pelagic mollusks, chaetognaths, nematodes, ammodytes, other larval fish.	Same as for adults, but for juveniles specifically: Atlantic cod, squid, seabirds.	Atlantic mackerel are opportunistic feeders that can ingest prey either by individual selection of organisms or by filter feeding (see adults).
Adults [4]	Opportunist feeders. Filter feeding or individual selection. Diet similar to juveniles, but wider range and larger prey items. Includes euphausid, pandalid, crangonid shrimps; chaetognaths; larvaceans; pelagic polychaetes; squids. *Calanus* and other copepods, amphipods, other planktonic organisms. Fishes: ammodytes, herring, silver and other hakes, sculpins. Lab studies: small medusae common to temperate waters; also, where prey abundance is only 0.1 g wet weight/m^3, mackerel may not be satiated if feeding was restricted to daylight.	Mortality from predation may be the most important source of natural mortality. Predators include conspecifics, tunas, bonito, striped bass, pilot whales, common dolphins, harbor seals, porpoises, seabirds, swordfish. Sharks: shortfin mako, tiger, blue, bigeye thresher, spiny dogfish. Other predators: king mackerel, thorny skate, silver hake, red hake, bluefish, pollock, white hake, goosefish, weakfish.	Although there are two major contingents of the population they are managed as a single transboundary stock. Shifts in feeding mode may be related to season for fish in the Gulf of St. Lawrence while diet of fish in Newfoundland indicates that particulate feeding may occur throughout the season.
Spawning Adults [5]	Fish feed until gonadal development begins, then stop feeding until spent, feeding then resumes.	Same as for adults in general.	Mackerel are serial, or batch, spawners. Fecundity of southern contingent: 285,000-1.98 mil. eggs for 31-44 cm fish. Northern contingent: 211,000 to 397,000 eggs for 35 and 40 cm females respectively with 5-7 batches. Control of spawning time is unclear although there may be both endogenous and exogenous factors which ensures peak hatching at the time of maximum zooplankton abundance. No evidence of diel periodicity in spawning.

Source: Studholme *et al.* 1998.

Table 1 (continued). Summary of life history and habitat parameters for Atlantic mackerel, *Scomber scombrus*.

Note: 1 mm = 0.04 in
1 cm = 0.39 in
1 m = 39.37 in
1 kg = 2.2046 lbs

[1] Worley (1933), Jury *et al.* (1940), Sette (1943), Berrien (1975, 1978), Ware (1977), Fritzsche (1978), Lanctot (1980), Peterson and Ausubel (1984), Ware and Lambert (1985), Stone *et al.* (1994), Collette and Klein-MacPhee (in prep.)
[2] Sette (1943), Bigelow and Schroeder (1953), Colton and Marak (1969), Berrien (1975, 1978, 1982), Peterson and Ausubel (1984), Ware and Lambert (1985), Scott and Scott (1988), Jury *et al.* (1994), Stone *et al.* (1994), Fortier and Villeneuve (1996), Collette and Klein-MacPhee (in prep.)
[3] Sette (1943, 1950), Bigelow and Schroeder (1953), Anderson and Paciorkwski (1980), Kendall and Gordon (1981), Berrien (1982), Ware and Lambert (1985), Pepin *et al.* (1988), D'Amours *et al.* (1990), Simard *et al.* (1992), Jury *et al.* (1994), Stone *et al.* (1994), Collette and Klein-MacPhee (in prep.)
[4] Sette (1950), Leim and Scott (1966), MacKay (1967), Scott and Tibbo (1968), Anderson (1973), Isakov (1973), Parsons and Moores (1974), Stobo and Hunt (1974), Maurer and Bowman (1975), Moores *et al.* (1975), Olla *et al.* (1975), Overholtz and Anderson (1976), MacKay (1979), Berrien (1982), Stillwell and Kohler (1982, 1985), Murray *et al.* (1983), Bowman and Michaels (1984), Bowman *et al.* (1984), Murray (1984), Runge *et al.* (1987), Dery (1988), Pepin *et al.* (1988), Overholtz *et al.* (1991a), Castonguay *et al.* (1992), Collette and Klein-MacPhee (in prep.)
[5] Sette (1943), MacKay (1967, 1973), Ware (1977), Morse (1980), Berrien (1982), Overholtz (1989), Overholtz *et al.* (1991a), Walsh and Johnstone (1992), Nichols and Warne (1993), O'Brien *et al.* (1993), Jury *et al.* (1994), Stone *et al.* (1994), Collette and Klein-MacPhee (in prep.)

Table 2. Spatial distribution and relative abundance of Atlantic mackerel in North and Mid-Atlantic estuaries.

North Atlantic Estuaries

Life Stage	Passamaquoddy Bay			Englishman/ Machias Bays			Narraguagus Bay			Blue Hill Bay			Penobscot Bay			Muscongus Bay		
	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
A		●	●		●	●		●	●		●	●		●	●		●	■
S																		
J		●	●		▼	▼		▼	▼		▼	▼		●	●		●	■
L			na			na			na			na			▼			
E			na			na			na			na			▼			

Life Stage	Damariscotta River			Sheepscot River			Kennebec/ Androscoggin Rivers			Casco Bay			Saco Bay			Wells Harbor		
	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	*	M	S
A		●	■		●	■		●	■		●	●		●	●		▼	▼
S																		
J		●	■		●	■		●	■		●	●		●	●		▼	▼
L												na						
E												na						

Life Stage	Great Bay			Merrimack River			Massachusetts Bay			Boston Harbor			Cape Cod Bay		
	T	M	S	T	M	*	*	*	S	*	M	S	*	M	S
A			▼		▼				●		●	●		●	■
S									●						■
J			●		▼				●		●	●		●	■
L		●	●		●				■		●	■		●	▲
E		●	■		▲				■		●	■		●	▲

Mid-Atlantic Estuaries

Life Stage	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiners Bay		
	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A			●			●			●			●						●
S												▼						▼
J			▼		▼	▼		▼	●		▼	●						●
L			▼		▼	▼		▼	●			●						▲
E			▼		▼	■		▼	■			■						▲

<u>Relative Abundance</u>

▲ - Highly Abundant
■ - Abundant
● - Common
▼ - Rare
Blank - Not Present
na - No Data Available

<u>Salinity Zone</u>

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone Not Present

<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 2(continued). Spatial distribution and relative abundance of Atlantic mackerel in North and Mid-Atlantic estuaries.

	Mid-Atlantic Estuaries																	
	Great South Bay			Hudson R./ Raritan Bay			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						na												

	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
- na - No Data Available

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: Jury *et al.* 1994, Stone *et al.* 1994.

Table 3. Temporal distribution of Atlantic mackerel in North and Mid-Atlantic estuaries.

North Atlantic Estuaries

Estuary	Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
Passamaquoddy Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*C*	*C*	*C*	*C*	*R*		
	L												
	E												
Englishman / Machias Bays	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*R*	*R*	*R*	*R*	*R*		
	L												
	E												
Narraguagus Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*R*	*R*	*R*	*R*	*R*		
	L												
	E												
Blue Hill Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*R*	*R*	*R*	*R*	*R*		
	L												
	E												
Penobscot Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*C*	*C*	*C*	*C*	*R*		
	L						*C*	*C*					
	E						*C*	*C*					
Muscongus Bay	A						*C*	*A*	*C*	*C*	*R*		
	S												
	J						*C*	*A*	*C*	*C*	*R*		
	L												
	E												
Damariscotta River	A						*C*	*A*	*C*	*C*	*R*		
	S												
	J						*C*	*A*	*C*	*C*	*R*		
	L												
	E												
Sheepscot River	A						*C*	*A*	*C*	*C*	*R*		
	S												
	J						*C*	*A*	*C*	*C*	*R*		
	L												
	E												
Kennebec / Androscoggin Rivers	A						*C*	*A*	*C*	*C*	*R*		
	S												
	J						*C*	*A*	*C*	*C*	*R*		
	L												
	E												
Casco Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*C*	*C*	*C*	*C*	*R*		
	L												
	E												
Saco Bay	A						*C*	*C*	*C*	*C*	*R*		
	S												
	J						*C*	*C*	*C*	*C*	*R*		
	L												
	E												
Wells Harbor	A						*R*	*R*	*R*	*R*	*R*		
	S												
	J						*R*	*R*	*R*	*R*	*R*		
	L												
	E												
Great Bay	A					*R*	*R*	*R*	*R*	*R*	*R*	*R*	
	S												
	J					*C*	*C*	*C*	*C*	*C*	*C*	*C*	
	L					*C*	*C*	*C*	*R*				
	E					*C*	*A*	*A*					
Merrimack River	A					*R*	*R*	*R*	*R*	*R*	*R*	*R*	
	S												
	J					*R*	*R*	*R*	*R*	*R*	*R*	*R*	
	L					*C*	*C*	*C*	*C*				
	E					*H*	*H*	*C*					
Massachusetts Bay	A					*C*	*C*	*C*	*C*	*C*	*C*	*R*	
	S					*C*	*C*	*C*	*C*				
	J					*C*	*C*	*C*	*C*	*C*	*C*		
	L					*C*	*A*	*A*	*R*				
	E					*C*	*A*	*A*	*R*				
Boston Harbor	A					*R*	*C*	*C*	*C*	*C*			
	S												
	J					*R*	*C*	*C*	*C*	*C*	*C*		
	L					*C*	*A*	*A*	*C*				
	E					*C*	*A*	*A*	*C*				
Cape Cod Bay	A					*A*	*A*	*A*	*C*	*C*	*C*	*C*	
	S					*A*	*A*	*A*					
	J					*A*	*A*	*A*	*A*	*C*	*C*	*C*	
	L					*H*	*H*	*A*	*C*				
	E					*H*	*H*	*A*	*C*				

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 3(continued). Temporal distribution of Atlantic mackerel in North and Mid-Atlantic estuaries.

		Mid-Atlantic Estuaries																																			
Estuary		Waquoit Bay												Buzzards Bay												Narragansett Bay											
Month		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
Life Stage	A					R	R	C	C	C						C	C	R	R	R	R	R	R	C	C					C	C	C	C	C			
	S																																				
	J					R	R	R	R	R								R	R	R	R	R	R							C	C	C	C	C			
	L					R	R	R	R									R	R	R	R	R								C	C	R					
	E					R	R	R	R									A	A	C	R									A	A	C					
Estuary		Long Island Sound												Connecticut River												Gardiners Bay											
Month		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
Life Stage	A				C	C	C	C	C	C	C	C																	C	C	R	R	R	R	R	R	
	S				R	R	R																						R	R	R						
	J				C	C	C	C	C	C	C	C																	C	C	C	C	C	C	C	C	
	L					C	R																						H	A	C						
	E				C	A	C																						H	A	C						
Estuary		Great South Bay												Hudson River / Raritan Bay												Barnegat Bay											
Month		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
Life Stage	A				C	C	R	R	R	R	R	R					C	C	R			R	C	C	R												
	S																																				
	J				C	C	C	C	C	C	C	C					C	C	C	R	R	R	C	C	R					R	R	R	R	R			
	L					C																							R	R	R						
	E				C																								R	R	R						
Estuary		New Jersey Inland Bays												Delaware Bay												Delaware Inland Bays											
Month		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
Life Stage	A															R	R	R										R	R	R							
	S																																				
	J					R	R	R	R	R																											
	L				R	R	R																														
	E				R	R	R																														
Estuary		Chincoteague Bay												Chesapeake Bay mainstem												Chester River											
Month		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
Life Stage	A													R	R	R																					
	S																																				
	J													R	R	R	R							R	R												
	L																R																				
	E																		na																		
Estuary		Choptank River												Patuxent River												Potomac River											
Month		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
Life Stage	A																																				
	S																																				
	J																																				
	L																																				
	E																																				

Relative Abundance

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C - Common
R - Rare
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Life Stage

A - Adults
S - Spawning Adults
J - Juveniles
L - Larvae
E - Eggs

Source: Jury *et al.* 1994, Stone *et al.* 1994.

Table 3(continued). Temporal distribution of Atlantic mackerel in North and Mid-Atlantic estuaries.

	Mid-Atlantic Estuaries																							
Estuary	Tangier / Pocomoke Sound												Rappahannock River											
Month	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A													*R*	*R*	*R*									
S																								
J													*R*	*R*	*R*	*R*							*R*	*R*
L																								
E																								

Estuary	York River												James River											
Month	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A	*R*	*R*	*R*										*R*	*R*	*R*									
S																								
J	*R*	*R*	*R*	*R*							*R*	*R*	*R*	*R*	*R*	*R*							*R*	*R*
L																								
E																								

<u>Relative Abundance</u>

H - Highly Abundant
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<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 4. Summary of life history and habitat parameters for long-finned squid, *Loligo pealei*.

Life Stage	Size and Growth	Habitat	Substrate	Temperature	Salinity
Eggs [1]	Incubation time varies with temperature: 26.7d at 12-18°C, 18.5d at 15.5-21.3°C, and 10.7d at 15.5-23.0°C.	Eggs generally in shallow waters, <50 m.	Egg masses are commonly found on sandy/mud bottom; usually attached to rocks/boulders, pilings, or algae such as *Fucus*, *Ulva lactuca*, *Laminaria* & *Porphyra* sp.	Eggs found in waters 10-23°C; usually >8°C. Optimal development at 12°C.	Found at salinities averaging 30-32 ppt.
Larvae [2]	Paralarvae range in size from: 1.4-15 mm ML (mantle length). Growth rates slower for winter hatched animals than spring hatched.	Found in coastal, surface waters in spring, summer and fall. Hatchlings found in surface waters day & night. Move deeper in water column as they grow larger.		Found at 10-26°C (at lower temperatures found at higher salinities).	Found at 31.5-34.0 ppt.
Juveniles [3]	Size ranges approx. from 15 mm - 8 cm. At 6-8 cm sexual size dimorphism is evident before offshore migrations occur. Growth rates of young-of-the-year are 12-38 mm/month.	Inhabit upper 10 m at depths of 50-100 m on continental shelf. Found in coastal inshore waters in spring/fall, offshore in winter. Migrate to surface at night. Ontogenetic descent: at 45 mm, chromatophores are concentrated on dorsal rather than ventral surface, indicating a change from inhabiting surface waters to demersal lifestyle.		Found at 10-26°C (at lower temperatures found at higher salinities). Juveniles prefer warmer bottom temperatures and shallower depths in fall than adults.	Found at 31.5-34.0 ppt.
Adults [4]	Smallest size at maturity = 8cm ML, most are >10cm ML. Males grow faster than females and attain larger sizes; larger sizes at higher latitudes. Growth is rapid, faster in warm months (1.5-2.0 cm/mo) than in cold months (0.4-0.6cm/mo). Life span is 1-2 years; Maximum size and age are ~50cm ML, 3 yrs.	Range from NF south to Cape Hatteras, on continental shelf & upper slope. Most abundant from Gulf of Maine to Hatteras. Mar-Oct: inshore, shallow waters up to 180 m. Winter: offshore deeper waters, up to 400 m on shelf edge. Most abundant at bottom during the day; move upwards at night. Generally found at greater depths and cooler bottom temperatures in the fall than juveniles.	Mud or sandy/mud.	Found at surface temperatures ranging from 9-21°C and bottom temperatures ranging from 8-16°C.	

[1] Bigelow (1924), McMahon and Summers (1971), Arnold *et al.* (1974), Griswold and Prezioso (1981), Lange (1982), Summers (1983), Dawe *et al.* (1990)
[2] McMahon and Summers (1971), McConathy *et al.* (1980), Vecchione (1981), Nesis (1982), Vovk (1983), Young and Hartman (1988)
[3] Summers (1968), Mercer (1969), Macy (1980), Vovk and Khvichiya (1980), Vecchione (1981), Young and Hartman (1988), Brodziak and Henderson (1997)
[4] Haefner (1964), Summers (1967, 1969, 1971, 1983), Rathjen (1973), Lux *et al.* (1974), Serchuk and Rathjen (1974), Cohen (1976), Mesnil (1977), Gosner (1978), Sissenwine and Bowman (1978), Lange (1980, 1982), Lange and Sissenwine (1980), Macy (1980), Nesis (1982), Vecchione *et al.* (1989), Dawe *et al.* (1990), Howell and Simpson (1994), Brodziak and Macy (1996), Brodziak and Henderson (1997)

Table 4 (continued). Summary of life history and habitat parameters for long-finned squid, *Loligo pealei*.

Life Stage	Prey	Predators	Spawning	Notes
Eggs [1]	N/A		Most eggs are spawned in May, hatching occurs in July. Fecundity ranges from 950-15,900 eggs per female.	Eggs are demersal. Enclosed in a gelatinous capsule containing up to 200 eggs. Each female lays 20-30 capsules. Laid in masses made up of hundreds of egg capsules from different females.
Larvae [2]	Primary prey are copepods.			"Paralarvae" defined as stage after hatching when cephalopods are pelagic. Tentacles are nonfunctional at $\leq$ 15 mm.
Juveniles [3]	Primary prey varies with size: <4.0cm: plankton, copepods; 4.1-6cm: euphausiids, arrow worms; 6.1-10cm: crabs, polychaetes, shrimp. Cannibalism observed in specimens larger than 5 cm ML (small *Illex illecebrosus* were found in 49 of 322 *Loligo* stomachs).	Many pelagic & demersal fish species as well as marine mammals & birds.		Changes in habitat as the squid grows are indicated by changes in the diet.
Adults [4]	Fish prey include silver hake, mackerel, herring, menhaden, sand lance, bay anchovy, menhaden, weakfish & silversides. Invertebrate prey include crustaceans (*Crangon* & *Palaeomonetes* sp.) & squid. 15 cm adults can eat fish up to half their mantle length. At 16-25 cm, consume more fish and less crustaceans as growth increases; >25 cm, more squid than fish eaten; and >30 cm, almost exclusively squid.	Predators include many fishes (bluefish, sea bass, mackerel, cod, haddock, pollock, hakes, sea raven, goosefish, flounder, dogfish, angel sharks, skates), pilot whale (*Globicephala melas*) & common dolphin (*Delphinus delphis*), and diving birds.	Spawning occurs on Scotian Shelf, Georges Bank, Gulf of Maine and from Nantucket Shoals to Cape Hatteras in shallow waters, 10-90 m, from April-Nov (New England: May-Aug; Bay of Fundy: Aug-Sept). Georges Bank: 2 broods - early spring & late summer. Spring spawn: hatch in June, mature over winter. Summer spawn: hatch in fall, mature in 2nd winter. Mating occurs during inshore migration in spring. Mortality occurs after spawning once.	*Loligo* form schools according to size class prior to feeding. Oxygen requirement >4ml/l. Larger individuals migrate earlier (April-May) than smaller ones.

Source: Cargnelli *et al.* 1998a.

Note:
1 mm = 0.04 in
1 cm = 0.39 in
1 m = 39.37 in
1 kg = 2.2046 lbs

[1] Haefner (1959), Summers (1971), Vovk (1972a), Arnold *et al.* (1974), Gosner (1978), Griswold and Prezioso (1981), Lange (1982), Lange and Sissenwine (1982), Nesis (1982)
[2] Vecchione (1981), Vovk (1983), Young and Hartman (1988)
[3] Vovk (1972a, 1985), Tibbetts (1977), Whitaker (1978), Vinogradov and Noskov (1979), Vovk and Khvichiya (1980), Vecchione (1981)
[4] Stevenson (1934), Summers (1969, 1971), Vovk (1972b, 1985), Rathjen (1973), Maurer (1975), Cohen (1976), Langton and Bowman (1977), Mesnil (1977), Tibbetts (1977), Gosner (1978), Vinogradov and Noskov (1979), Lange (1980, 1982), Lange and Sissenwine (1980, 1983), Macy (1980), Griswold and Prezioso, (1981), Kier (1982), Summers (1983), Maurer and Bowman (1985), Dawe *et al.* (1990), Waring *et al.* (1990), Overholtz and Waring (1991), Howell and Simpson (1994), Brodziak and Macy (1996), Gannon *et al.* (1997)

Table 5. Summary of life history and habitat parameters for short-finned squid, *Illex illecebrosus*.

Life Stage	Size and Growth	Habitat	Substrate	Temperature	Salinity
Eggs [1]	Eggs protected in gelatinous masses ranging in diameter from 30 - 100 cm. Females can produce 10,000 - 400,000 eggs.	Egg masses are found offshore, in open ocean, typically at mid-water depths near the pycnocline. eggs enter Gulf Stream, travel northward to the inshore boundary of the current.	Egg masses are pelagic; do not attach to substrate.	Egg incubation lasts 16 days at 13°C, 12 days at 16°C & 8 days at 21°C; normal development requires at least 13°C.	Egg masses have greater density than seawater; become neutrally buoyant in colder (higher density) water.
Larvae [2]	Size at hatch = 1 mm ML. Paralarvae have non-functional tentacles; body not yet elongated. Rhynchoteuthion larval stage ends when proboscis splits into 2 tentacles. Larval lengths increase from Gulf Stream to continental shelf.	Offshore, along continental shelf edge; surface waters to 360m. Hatching occurs at inshore boundary of Gulf Stream, 9 to 16 days after spawning off Cape Hatteras. Abundant in late January in Gulf Stream/slope water, in warm water above thermocline. The convergence of Gulf Stream and slope water creates an area of high productivity which is beneficial to young for feeding & growth. Greater abundance during the day at 50-100m.		Found from 5-20°C; maximum abundance > 16.5°C.	Found at salinities ranging from 35-37 ppt.
Juveniles [3]	Prerecruits: 10-100 mm ML. Separation of proboscis into tentacles indicates onset of juvenile stage. Larger juveniles found from east to west, indicating westward movement on continental shelf with growth. Growth is approximately 1.5 mm/day. Young *Illex* in waters near Newfoundland were larger than those of similar age found in southern areas; this may be result of rapid growth during early stages due to high food availability in northeastern offshore waters.	Late winter: in Gulf Stream; Spring: open ocean, offshore, 50 to 500m; Summer: after being transported northward via Gulf Stream, juveniles migrate onto continental shelf and into inshore waters near New England and Nova Scotia.		Gulf Stream: >16°C; slope water: <16°C; surface: 14-21°C; cont. shelf: 5-6°C in spring.	Found at salinities ranging from 34-37 ppt.
Adults [4]	Can reach size of 34 cm ML. Life span 1-1.5 years. Males & females grow 1.6 & 1.9 cm/month. Females grow faster than males but mature later; females are 19-34 cm ML at maturity.	Range from Scotian Shelf and Newfoundland south to Cape Hatteras; most abundant at depths of 100-150m. Winter/spring: continental shelf to offshore, 100-945m Summer/fall: inshore, in bays, Gulf of Maine, Mass. Bay, & Georges Bank Fall: migrate from inshore to Gulf Stream for spawning in winter. Larger *Illex* found at lower depths, indicating ontogenetic migration occurs when maturation begins.	Over various sediment types, including sand-silt of "Sambro sand" (sediment between banks & edges of basins on Scotian Shelf, as well as along edge of cont. shelf, 100-300m). Avoid areas inhabited by anemones.	Found at temperatures ranging from 3.5-15.0°C (surface >20°C), most abundant at 5-10.0°C. Maturation may be enhanced by high temperatures but not initiated by it.	Generally found at 30-36.5 ppt.

[1] Durward *et al.* (1978), O'Dor and Durward (1979), Durward *et al.* (1980), O'Dor *et al.* (1980b, 1982a, 1986), O'Dor (1983), O'Dor and Balch (1985), Rowell *et al.* (1985a), Perez (1994)
[2] Vecchione (1979), Amaratunga (1980a), Durward *et al.* (1980), O'Dor (1983), Trites (1983), Dawe and Beck (1985), Hatanaka *et al.* (1985), Rowell and Trites (1985), Rowell *et al.* (1985a), Vecchione and Roper (1986), Young and Harman (1988), Mann and Lazier (1991), Perez (1994)
[3] Squires (1957), Vecchione (1979), Amaratunga (1980a), Amaratunga *et al.* (1980b), Fedulov and Froerman (1980), Dawe *et al.* (1981a), Coelho (1985), Rowell *et al.* (1985a), Black *et al.* (1987), Nigmatullin (1987), Dawe and Beck (1992), Perez (1994), Brodziak and Hendrickson (1997)
[4] Frost and Thompson (1933), McLellan *et al.* (1953), Squires (1957, 1967), Templeman (1966), Mercer (1973a,b), Mercer and Paulmier (1974), Bowman (1977), Mesnil (1977), O'Dor *et al.* (1977, 1980a), Amaratunga *et al.* (1978, 1979, 1980a), Lange (1978), Lux *et al.* (1978), Palmer and O'Dor (1978), Fedulov and Froerman (1980), Hurley (1980), Whitaker (1980), Dawe and Drew (1981), Dawe *et al.* (1981b), Grinkov and Rikhter (1981), Lange and Johnson (1981), Scott (1982), Wigley (1982), Waldron (1983), Roper *et al.* (1984), Coelho (1985), Dawe and Beck (1985), Rowell *et al.* (1985b), Vecchione *et al.* (1989), Laptikhovsky and Nigmatullin (1993), Perez (1994), Felley and Vecchione (1995), Brodziak and Hendrickson (1997)

Table 5 (continued). Summary of life history and habitat parameters for short-finned squid, *Illex illecebrosus*.

Life Stage	Prey	Predators	Spawning	Notes
Eggs [1]	N/A		Most of the population spawns south of Cape Hatteras. Egg masses are spawned pelagically. Masses that do not move with currents turn black on side towards bottom due to anoxia.	Eggs that are spawned in Gulf Stream waters can hatch in northern shelf waters (transported by Gulf Stream at rate of 7km/hr); can also hatch in warm Gulf Stream waters.
Larvae [2]	Hatchlings may spend early life in remains of egg mass to utilize the nutrients for food. Yolk-sac not especially large; food must be adequate to sustain hatchling during this stage of rapid growth and increased metabolism.			Gulf Stream may be important mode of transportation for larvae throughout range in NW Atlantic; initially flows northeastward along shelf, off Cape Hatteras, flows easterly - creates an eddy in which young are transported westward into slope waters.
Juveniles [3]				Diel vertical migrations; migrate upwards at night. Gulf Stream provides mode of transportation northward for larvae and juveniles after spawning occurs in southern regions; hydrographic variability in this system may explain annual abundance differences.
Adults [4]	Typically feed on squid, fish & crustaceans. Fish prey include juvenile Atlantic cod, mackerel, redfish, sand lance, Atlantic herring, adult capelin, smelt & mummichogs. Undergo seasonal/ontogenetic diet shifts: spring (offshore): euphausiids; summer- fall (inshore): fish & squid. Visual predators; feeding rate reduced in highly turbid waters.	Many pelagic & benthic fishes feed heavily on *Illex*, including bluefin tuna and silver & red hakes. Other fish predators include shark & dogfish sp., four-spot flounder, Atlantic cod, swordfish, bluefish, goosefish and sea raven. Mammalian predators include: common dolphin and pilot whales. Avian predators include shearwaters, gannets, & fulmars.	Pelagic spawning during Dec-March; probably in northern part of Gulf Stream or at boundary with slope water, possibly limited to south of Hatteras. Mature *Illex* migrate offshore in the fall, spawn in waters up to 300m depth. Males may mate with more than one female of advanced sexual maturity. Adults die after spawning.	Most abundant at dawn/dusk; feed primarily at night before sunrise near surface or mid-water. Migrate to bottom or deeper waters during daytime. Change color to camouflaged pattern when resting on bottom to reduce risk of predation by benthic species.

Source: Cargnelli *et al.* 1998b.

Note:
1 mm = 0.04 in
1 cm = 0.39 in
1 m = 39.37 in
1 kg = 2.2046 lbs

[1] O'Dor *et al.* (1980b, 1982b, 1986), O'Dor (1983), Rowell *et al.* (1985a), Perez (1994)
[2] Durward *et al.* (1980), Trites (1983), Rowell and Trites (1985), O'Dor *et al.* (1986), Vecchione and Roper (1986), Csanady and Hamilton (1988), Mann and Lazier (1991), Perez (1994)
[3] Amaratunga *et al.* (1980b), Dawe *et al.* (1981a), Coelho (1985), Arkhipkin and Fedulov (1986)
[4] Templeman (1944), Squires (1957, 1966, 1967), Vinogradov (1970, 1984), Butler (1971), Vinogradov (1972), Mercer and Paulmier (1974), Maurer (1975), Langton and Bowman (1977), Bennett (1978), Durward *et al.* (1978), Hirtle (1978), Ennis and Collins (1979), Froerman (1979), Vinogradov and Noskov (1979), Amaratunga (1980b), Amaratunga *et al.* (1980a), Fedulov and Froerman (1980), Hurley (1980), Lange and Sissenwine (1980), O'Dor *et al.* (1980a,b), Brown *et al.* (1981), DeMont (1981), Hirtle *et al.* (1981), Wigley (1982), O'Dor (1983), Lily and Osborne (1984), Dawe and Beck (1985), Maurer and Bowman (1985), Nicol and O'Dor (1985), O'Dor and Balch 1985), Rowell *et al.* (1985a), Stillwell and Kohler (1985), Major (1986), Scott and Scott (1988), Vecchione *et al.* (1989), Laptikhovsky and Nigmatullin (1993), Perez (1994), Brodziak and Hendrickson (1997), Dawe *et al.* (1997)

Table 6. **Summary of life history and habitat parameters for butterfish, *Peprilus triacanthus*.**

Life Stage	Location	Habitat	Temperature	Salinity
Eggs	Cape Sable, Nova Scotia to Florida; in spring along edge of continental shelf from Georges Bank to Cape Hatteras; found progressively closer to coast from south to north as water temperatures increase. Commonly occur in the saline parts of bays and estuaries from MA to NY and Chesapeake Bay in spring and summer.	Surface waters from continental shelf into estuaries and bays; collected to about 60 m deep in shelf waters. Common in high salinity zone of estuaries and bays from MA through VA. MARMAP Survey: collected in surface waters in 10-1250 m of water.	Literature: 12.8-22.5°C; MARMAP Survey: 6-26°C; most eggs between 11-17°C.	Estuarine to full seawater; about 25-33 ppt
Larvae	Cape Sable, Nova Scotia to Cape Kennedy, FL; most abundant in central Middle Atlantic Bight in summer, but absent in the winter. Commonly occur in bays and estuaries from MA to NY and Chesapeake Bay in summer and fall.	Surface waters from continental shelf into estuaries and bays; collected to about 60 m deep in shelf waters; common in high salinity zone of estuaries and bays; may spend day deeper in the water column and migrate to the surface at night. MARMAP Survey: collected in surface waters in water 10-1750 m deep.	Literature: 4.4-27.9°C. MARMAP Survey: 7-26°C; most eggs between 9-19°C.	6.4-37.4 ppt
Juveniles	Cape Sable, Nova Scotia to Florida; most abundant in Middle Atlantic Bight in summer and near the edge of continental shelf in winter. Commonly occur in bays and estuaries from MA to VA from spring through fall; less abundant in bays and estuaries in the Gulf of Maine and in the South Atlantic Bight.	From surface waters to depth on continental shelf; into coastal bays and estuaries; common in inshore areas, including the surf zone, and in high salinity and mixed salinity zones of bays and estuaries. NEFSC bottom-trawl Survey: collected on continental shelf in 10-330 m of water; most collected in <120 m.	4.4-29.7°C; survival reduced below 10°C.	3.0-37.4 ppt
Adults	Cape Sable, Nova Scotia to Florida; most abundant inshore in Middle Atlantic Bight in summer and near the edge of continental shelf in winter; most abundant north of Cape Cod in summer and fall; commonly occur in bays and estuaries from MA to VA from spring through fall; less abundant in bays and estuaries in the Gulf of Maine and in the South Atlantic Bight; do not migrate far offshore in South Atlantic Bight.	From surface waters to depths of 270-420 m on continental shelf; into coastal bays and estuaries; common in inshore areas, including the surf zone, and in high salinity and mixed salinity zones of bays and estuaries. NEFSC bottom-trawl Survey: collected on continental shelf in 10-360 m of water; most collected in <180 m.	4.4-26.0°C; survival reduced below 10°C.	3.8-33.0 ppt
Spawning Adults	At least the Gulf of Maine to the South Atlantic Bight (SAB); most abundant in Middle Atlantic Bight; in SAB between Cape Hatteras and Cape Kennedy. Common in Long Island Sound, some Long Island bays, and Chesapeake Bay in spring and summer. In NY Bight, caught from May-August.	Spawning occurs on continental shelf, inshore areas, and in bays and estuaries (rarely in bays and estuaries north of Cape Cod). Spawning adults common in Long Island Sound and bays and estuaries of Long Island. In NY Bight, caught between 3-145 m.	Spawning does not occur at <15°C.	

Table 6 (continued). Summary of life history and habitat parameters for butterfish, *Peprilus triacanthus*.

Life Stage	Dissolved Oxygen	Substrate	Currents	Light	Predators	Prey	Notes
Eggs							Incubation period 2-3 days. Salinity range based on 78-100% seawater (Martin and Drewry 1978) assuming seawater at 33 ppt.
Larvae							More nektonic than planktonic by 10-15 mm.
Juveniles	Hudson-Raritan Bay: 3-9 mg/l; most 5-8 mg/l.	Larger individuals found over sandy and muddy substrates.		Larger juveniles pelagic schoolers; may congregate near bottom during day and disperse upward at night.	Preyed on by haddock, silver hake, bluefish, swordfish, weakfish, goosefish, sharks, and long-finned squid.	Feed mainly on planktonic prey, including thaliaceans, squids, copepods, amphipods, decapods, colenterates, polychaetes, small fishes, and ctenophores.	Smaller juveniles associate with floating objects including jellyfish and inanimate objects.
Adults	Abundance declines in Long Island Sound below 2.0-2.9 mg/l. Hudson-Raritan Bay: 3-10 mg/l; most 6-9 mg/l.	Schools found over sandy, sandy-silt, and muddy substrates.			Preyed on by haddock, silver hake, bluefish, swordfish, weakfish, goosefish, sharks, skates, and long-finned squid.	Feed mainly on planktonic prey, including thaliaceans, squids, copepods, amphipods, decapods, colenterates, polychaetes, small fishes, and ctenophores.	Median size of sexual maturity 120 mm FL based on O'Brien *et al.* (1993).
Spawning Adults							Spawning occurs July-October on Scotian Shelf, May-August in Gulf of Maine, May-October in Middle Atlantic Bight (peak June-August), January-April off Cape Hatteras (peak in March), and year round in South Atlantic Bight (peak in spring).

Source: EFH Butterfish Team 1998.

Note:
1 mm = 0.04 in
1 cm = 0.39 in
1 m = 39.37 in
1 kg = 2.2046 lbs
1 mg/l = 1 ppt

Table 7. Spatial distribution and relative abundance of butterfish in North and Mid-Atlantic 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		na	na											▼	▼			
E		na	na											▼	▼			

	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		▼	▼		▼				●			●			●

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		▼	●		▼	●		▼	■			●						●

Relative Abundance

▲ - Highly Abundant
■ - Abundant
● - Common
▼ - Rare
Blank - Not Present
na - No Data Available

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: Jury *et al.* 1994, Stone *et al.* 1994.

Table 7(continued). Spatial distribution and relative abundance of butterfish in North and Mid-Atlantic estuaries.

	Mid-Atlantic Estuaries																	
	Great South Bay			Hudson R./ Raritan Bay			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
na - No Data Available

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: Jury *et al.* 1994, Stone *et al.* 1994.

Table 8. Temporal distribution of butterfish in North and Mid-Atlantic estuaries.

North Atlantic Estuaries

Passamaquoddy Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Englishman / Machias Bays

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Narraguagus Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Blue Hill Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Penobscot Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L							R	R	R			
E							R	R	R			

Muscongus Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Damariscotta River

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Sheepscot River

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Kennebec / Androscoggin Rivers

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Casco Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Saco Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L												
E												

Wells Harbor

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A												
S												
J												
L												
E												

Great Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L						R	R	R	R			
E						R	R	R	R			

Merrimack River

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			
L						R	R	R				
E						R	R	R				

Massachusetts Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	C	C	C	R		
S						R	R	R	R			
J						R	C	C	C	R		
L						R	R	R	R			
E						C	C	C	C			

Boston Harbor

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						R	R	R	R	R		
S												
J						R	R	R	R	R		
L							C	C	C			
E						R	C	C	R			

Cape Cod Bay

Life Stage	J	F	M	A	M	J	J	A	S	O	N	D
A						C	C	C	C	C		
S												
J						C	C	C	C	C		
L							R	R	R	R		
E						R	C	C	C	R		

<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 of butterfish in North and Mid-Atlantic estuaries.

Mid-Atlantic Estuaries

Estuary	Waquoit Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	C	C	C	C		
S					R	R	R	R	R			
J					C	C	C	C	C	C		
L						C	C	C	C	C		
E					C	C	C	C				

Estuary	Buzzards Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A				R	C	A	H	H	A	A	C	R
S						R	R	R	R			
J				R	C	A	H	H	H	A	C	R
L						R	C	C	R	R		
E					R	C	C	R	R			

Estuary	Narragansett Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A				R	C	C	C	A	A	A	R	R
S					R	R	R	R				
J				R	C	C	C	A	A	A	R	R
L						C	C	C	C	C		
E					C	A	A	C				

Estuary	Long Island Sound											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	A	H	H	H	A	C
S						C	C	C	R			
J					C	C	A	H	H	H	C	R
L						C	C	C	R	R	R	
E						C	C	C	R			

Estuary	Connecticut River											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					R	R	R	C	C	C	R	R
S												
J					R	R	R	C	C	C	R	R
L												
E												

Estuary	Gardiners Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	C	C	C	C	C	C
S					C	C	C					
J					C	C	C	C	C	C	C	C
L					C	C	C					
E					C	C	C					

Estuary	Great South Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	C	C	C	C	C	C
S					C	C	C					
J					C	C	C	C	C	C	C	C
L					C	C	C	C				
E					C	C	C	C				

Estuary	Hudson River / Raritan Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A				C	C	C	C	C	C	C	C	
S												
J				C	C	C	C	C	C	C	C	
L					R	R	R	C	R	R	R	
E						R	R	R				

Estuary	Barnegat Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					R	R	R	R	R	R		
S												
J						C	C	C	C	C		
L						R	R	R				
E												

Estuary	New Jersey Inland Bays											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A							R	R	R			
S												
J						C	C	C	C	C		
L						R	R	R				
E												

Estuary	Delaware Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	C	C	C	C		
S					R	R	R					
J							C	C	C	C	C	C
L					C	C	R					
E					R	R	R					

Estuary	Delaware Inland Bays											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					C	C	C	C	R	R	R	
S												
J					C	C	C	C	R	R	R	
L												
E												

Estuary	Chincoteague Bay											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A												
S												
J												
L												
E												

Estuary	Chesapeake Bay mainstem											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A				R	C	C	C	C	C	C	C	
S					R	C	C					
J							C	C	C	C		
L						R	C	C				
E					R	C	C					

Estuary	Chester River											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A												
S												
J												
L												
E												

Estuary	Choptank River											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A						R	R	R	R			
S												
J							R	R	R			
L												
E												

Estuary	Patuxent River											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A						R	R	R	R			
S												
J							R	R	R			
L												
E												

Estuary	Potomac River											
Month	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					R	R	R	R	R	R		
S												
J						R	R	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 of butterfish in North and Mid-Atlantic estuaries.

	Mid-Atlantic Estuaries																							
Estuary	Tangier / Pocomoke Sound												Rappahannock River											
Month	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A					*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*	
L																								
E																								
Estuary	York River												James River											
Month	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Life Stage A				*R*	*C*	*C*	*C*	*C*	*C*	*C*	*C*					*R*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	
S																								
J							*C*	*C*	*C*	*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 9. Approximate area (percent and number of 10 minute squares) for the Atlantic mackerel 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 75% of the catch.

Eggs

% Area	% Catch Index	Number of 10" Squares
0	0	0
5	50	15
12	75	36
20	90	60
50	94	150
75	96	225
90	99	270
100	100	300

Larvae

% Area	% Catch Index	Number of 10" Squares
0	0	0
7	50	7
18	75	18
30	90	31
50	92	51
75	97	77
90	99	92
100	100	102

Source: Adapted from Cross pers. comm.

Table 9(continued). Approximate area (percent and number of 10 minute squares) for the Atlantic mackerel 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 75% of the catch.

Juvenile

% Area	% Catch Index	Number of 10" Squares
0	0	0
1	50	3
5	75	15
17	90	51
50	95	150
75	97	225
90	99	270
100	100	300

Adults

% Area	% Catch Index	Number of 10" Squares
0	0	0
5	50	7
10	75	14
20	90	28
50	94	70
75	96	105
90	99	126
100	100	140

Source: Adapted from Cross pers. comm.

Table 10. Approximate area (percent and number of 10 minute squares) for the *Loligo* 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 75% of the catch.

Pre-recruits

% Area	% Catch Index	Number of 10" Squares
0	0	0
12	50	96
27	75	216
42	90	336
50	92	400
75	95	600
90	97	720
100	100	800

Recruits

% Area	% Catch Index	Number of 10" Squares
0	0	0
11	50	108
30	75	294
48	90	470
50	91	490
75	95	735
90	98	882
100	100	980

Source: Adapted from Cross pers. comm.

Table 11. Approximate area (percent and number of 10 minute squares) for the *Illex* 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 75% of the catch.

Pre-recruits

% Area	% Catch Index	Number of 10" Squares
0	0	0
4	50	15
9	75	34
29	90	110
50	93	190
75	96	285
90	98	342
100	100	380

Recruits

% Area	% Catch Index	Number of 10" Squares
0	0	0
5	50	46
19	75	173
40	90	364
50	92	455
75	96	683
90	98	819
100	100	910

Source: Adapted from Cross pers. comm.

Table 12. Approximate area (percent and number of 10 minute squares) for the butterfish 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 75% of the catch.

Eggs

% Area	% Catch Index	Number of 10" Squares
0	0	0
10	50	24
21	75	50
40	90	95
50	92	119
75	96	178
90	99	213
100	100	237

Larvae

% Area	% Catch Index	Number of 10" Squares
0	0	0
10	50	38
23	75	87
43	90	163
50	92	190
75	95	285
90	99	342
100	100	380

Source: Adapted from Cross pers. comm.

Table 12(continued). Approximate area (percent and number of 10 minute squares) for the butterfish 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 75% of the catch.

Juvenile

% Area	% Catch Index	Number of 10" Squares
0	0	0
8	50	62
18	75	140
30	90	234
50	92	390
75	95	585
90	99	702
100	100	780

Adults

% Area	% Catch Index	Number of 10" Squares
0	0	0
8	50	68
18	75	153
28	90	238
50	94	425
75	96	638
90	99	765
100	100	850

Source: Adapted from Cross pers. comm.

Table 13. North and Mid-Atlantic estuaries that are designated as Atlantic mackerel essential fish habitat. Estuaries with an "x" are Atlantic mackerel essential fish habitat.

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		x	x		x	x		x	x		x	x		x	x		x	x
J		x	x											x	x		x	x
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		x	x		x	x		x	x		x	x		x	x			
J		x	x		x	x		x	x		x	x		x	x			
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		x	x		x	x
J			x						x		x	x		x	x
L		x	x		x				x		x	x		x	x
E		x	x		x				x		x	x		x	x

Mid-Atlantic Estuaries

	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiner / Peconic Bays		
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
L									x			x						x
E						x			x			x						x

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone Not Present

Life Stage

A - Adults
J - Juveniles
L - Larvae
E - Eggs

Table 13 (continued). North and Mid-Atlantic estuaries that are designated as Atlantic mackerel essential fish habitat. Estuaries with an "x" are Atlantic mackerel essential fish habitat.

	Mid-Atlantic Estuaries																	
	South Shore Bay Complex			Hudson R./ Raritan Bay			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												
J			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																		
J																		
L																		
E																		

	Tangier / Pocomoke Sound			Rappahannock River			York River			James River		
Life Stage	*	M	*	T	M	*	T	M	*	T	M	*
A												
J												
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 - Eggs

Table 14. North and Mid-Atlantic estuaries that are designated as butterfish essential fish habitat. Estuaries with an "x" are butterfish essential fish habitat.

	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																		
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					x	x
J									x					x	x
L												x			
E									x			x			x

	Mid-Atlantic Estuaries																	
	Waquoit Bay			Buzzards Bay			Narragansett Bay			Long Island Sound			Connecticut River			Gardiner / Peconic Bays		
Life Stage	*	M	S	*	M	S	T	M	S	T	M	S	T	M	*	*	M	S
A			x		x	x		x	x		x	x		x			x	x
J			x		x	x		x	x		x	x		x			x	x
L			x			x			x			x						x
E			x			x			x			x						x

<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 - Eggs

Table 14 (continued). North and Mid-Atlantic estuaries that are designated as butterfish essential fish habitat. Estuaries with an "x" are butterfish essential fish habitat.

	Mid-Atlantic Estuaries																	
	South Shore Bay Complex			Hudson R./ Raritan Bay			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
J			x		x	x		x	x		x	x		x	x			x
L			x		x										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					x	x												
E					x	x												

	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												

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Salinity Zone Not Present

Life Stage

A - Adults
J - Juveniles
L - Larvae
E - Eggs

Table 15. 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 16. 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 16 (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 16 (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 16 (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 17. 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 17 (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 17 (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 17 (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 18. 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 18 (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 18 (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 18 (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 18 (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 19. 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 20. 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 21. 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 22. Proposed impact of fishing gear on Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish EFH.

GEAR TYPE	KNOWN IMPACT	POTENTIAL IMPACT	NONE 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 23. Matrix of prioritized threats in regards to their potential impact to Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish EFH along the Atlantic coast.

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 24. 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 25. 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	Sheepscot Bay T	Sheepscot Bay M	Sheepscot Bay S	Kennebec/Andro River T	Kennebec/Andro River M	Kennebec/Andro 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	?	?	?	●	?	?	?	●	●	?	●	●	●	●	?	?	?
EPIPHYTE ABUNDANCE	?	●	?	?	?	?	?	?	?	?	?	●	●	●	●	●	●	●	?	?	?
NITROGEN (mg/l)	●	●	?	●	?	?	●	●	?	V•	●	?	●	●	●	●	●	●	?	?	?
PHOSPHORUS (mg/l)	●	●	?	?	?	?	●	●	●	●	●	?	●	●	●	●	●	●	?	?	?
BOTTOM DO (mg/l)	Λ	●	?		?	?	●	●	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	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	●	●	●	?	?	?	?	●	●	●	?	●	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

Source: NOAA 1996, 1997a-b

Table 25 (continued). Recent trends in selected parameters characterizing eutrophication, by estuary.

Parameter		Buzzards Bay M	Buzzards Bay S	Narragansett Bay T	Narragansett Bay M	Narragansett Bay S	Gardiners Bay M	Gardiners Bay S	Long Island Sound T	Long Island Sound M	Long Island Sound S	Connecticut River T	Connecticut River M	Great South Bay M	Great South Bay S	Hudson R./Raritan Bay T	Hudson R./Raritan Bay M	Hudson R./Raritan Bay S	Barnegat Bay M	Barnegat Bay S	N. J. Inland Bays M	N. J. Inland Bays S
CHLOROPHYLL *A* (µg/l)		?	∧•	●	●	●	●	●	[illegible]	●	●	?	?	●	●	?	●	●•	●	●	∧•	∧•
TURBIDITY (concentration)		?	?	●	●	●	●	●	●•	∨	∨	?	?	●	●	?	?	?	?	?	?	?
NUISANCE ALGAE	*event duration*	?	?	∧	∧	∧	●	?	?	∧	∧	?	?	?	?	?	●•	●•	●	●	●	∧•
	frequency of occurrence	?	?	∧	∧	∧	●	?	?	∧	∧	?	?	?	?	?	●•	●•	●	●	●	∧•
TOXIC ALGAE	*event duration*	?	?	?	?	?	?	?	●	●	●	?	?	●	●	?	●•	●•	●	●	●	●
	frequency of occurrence	?	?	?	?	?	?	?	●	●	●	?	?	●	●	?	?	?	●	●	●	●
MACROALGAL ABUNDANCE		?	?	∧	∧	?	∧	∨	?	∧	●	?	?	●	●	?	?	?	?	?	?	?
EPIPHYTE ABUNDANCE		?	?	?	?	?	?	?	?	∧	●	?	?	●	●	?	?	?	?	?	?	?
NITROGEN (mg/l)		?	∧•	●	●	●	●	∨	●	∧•	●	●	?	●	●	∨	●	●	?	?	?	?
PHOSPHORUS (mg/l)		?	?	●	●	●	●	∨	[illegible]	∧	●	●	?	●	●	●	∨	∨	?	?	?	?
BOTTOM DO (mg/l)		?	?	∧	∧	●	●	●	∧	∧	∨	?	?	●	●	?	∧	∨	?	?	?	?
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	?	?	∨	∨	●	●	●	⑤	●	∧	?	?	●	●	?	∨	●	?	?	?	?
PRIMARY PRODUCTIVITY		?	②	?	?	?	●	●	?	●•	●	?	?	●	●	?	③	③	?	?	?	●•
PLANKTONIC COMMUNITY		?	?	④	●	④	●	●	?	●	●	?	?	●	●	?	●	●	●•	●•	?	●•
BENTHIC COMMUNITY		?	?	①	●	●	?	?	●	●	●	?	?	●	●	③	●	①	●•	●•	?	?
SAV (spatial coverage)		∨	∨	●	●	●	∧	∧	∨	∨	∨	?	?	∨	∨	?	∨	∨	?	?	?	?

Parameter		Delaware Bay T	Delaware Bay M	Delaware Bay S	DE Inland Bays M	DE Inland Bays S	MD Inland Bays M	MD Inland Bays S	Chincoteague Bay S	Chesapeake Bay T	Chesapeake Bay M	Chesapeake Bay S	Patuxent River T	Patuxent River M	Potomac River T	Potomac River M	Rappahannock River T	Rappahannock River M	York River T	York River M	James River T	James River M	Chester River T	Chester River M	Choptank River T	Choptank River M	Tan./Poc. Sounds T	Tan./Poc. Sounds M
CHLOROPHYLL *A* (µg/l)		●	●	●	●	●	∨•	●	?	●	●	●	∧	●	●	∨	∧	∧	∧	∧	∧	∧	●	●	●	●	∧	∧
TURBIDITY (concentration)		●	●	●	●	●	●	?	●	●	●	●	●	●	●	∨	●	●	●	●	●	●	●	●	●	∨	●	∨
NUISANCE ALGAE	*event duration*	●	●	●	●	●	●	●	?	●	●	●	●	?	∨	●	●	●	●	●	●	●	?	?	●	●	?	●
	frequency of occurrence	●	●	●	●	●	●	●	?	●	●	●	●	●	∨	∨	●	●	●	●	●	●	?	?	●	●	?	●
TOXIC ALGAE	*event duration*	●	●	●	?	?	?	?	?	●	●	●	?	?	●	●	●	●	●	●	●	●	?	?	●	●	?	●
	frequency of occurrence	●	●	●	?	?	?	?	?	●	●	●	?	?	●	●	●	●	●	●	●	●	?	?	●	●	?	●
MACROALGAL ABUNDANCE		●	●	●	?	?	?	?	?	●	●	●	●	●	∨	●	●	●	●	●	●	●	?	?	●	●	?	∧
EPIPHYTE ABUNDANCE		●	●	●	●	●	?	?	?	●	?	●	?	?	?	?	●	●	●	●	●	●	?	?	●	∨	?	∧
NITROGEN (mg/l)		∨	∨	∨	●	●	∨•	?	∨•	●	∧•	●	∨	∨	●	●	●	●	●	●	●	●	●	●	●	●	?	∨
PHOSPHORUS (mg/l)		∧	∧	∧	●	●	∨	●	∨•	●	∨•	●	∨	∨	∨	●	∧	●	∧	●	●	●	●	●	●	∨	?	∨
BOTTOM DO (mg/l)		∧	∧	●	●	●	●	●	●	●	●	●	∧	●	∧	●	●	∨	●	●	●	∨	●	●	●	●	●	●
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		●	④	④	①	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	?	●	●	●	?	?
BENTHIC COMMUNITY		?	?	②	●	●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	?	?
SAV (spatial coverage)		●	●	●	●	●	●	?	∧	●	∧	∧	∧	●	∧	∧	●	∧	●	●	●	∧	●	∧	●	∧	?	∧

? - unknown   ∨ - decreasing trend   • - speculative response   ∧ - increasing trend   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 25 (continued). Recent trends in selected parameters characterizing eutrophication, by estuary.

Parameter		Albemarle/Pamlico Sounds	Pamlico River	Neuse River	Bogue Sound	New River	Cape Fear River	Winyah Bay	N & S Santee River	Charleston Harbor	Stono/N. Edisto River	St. Helena Sound
		T M S	M	T M	M S	M S	T M S	T M S	T M	T M S	M S	M S
CHLOROPHYLL *A* (µg/l)		? ? ●•	Λ	● Λ	? ●	? ?	? ? ●	? ? ●	? ?	? ? ?	? ?	? ?
TURBIDITY (concentrations)		V ? ?	?	● ?	? ●	? ?	Λ ? ?	Λ Λ ●	V V	? Λ Λ	Λ Λ	● ?
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 ? ?	?	? ●	? ●	? ?	● ● ●	? ? ?	●• ●•	Λ ? ?	● ●	? ?
EPIPHYTE ABUNDANCE		? ? ?	?	? ●	? ?	? ?	● ● ●	? ? ?	●• ●•	? ? ?	● ●	? ?
NITROGEN (mg/l)		? ● ?	●	Λ Λ	● ●	? ?	? ? ?	V V V	V V	V V V	V ?	V ?
PHOSPHORUS (mg/l)		? ● ?	V	● ●	● ●	? ?	? ? ?	V V V	V 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	? ?	? ?	? ? ?	? ? ●	? ?	? Λ ?	● ●	? ?
WETLANDS (spatial coverage)		● ● ?	●	● ●	● ●	? ?	? ? ?	? ● ●	● ●	? ● ●	● ●	● ●

Parameter		Broad River	Savannah River	Ossabaw Sound	St. Catherine/Sapelo Sound	Altamaha River	St. Andrews/ St. Simon Sound	St. Marys/Cumberland Sound	St. Johns River	Indian River	Biscayne Bay
		M S	T M S	T M S	M S	T M S	T M S	M S	T M S	S	M S
CHLOROPHYLL *A* (µg/l)		? ?	? ? ?	? ●• ?	? ?	? ? ?	? ? ?	? ?	● ● ●	Λ•	● ●
TURBIDITY (concentrations)		Λ ●	Λ ● ?	? ? ?	? ?	? ● ?	? ? ?	? ?	● ● ●	●	● 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)		? ?	? Λ ?	? ? ?	? ?	? ? ?	? ? ?	? ?	● ● ●	●	V V
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		? ?	? ● ?	? ? ?	? ?	? ? ?	? ? ?	? ?	● ● ●	②	? ●
SAV (spatial coverage)		? ?	? ● ●	? ? ?	● ●	? ● ●	? ● ●	● ●	V V ●	V•	● Λ
WETLANDS (spatial coverage)		● ●	? V• V•	? ? ?	? ?	? ? ?	? ? ?	? ?	? ? ?	V•	V V

? - unknown   V - decreasing trend   • - speculative response   ● - no trend or shift   Λ - increasing trend   ① - shift from annelids to diverse mixture   ② - shift from a mixture of annelids and crustaceans to crustaceans

Source: NOAA 1996, 1997a-b

Table 26. Catch disposition for trips that caught and kept 1000 lbs or more of Atlantic mackerel (n=37) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Alewife	450	75.0	0.2	150	25.0	0.1	600	0.2
Angler	80	100.0	0.0	0	0.0	0.0	80	0.0
Summer Flounder	402	71.3	0.1	162	28.7	0.1	564	0.2
Witch Flounder	5	100.0	0.0	0	0.0	0.0	5	0.0
Haddock	2	100.0	0.0	0	0.0	0.0	2	0.0
Atlantic Herring	87,500	99.3	28.6	590	0.7	0.2	88,090	33.9
Atlantic Mackerel	128,604	84.0	42.0	24,447	16.0	9.4	153,051	58.8
Black Sea Bass	919	28.1	0.3	2,348	71.9	0.9	3,267	1.3
Scup	2,087	33.9	0.7	4,064	66.1	1.6	6,151	2.4
Spiny Dogfish	990	54.3	0.3	832	45.7	0.3	1,822	0.7
Silver Hake	13	100.0	0.0	0	0.0	0.0	13	0.0
Loligo Squid	6,264	99.3	2.0	41	0.7	0.0	6,305	2.4
Illex Squid	0	0.0	0.0	150	100.0	0.1	150	0.1
Total	227,316	87.4		32,784	12.6		260,100	

Table 27. Catch disposition for trips that kept 10,000 or more pounds of Atlantic mackerel, 1997 all gears combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Angler	11,413	99.5	0.0	60	0.5	0.0	11,473	0.0
Bluefish	10	100.0	0.0	0	0.0	0.0	10	0.0
Butterfish	338,683	99.6	1.0	1,190	0.4	0.0	339,873	1.0
Atlantic Croaker	9,235	100.0	0.0	0	0.0	0.0	9,235	0.0
Blue Back Herring	6,000	51.1	0.0	5,750	48.9	0.0	11,750	0.0
Conger Eel	20	100.0	0.0	0	0.0	0.0	20	0.0
Summer Flounder	29,666	98.9	0.1	315	1.1	0.0	29,981	0.1
Fourspot Flounder	170	100.0	0.0	0	0.0	0.0	170	0.0
Red Hake	29,973	98.2	0.1	557	1.8	0.0	30,530	0.1
White Hake	28,196	96.7	0.1	950	3.3	0.0	29,146	0.1
Hake, (Mix) Red & White	6	100.0	0.0	0	0.0	0.0	6	0.0
Atlantic Herring	1,923,194	98.5	5.7	30,000	1.5	0.1	1,953,194	5.8
John Dory	424	100.0	0.0	0	0.0	0.0	424	0.0
King Whiting	800	100.0	0.0	0	0.0	0.0	800	0.0
Atlantic Mackerel	29,379,150	98.6	87.2	408,225	1.4	1.2	29,787,375	88.4
Menhaden	120	100.0	0.0	0	0.0	0.0	120	0.0
Scup	202,365	95.1	0.6	10,455	4.9	0.0	212,820	0.6
Black Sea Bass	22,274	99.3	0.1	164	0.7	0.0	22,438	0.1
Sea Robins	23	100.0	0.0	0	0.0	0.0	23	0.0
Squeteague (Weakfish)	10,692	100.0	0.0	0	0.0	0.0	10,692	0.0
American Shad	253	100.0	0.0	0	0.0	0.0	253	0.0
Thresher Shark	257	100.0	0.0	0	0.0	0.0	257	0.0
Skates	11	100.0	0.0	0	0.0	0.0	11	0.0
Striped Bass	0	0.0	0.0	33,507	100.0	0.1	33,507	0.1
Tautog	342	100.0	0.0	0	0.0	0.0	342	0.0
Tilefish	5,922	100.0	0.0	0	0.0	0.0	5,922	0.0
Black Whiting	5,645	100.0	0.0	0	0.0	0.0	5,645	0.0
Silver Hake	213,217	99.4	0.6	1,340	0.6	0.0	214,557	0.6
Other Fish	5,750	100.0	0.0	0	0.0	0.0	5,750	0.0
Lobster	1,220	97.0	0.0	38	3.0	0.0	1,258	0.0
Loligo Squid	816,493	99.9	2.4	840	0.1	0.0	817,333	2.4
Illex Squid	86,847	100.0	0.3	0	0.0	0.0	86,847	0.3
Squid (NS)	65,695	100.0	0.2	0	0.0	0.0	65,695	0.2
ALL SPECIES	33,194,066	98.5		493,391			33,687,457	

Source: Vessel Trip Report data, 1997.

Number of trips = 254

Table 28. Recreational catch statistics for Atlantic mackerel based on MRFSS Survey, 1982-1997.

Year	Catch (A + B1 + B2)	Landings (A + B1)	Released (B2)	Percent Released
1982	1,542,831	1,533,059	9,771	0.6
1983	4,119,384	3,995,716	123,668	2.9
1984	3,825,235	3,448,940	376,296	9.8
1985	7,824,840	7,169,547	654,993	8.4
1986	5,387,971	5,275,651	112,320	2.1
1987	7,733,394	6,399,372	1,334,022	17.2
1988	5,999,285	5,548,553	450,732	7.5
1989	4,035,088	3,613,474	421,614	10.4
1990	3,991,241	3,688,023	303,218	7.6
1991	5,455,187	5,235,308	219,879	4.0
1992	1,038,744	809,137	229,607	22.1
1993	2,305,073	2,119,621	185,452	8.0
1994	4,860,101	4,567,433	292,669	6.0
1995	4,008,473	3,200,846	807,627	20.1
1996	3,649,802	3,241,544	408,258	11.2
1997	5,192,168	4,548,338	643,830	12.4

Table 29a. Catch disposition for trips that caught and kept 100 lbs or more of *Loligo* squid (n=198) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Alewife	450	74.9	0.1	151	25.1	0.1	601	0.1
Angler	1,778	67.2	0.2	868	32.8	0.5	2,646	0.3
Bluefish	433	98.6	0.1	6	1.4	0.0	439	0.1
Butterfish	29,972	99.2	3.8	235	0.8	0.1	30,207	3.9
Blueback Herring	50	0.3	0.0	18,000	99.7	10.5	18,050	2.3
Conger Eel	4	100.0	0.0	0	0.0	0.0	4	0.0
Witch Flounder	1	100.0	0.0	0	0.0	0.0	1	0.0
Winter Flounder	64	39.5	0.0	98	60.5	0.1	162	0.0
Summer Flounder	175	15.9	0.0	926	84.1	0.5	1,101	0.1
Sand Dab	2	33.3	0.0	4	66.7	0.0	6	0.0
Yellowtail Flounder	0	0.0	0.0	46	100.0	0.0	46	0.0
Fourspot Flounder	0	0.0	0.0	1	100.0	0.0	1	0.0
Haddock	2	66.7	0.0	1	33.3	0.0	3	0.0
Red Hake	0	0.0	0.0	203	100.0	0.1	203	0.0
White Hake	0	0.0	0.0	13	100.0	0.0	13	0.0
Atlantic Herring	7,210	89.4	0.9	858	10.6	0.5	8,068	1.0
John Dory	0	0.0	0.0	8	100.0	0.0	8	0.0
Atlantic Mackerel	117,946	86.3	15.1	18,752	13.7	10.9	136,698	17.5
Atlantic Menhaden	1	100.0	0.0	0	0.0	0.0	1	0.0
Pollock	0	0.0	0.0	1	100.0	0.0	1	0.0
Black Sea Bass	1,648	38.8	0.2	2,604	61.2	1.5	4,252	0.5
Scup	2,476	33.4	0.3	4,929	66.6	2.9	7,405	0.9
Tilefish	155	100.0	0.0	0	0.0	0.0	155	0.0
Smooth Dogfish	0	0.0	0.0	163	100.0	0.1	163	0.0
Spiny Dogfish	0	0.0	0.0	2,104	100.0	1.2	2,104	0.3
Little Skate	0	0.0	0.0	13	100.0	0.0	13	0.0
Big Skate	0	0.0	0.0	61	100.0	0.0	61	0.0
Striped Bass	85	65.4	0.0	45	34.6	0.0	130	0.0
Silver Hake	8,455	99.4	1.1	52	0.6	0.0	8,507	1.1
Loligo Squid	56,805	99.0	7.3	577	1.0	0.3	57,382	7.3
Illex Squid	502,356	99.9	64.3	634	0.1	0.4	502,990	64.4
Total	730,068	93.4		51,353	6.6		781,421	

Table 29b. Catch disposition for trips that caught and kept 500 lbs or more of *Loligo* squid (n=77) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Angler	868	99.8	0.5	2	0.2	0.0	870	0.5
Bluefish	301	100.0	0.2	0	0.0	0.0	301	0.2
Butterfish	288	61.8	0.2	178	38.2	0.1	466	0.2
Witch Flounder	1	100.0	0.0	0	0.0	0.0	1	0.0
Winter Flounder	6	85.7	0.0	1	14.3	0.0	7	0.0
Summer Flounder	61	14.8	0.0	351	85.2	0.2	412	0.2
Sand Dab	1	100.0	0.0	0	0.0	0.0	1	0.0
Haddock	0	0.0	0.0	1	100.0	0.0	1	0.0
Red Hake	0	0.0	0.0	22	100.0	0.0	22	0.0
Atlantic Herring	7,210	89.4	3.8	858	10.6	0.5	8,068	4.3
Atlantic Mackerel	88,598	82.7	47.0	18,500	17.3	9.8	107,098	56.8
Pollock	0	0.0	0.0	1	100.0	0.0	1	0.0
Black Sea Bass	1,172	31.1	0.6	2,595	68.9	1.4	3,767	2.0
Scup	2,434	33.8	1.3	4,764	66.2	2.5	7,198	3.8
Tilefish	155	100.0	0.1	0	0.0	0.0	155	0.1
Spiny Dogfish	0	0.0	0.0	68	100.0	0.0	68	0.0
Striped Bass	85	65.4	0.0	45	34.6	0.0	130	0.1
Silver Hake	5,155	90.5	2.7	544	9.5	0.3	5,699	3.0
Loligo Squid	45,337	98.9	24.0	512	1.1	0.3	45,849	24.3
Illex Squid	7,830	93.1	4.2	582	6.9	0.3	8,412	4.5
Total	159,502	84.6		29,024	15.4		188,526	

Table 29c. Catch disposition for trips that caught and kept 1000 lbs or more of *Loligo* squid (n=41) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Angler	228	100.0	0.2	0	0.0	0.0	228	0.2
Bluefish	129	100.0	0.1	0	0.0	0.0	129	0.1
Butterfish	260	100.0	0.2	0	0.0	0.0	260	0.2
Winter Flounder	6	100.0	0.0	0	0.0	0.0	6	0.0
Summer Flounder	58	15.4	0.0	319	84.6	0.2	377	0.3
Sand Dab	1	100.0	0.0	0	0.0	0.0	1	0.0
Haddock	0	0.0	0.0	1	100.0	0.0	1	0.0
Atlantic Herring	0	0.0	0.0	190	100.0	0.1	190	0.1
Atlantic Mackerel	65,501	78.0	51.2	18,500	22.0	14.5	84,001	65.6
Black Sea Bass	1,000	44.4	0.8	1,251	55.6	1.0	2,251	1.8
Scup	2,057	33.0	1.6	4,180	67.0	3.3	6,237	4.9
Silver Hake	0	0.0	0.0	500	100.0	0.4	500	0.4
Loligo Squid	33,170	98.6	25.9	482	1.4	0.4	33,652	26.3
Illex Squid	0	0.0	0.0	150	100.0	0.1	150	0.1
Total	102,410	80.0		25,573	20.0		127,983	

Table 30. Catch disposition for trips that kept 2500 or more pounds of *Loligo* squid, 1997, all gears combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Angler	304,540	99.3	0.7	2,042	0.7	0.0	306,582	0.7
Bluefish	296,209	99.4	0.7	1,640	0.6	0.0	297,849	0.7
Bonito	1,411	100.0	0.0	0	0.0	0.0	1,411	0.0
Butterfish	2,433,613	95.9	5.6	105,154	4.1	0.2	2,538,767	5.9
Cobia	106	100.0	0.0	0	0.0	0.0	106	0.0
Cod	112	100.0	0.0	0	0.0	0.0	112	0.0
Atlantic Croaker	70,570	100.0	0.2	0	0.0	0.0	70,570	0.2
Cunner	20	100.0	0.0	0	0.0	0.0	20	0.0
Cusk	165	100.0	0.0	0	0.0	0.0	165	0.0
Blue Back Herring	136,480	96.0	0.3	5,750	4.0	0.0	142,230	0.3
Conger Eel	1,719	100.0	0.0	0	0.0	0.0	1,719	0.0
Winter Flounder	1,279	100.0	0.0	0	0.0	0.0	1,279	0.0
Summer Flounder	246,115	93.8	0.6	16,368	6.2	0.0	262,483	0.6
Witch Flounder	398	100.0	0.0	0	0.0	0.0	398	0.0
Yellowtail Flounder	90	20.7	0.0	345	79.3	0.0	435	0.0
Am. Plaice Flounder	11	100.0	0.0	0	0.0	0.0	11	0.0
Sand-Dab Flounder	366	97.3	0.0	10	2.7	0.0	376	0.0
Flounder (NK)	875	100.0	0.0	0	0.0	0.0	875	0.0
Fourspot Flounder	1,529	99.7	0.0	5	0.3	0.0	1,534	0.0
Frigate Mackerel	38	100.0	0.0	0	0.0	0.0	38	0.0
Red Hake	256,414	91.7	0.6	23,308	8.3	0.1	279,722	0.6
White Hake	166,857	98.8	0.4	1,990	1.2	0.0	168,847	0.4
Hake, (Mix) Red & White	5,225	99.1	0.0	50	0.9	0.0	5,275	0.0
Atlantic Herring	111,505	40.2	0.3	165,800	59.8	0.4	277,305	0.6
John Dory	22,894	92.3	0.1	1,915	7.7	0.0	24,809	0.1
King Mackerel	50	100.0	0.0	0	0.0	0.0	50	0.0
King Whiting	37,625	97.4	0.1	1,000	2.6	0.0	38,625	0.1
Lumpfish	156	100.0	0.0	0	0.0	0.0	156	0.0
Atlantic Mackerel	4,842,180	98.8	11.2	59,770	1.2	0.1	4,901,950	11.3
Chub Mackerel	5,790	49.1	0.0	6,000	50.9	0.0	11,790	0.0
Menhaden	400	100.0	0.0	0	0.0	0.0	400	0.0
Redfish	164	100.0	0.0	0	0.0	0.0	164	0.0
Scup	442,950	97.6	1.0	11,046	2.4	0.0	453,996	1.0
Black Sea Bass	159,243	98.8	0.4	1,907	1.2	0.0	161,150	0.4
Sea Robins	2,002	19.4	0.0	8,320	80.6	0.0	10,322	0.0
Squeteague Weakfish	4,800	99.9	0.0	5	0.1	0.0	4,805	0.0
Spotted Weakfish	5,493	99.2	0.0	45	0.8	0.0	5,538	0.0
American Shad	480	82.8	0.0	100	17.2	0.0	580	0.0
Dogfish (NK)	13,823	100.0	0.0	0	0.0	0.0	13,823	0.0
Smooth Dogfish	20,281	98.9	0.0	225	1.1	0.0	20,506	0.0
Spiny Dogfish	25,846	20.3	0.1	101,450	79.7	0.2	127,296	0.3
Mako Shortfin Shark	2,200	95.7	0.0	100	4.3	0.0	2,300	0.0
Mako Shark	40	100.0	0.0	0	0.0	0.0	40	0.0
Shark (NK)	262	72.4	0.0	100	27.6	0.0	362	0.0
Skates	4,159	12.3	0.0	29,565	87.7	0.1	33,724	0.1
Spot	600	100.0	0.0	0	0.0	0.0	600	0.0
Striped Bass	2,146	98.4	0.0	35	1.6	0.0	2,181	0.0
Nothern Puffer	30	100.0	0.0	0	0.0	0.0	30	0.0
Swordfish	1,069	74.8	0.0	360	25.2	0.0	1,429	0.0
Tautog	2,191	99.9	0.0	2	0.1	0.0	2,193	0.0
Tilefish	59,721	99.6	0.1	246	0.4	0.0	59,967	0.1

Table 30 (continued). Catch disposition for trips that kept 2500 or more pounds of *Loligo* squid, 199 combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Triggerfish	129	100.0	0.0	0	0.0	0.0	129	0.0
Tuna (NK)	49	100.0	0.0	0	0.0	0.0	49	0.0
Little Tuna	180	100.0	0.0	0	0.0	0.0	180	0.0
Albacore Tuna	1,315	100.0	0.0	0	0.0	0.0	1,315	0.0
Yellowfin Tuna	396	100.0	0.0	0	0.0	0.0	396	0.0
Porbeagle Shark	40	100.0	0.0	0	0.0	0.0	40	0.0
Sandbar Shark	15	50.0	0.0	15	50.0	0.0	30	0.0
Dusky Shark	172	100.0	0.0	0	0.0	0.0	172	0.0
Red Hake	152,723	98.1	0.4	3,000	1.9	0.0	155,723	0.4
Silver Hake	4,446,968	98.8	10.3	51,750	1.2	0.1	4,498,718	10.4
Jonah Crab	1,511	98.4	0.0	25	1.6	0.0	1,536	0.0
Crab (NK)	101	25.2	0.0	300	74.8	0.0	401	0.0
Horseshoe Crab	8	34.8	0.0	15	65.2	0.0	23	0.0
Lobster	19,181	98.5	0.0	295	1.5	0.0	19,476	0.0
Sea Scallop	482	100.0	0.0	0	0.0	0.0	482	0.0
Loligo Squid	26,370,084	99.8	61.0	47,169	0.2	0.1	26,417,253	61.1
Illex Squid	1,874,471	99.5	4.3	8,500	0.5	0.0	1,882,971	4.4
Squid (NS)	31,393	100.0	0.1	0	0.0	0.0	31,393	0.1
ALL SPECIES	42,591,460		98.5	655,722			43,247,182	

Source: Vessel Trip Report data, 1997.
Number of trips = 2,098

Table 31. Catch disposition for trips that caught and kept 1000 lbs or more of *Illex* squid (n=116) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Alewife	0	0.0	0.0	1	0.0	0.0	1	0.0
Angler	57	27.1	0.0	153	0.0	0.1	210	0.0
Butterfish	40,570	94.0	5.2	2,576	0.3	1.5	43,146	3.3
Fourspot Flounder	0	0.0	0.0	1	0.0	0.0	1	0.0
Herring (Uncl.)	0	0.0	0.0	13,475	1.7	7.9	13,475	1.0
Red Hake	0	0.0	0.0	625	0.1	0.4	625	0.0
White Hake	0	0.0	0.0	13	0.0	0.0	13	0.0
Atlantic Mackerel	0	0.0	0.0	1	0.0	0.0	1	0.0
Black Sea Bass	0	0.0	0.0	1	0.0	0.0	1	0.0
American Shad	0	0.0	0.0	4	0.0	0.0	4	0.0
Silver Hake	30	2.5	0.0	1,194	0.2	0.7	1,224	0.1
Loligo Squid	1,816	98.2	0.1	34	0.0	0.0	1,850	0.1
Illex Squid	1,230,513	100.0	95.2	506	0.1	0.3	1,231,019	95.3
Total	1,272,986	98.6		18,584	1.4		1,291,570	

Table 32. Catch disposition for trips that kept 5000 or more pounds of *Illex* squid, 1997, all gears combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Angler	4,451	99.6	0.0	20	0.4	0.0	4,471	0.0
Bluefish	9,226	100.0	0.0	0	0.0	0.0	9,226	0.0
Butterfish	114,831	75.8	0.4	36,700	24.2	0.1	151,531	0.5
Atlantic Croaker	62,408	97.7	0.2	1,500	2.3	0.0	63,908	0.2
Summer Flounder	2,001	100.0	0.0	0	0.0	0.0	2,001	0.0
Witch Flounder	122	100.0	0.0	0	0.0	0.0	122	0.0
Red Hake	2,648	63.8	0.0	1,500	36.2	0.0	4,148	0.0
Hake, (Mix) Red & White	220	100.0	0.0	0	0.0	0.0	220	0.0
Atlantic Herring	27,509	100.0	0.1	0	0.0	0.0	27,509	0.1
John Dory	360	29.8	0.0	850	70.2	0.0	1,210	0.0
King Whiting	1,323	57.0	0.0	1,000	43.0	0.0	2,323	0.0
Atlantic Mackerel	193,338	100.0	0.6	0	0.0	0.0	193,338	0.6
Chub Mackerel	0	0.0	0.0	6,000	100.0	0.0	6,000	0.0
Scup	3,884	74.9	0.0	1,300	25.1	0.0	5,184	0.0
Black Sea Bass	2,161	62.4	0.0	1,300	37.6	0.0	3,461	0.0
Dogfish (NK)	750	100.0	0.0	0	0.0	0.0	750	0.0
Spiny Dogfish	330	39.8	0.0	500	60.2	0.0	830	0.0
Thresher Shark	165	100.0	0.0	0	0.0	0.0	165	0.0
Span Mackerel	0	0.0	0.0	50	100.0	0.0	50	0.0
Tautog	4	100.0	0.0	0	0.0	0.0	4	0.0
Tilefish	211	100.0	0.0	0	0.0	0.0	211	0.0
Yellowfin Tuna	200	100.0	0.0	0	0.0	0.0	200	0.0
Black Whiting	0	0.0	0.0	1,500	100.0	0.0	1,500	0.0
Silver Hake	61,971	96.1	0.2	2,500	3.9	0.0	64,471	0.2
Lobster	850	100.0	0.0	0	0.0	0.0	850	0.0
Loligo Squid	1,760,739	99.9	5.7	2,500	0.1	0.0	1,763,239	5.7
Illex Squid	28,553,538	100.0	92.5	4,450	0.0	0.0	28,557,988	92.5
ALL SPECIES	30,803,240	99.8		61,670	0.2		30,864,910	

Source: Vessel Trip Report data, 1997.

Number of trips = 222

Table 33a. Catch disposition for trips that caught and kept 100 lbs or more of butterfish (n=72) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Alewife	0	0.0	0.0	1	0.0	0.0	1	0.0
Angler	220	65.9	0.0	114	0.0	0.0	334	0.1
Bluefish	129	100.0	0.0	0	0.0	0.0	129	0.0
Butterfish	31,720	60.0	5.8	235	0.0	0.0	31,955	5.9
Winter Flounder	6	100.0	0.0	0	0.0	0.0	6	0.0
Summer Flounder	75	14.9	0.0	427	0.1	0.1	502	0.1
Sand Dab	1	100.0	0.0	0	0.0	0.0	1	0.0
Yellowtail Flounder	0	0.0	0.0	35	0.0	0.0	35	0.0
Fourspot Flounder	0	0.0	0.0	1	0.0	0.0	1	0.0
Red Hake	0	0.0	0.0	6	0.0	0.0	6	0.0
White Hake	0	0.0	0.0	13	0.0	0.0	13	0.0
Atlantic Herring	0	0.0	0.0	75	0.0	0.0	75	0.0
John Dory	0	0.0	0.0	8	0.0	0.0	8	0.0
Atlantic Mackerel	1	100.0	0.0	0	0.0	0.0	1	0.0
Black Sea Bass	12	85.7	0.0	2	0.0	0.0	14	0.0
Scup	7	100.0	0.0	0	0.0	0.0	7	0.0
Spiny Dogfish	0	0.0	0.0	2,000	0.3	0.4	2,000	0.4
Silver Hake	375	97.9	0.1	8	0.0	0.0	383	0.1
Loligo Squid	6,717	99.9	1.2	5	0.0	0.0	6,722	1.2
Illex Squid	501,564	100.0	92.2	0	0.0	0.0	501,564	92.2
Total	540,827	99.5		2,930	0.5		543,757	

Table 33b. Catch disposition for trips that caught and kept 500 lbs or more of butterfish (n=26) based on 1996 NMFS sea sampling data (all gears combined).

Species	Kept (lbs)	% Species	% Total	Discarded	% Species	% Total	Total (lbs)	% Total
Angler	200	87.7	0.1	28	12.3	0.0	228	0.1
Butterfish	30,850	60.0	11.7	40	0.1	0.0	30,890	11.7
Summer Flounder	0	0.0	0.0	425	100.0	0.2	425	0.2
Yellowtail Flounder	0	0.0	0.0	35	100.0	0.0	35	0.0
Red Hake	0	0.0	0.0	6	100.0	0.0	6	0.0
Atlantic Herring	0	0.0	0.0	75	100.0	0.0	75	0.0
Black Sea Bass	10	90.9	0.0	1	9.1	0.0	11	0.0
Spiny Dogfish	0	0.0	0.0	2,000	100.0	0.8	2,000	0.8
Silver Hake	375	100.0	0.1	0	0.0	0.0	375	0.1
Loligo Squid	323	100.0	0.1	0	0.0	0.0	323	0.1
Illex Squid	229,400	100.0	87.0	0	0.0	0.0	229,400	87.0
Total	261,158	99.0		2,610	1.0		263,768	

Source: 1996 NMFS sea sampling data

Table 34. Catch disposition for trips that kept 500 or more pounds of butterfish, 1997, all gears combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Angler	273,619	99.1	0.9	2,569	0.9	0.0	276,188	0.9
Bluefish	329,578	99.9	1.1	450	0.1	0.0	330,028	1.1
Bonito	2,211	100.0	0.0	0	0.0	0.0	2,211	0.0
Butterfish	5,122,540	97.4	17.5	136,814	2.6	0.5	5,259,354	18.0
Cobia	675	100.0	0.0	0	0.0	0.0	675	0.0
Cod	2,658	96.5	0.0	95	3.5	0.0	2,753	0.0
Atlantic Croaker	1,037,135	100.0	3.5	55	0.0	0.0	1,037,190	3.5
Cunner	20	100.0	0.0	0	0.0	0.0	20	0.0
Cusk	90	97.8	0.0	2	2.2	0.0	92	0.0
Blue Back Herring	8,415	100.0	0.0	0	0.0	0.0	8,415	0.0
Conger Eel	2,500	100.0	0.0	0	0.0	0.0	2,500	0.0
Winter Flounder	7,409	84.2	0.0	1,390	15.8	0.0	8,799	0.0
Summer Flounder	431,432	95.7	1.5	19,336	4.3	0.1	450,768	1.5
Witch Flounder	1,321	100.0	0.0	0	0.0	0.0	1,321	0.0
Yellowtail Flounder	1,206	87.3	0.0	175	12.7	0.0	1,381	0.0
Am. Plaice Flounder	11	100.0	0.0	0	0.0	0.0	11	0.0
Sand-Dab Flounder	306	96.8	0.0	10	3.2	0.0	316	0.0
Flounder (NK)	650	93.5	0.0	45	6.5	0.0	695	0.0
Fourspot Flounder	2,515	92.5	0.0	205	7.5	0.0	2,720	0.0
Frigate Mackerel	14,278	100.0	0.0	0	0.0	0.0	14,278	0.0
Red Hake	541,871	98.9	1.9	6,174	1.1	0.0	548,045	1.9
White Hake	163,293	99.1	0.6	1,505	0.9	0.0	164,798	0.6
Hake, (Mix) Red & White	35,080	100.0	0.1	0	0.0	0.0	35,080	0.1
Atlantic Herring	125,886	36.0	0.4	223,491	64.0	0.8	349,377	1.2
John Dory	21,598	95.5	0.1	1,015	4.5	0.0	22,613	0.1
King Mackerel	65	100.0	0.0	0	0.0	0.0	65	0.0
King Whiting	7,833	88.7	0.0	1,000	11.3	0.0	8,833	0.0
Lumpfish	4,395	100.0	0.0	0	0.0	0.0	4,395	0.0
Atlantic Mackerel	3,533,062	99.0	12.1	36,855	1.0	0.1	3,569,917	12.2
Chub Mackerel	7,775	100.0	0.0	0	0.0	0.0	7,775	0.0
Menhaden	45,634	100.0	0.2	0	0.0	0.0	45,634	0.2
Mullets	31,646	100.0	0.1	0	0.0	0.0	31,646	0.1
Redfish	449	100.0	0.0	0	0.0	0.0	449	0.0
Pollock	12	100.0	0.0	0	0.0	0.0	12	0.0
Sculpins	165	100.0	0.0	0	0.0	0.0	165	0.0
Sea Raven	50	100.0	0.0	0	0.0	0.0	50	0.0
Scup	586,916	98.5	2.0	8,918	1.5	0.0	595,834	2.0
Red Porgy	14,480	100.0	0.0	0	0.0	0.0	14,480	0.0
Black Sea Bass	129,584	98.6	0.4	1,812	1.4	0.0	131,396	0.4
Sea Robins	3,639	26.6	0.0	10,020	73.4	0.0	13,659	0.0
Squeteague Weakfish	251,030	99.8	0.9	530	0.2	0.0	251,560	0.9
Spotted Weakfish	9,229	97.5	0.0	240	2.5	0.0	9,469	0.0
American Shad	2,778	95.5	0.0	130	4.5	0.0	2,908	0.0
Dogfish (NK)	15,867	100.0	0.1	0	0.0	0.0	15,867	0.1
Smooth Dogfish	5,405	98.2	0.0	100	1.8	0.0	5,505	0.0
Spiny Dogfish	38,369	42.3	0.1	52,265	57.7	0.2	90,634	0.3
Thresher Shark	917	100.0	0.0	0	0.0	0.0	917	0.0
Thresher Bigeye Shark	1,170	100.0	0.0	0	0.0	0.0	1,170	0.0
Shark (NK)	126	100.0	0.0	0	0.0	0.0	126	0.0
Skates	5,261	37.2	0.0	8,866	62.8	0.0	14,127	0.0
Span Mackerel	9,947	100.0	0.0	0	0.0	0.0	9,947	0.0

Table 34 (continued). Catch disposition for trips that kept 500 or more pounds of butterfish, 1997, all gears combined.

Common Name	Kept lbs	% Species	% Total	Discarded lbs	% Species	% Total	Total lbs	% Total
Spot	3,811	100.0	0.0	0	0.0	0.0	3,811	0.0
Striped Bass	10,786	87.4	0.0	1,561	12.6	0.0	12,347	0.0
Northern Puffer	345	100.0	0.0	0	0.0	0.0	345	0.0
Tautog	1,739	99.7	0.0	5	0.3	0.0	1,744	0.0
Tilefish	78,520	99.6	0.3	321	0.4	0.0	78,841	0.3
Triggerfish	1,380	100.0	0.0	0	0.0	0.0	1,380	0.0
Tuna (NK)	130	100.0	0.0	0	0.0	0.0	130	0.0
Porbeagle Shark	40	100.0	0.0	0	0.0	0.0	40	0.0
Black Whiting	72,001	96.0	0.2	3,000	4.0	0.0	75,001	0.3
Silver Hake	6,318,379	99.3	21.6	42,569	0.7	0.1	6,360,948	21.7
Wolfishes	2	100.0	0.0	0	0.0	0.0	2	0.0
Other Fish	131,316	100.0	0.4	20	0.0	0.0	131,336	0.4
Jonah Crab	967	97.5	0.0	25	2.5	0.0	992	0.0
Rock Crab	15	100.0	0.0	0	0.0	0.0	15	0.0
Crab (NK)	1,114	100.0	0.0	0	0.0	0.0	1,114	0.0
Horseshoe Crab	9,477	80.5	0.0	2,292	19.5	0.0	11,769	0.0
Lobster	18,288	94.8	0.1	1,004	5.2	0.0	19,292	0.1
Shrimp (Pandalid)	4,035	100.0	0.0	0	0.0	0.0	4,035	0.0
Channeled Wheld	70	100.0	0.0	0	0.0	0.0	70	0.0
Sea Scallop	249	100.0	0.0	0	0.0	0.0	249	0.0
Loligo Squid	7,380,296	99.8	25.2	11,475	0.2	0.0	7,391,771	25.3
Illex Squid	413,909	98.8	1.4	5,000	1.2	0.0	418,909	1.4
Squid (NS)	1,387,058	100.0	4.7	75	0.0	0.0	1,387,133	4.7
ALL SPECIES	28,666,028	98.0		581,414			29,247,442	

Source: Vessel Trip Report data, 1997.
Number of trips = 1,573

Table 35. The percentage (%) of Atlantic mackerel caught and landed by recreational fishermen for each mode by subregion, 1988-1997.

	Catch (Number)			Landing (Weight)		
Mode	North Atlantic	Mid-Atlantic	South Atlantic	North Atlantic	Mid-Atlantic	South Atlantic
Shore	20.1	0.8	75.4	11.5	0.1	42.4
Party / Charter	8.3	59.8	24.6	8.9	74.6	0.5
Private / Rental	71.6	39.4	0.0	79.6	25.3	57.1

Source: Unpublished MRFSS data.

Table 36. 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 37. 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 38. 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 39. 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 40. 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.

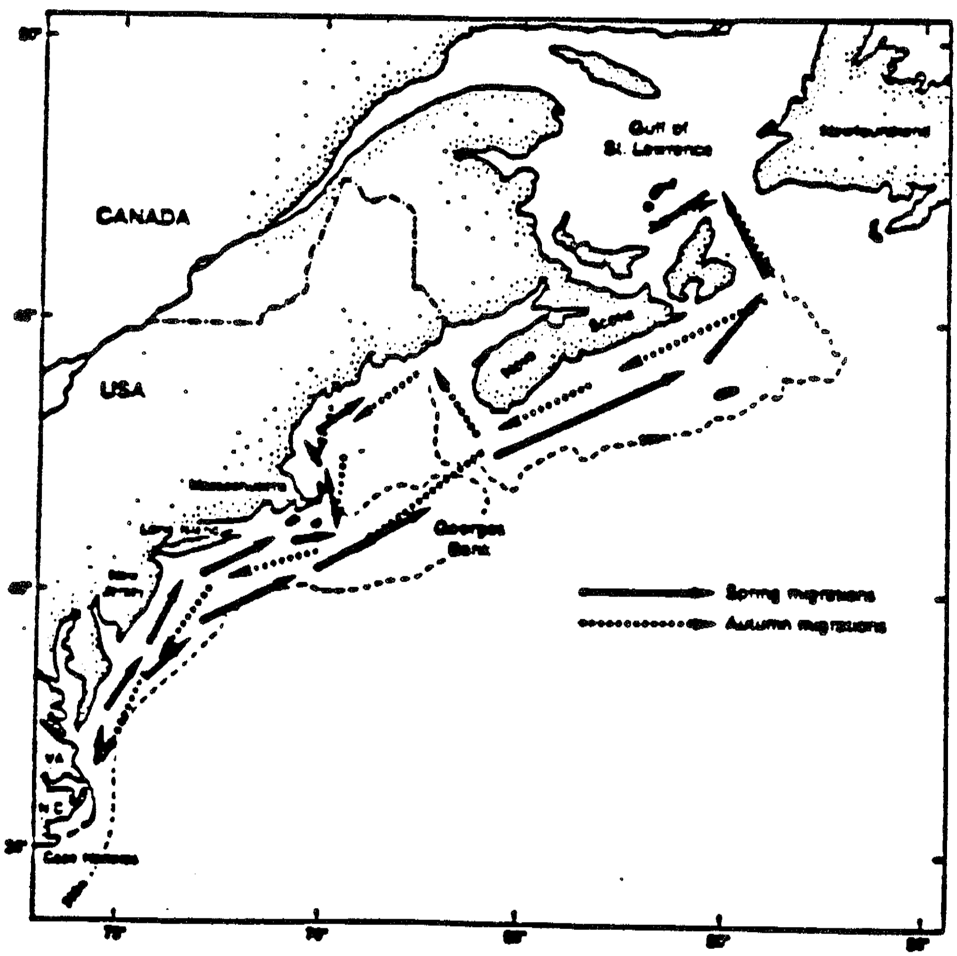


Figure 1. Distribution and movements of Northwest Atlantic mackerel. Source: Overholtz 1985.

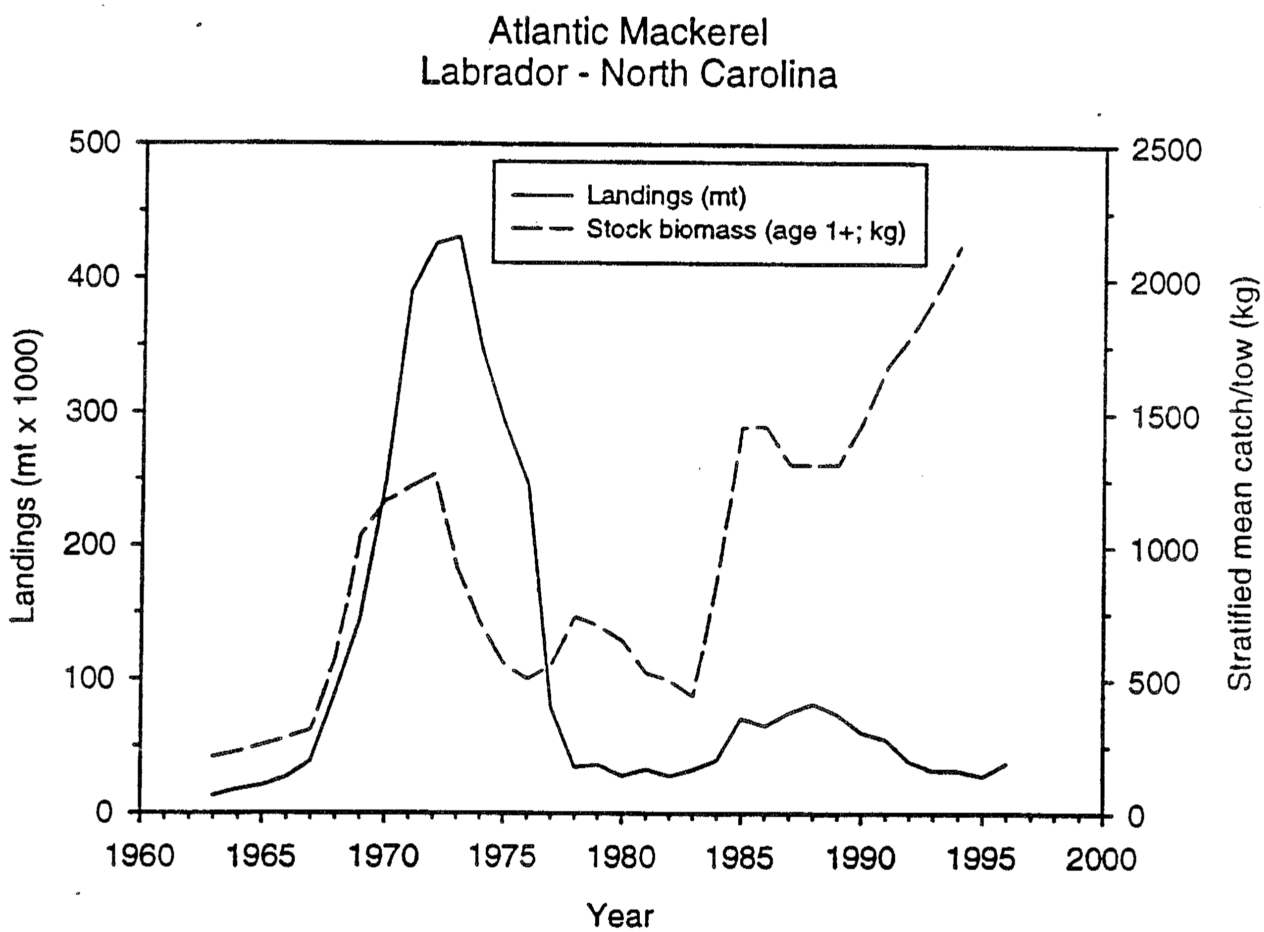
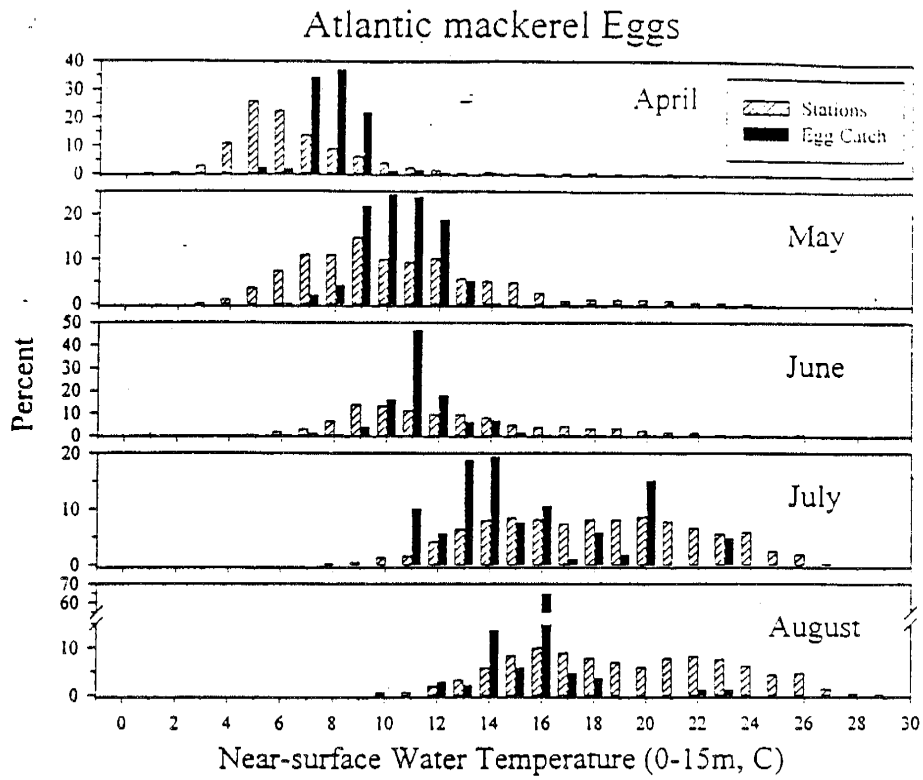


Figure 2. U.S. commercial landings and stock biomass of Atlantic mackerel from Labrador to North Carolina.
Source: Studholme *et al.* 1998.



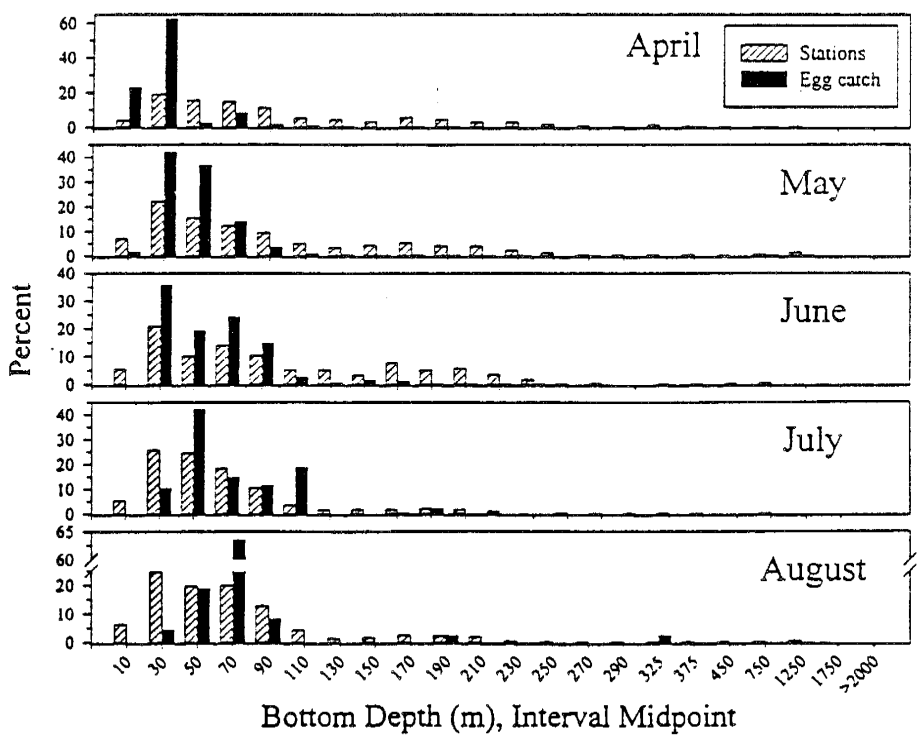


Figure 3. Histograms of monthly egg abundance relative to water temperature and depth from MARMAP surveys, April through August 1977-1987. Open bars represent the proportion of all stations which were surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m^2).
Source: Studholme *et al.* 1998.

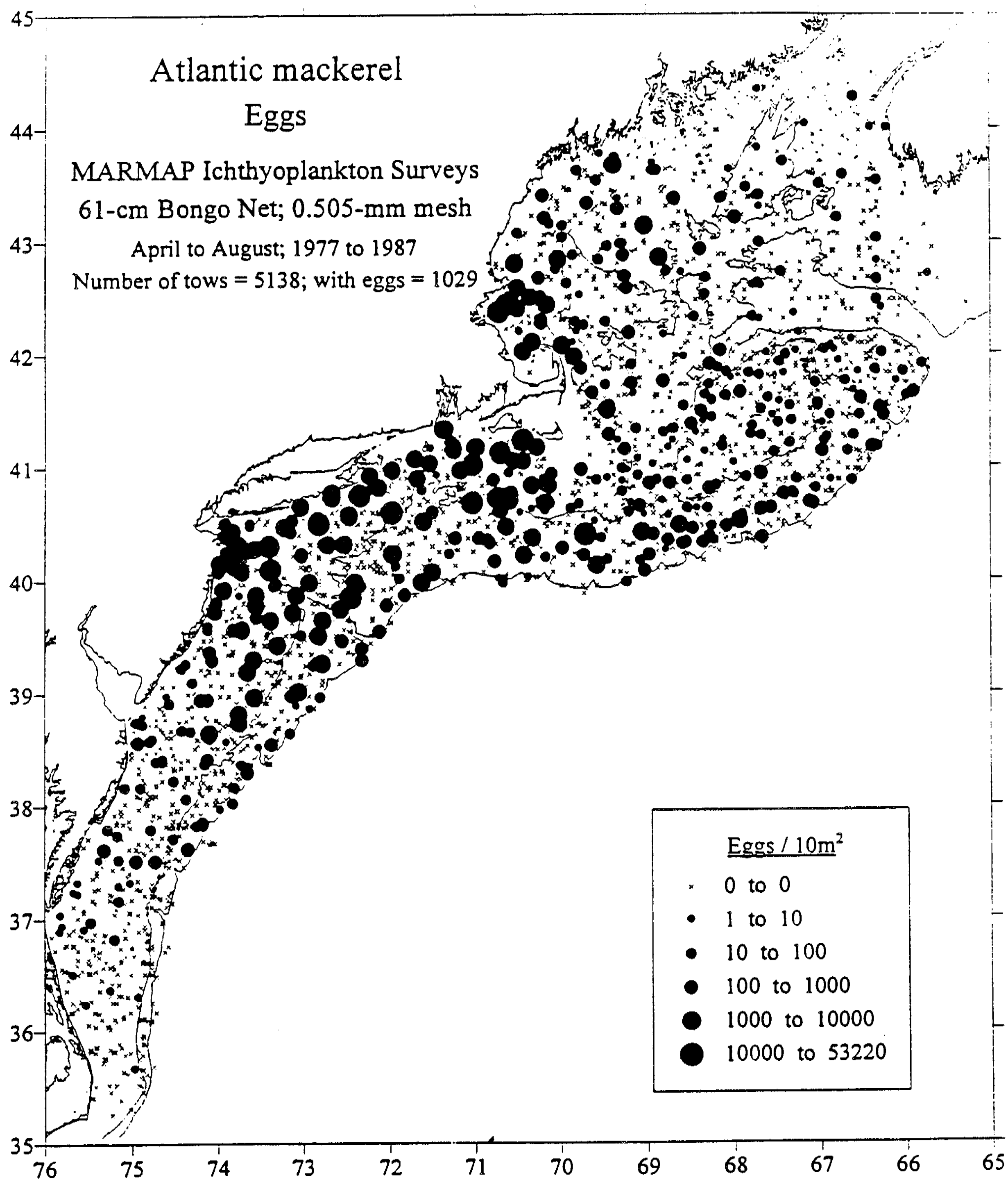


Figure 4. Distribution of Atlantic mackerel eggs collected during MARMAP offshore ichthyoplankton surveys, April through August 1977-1987.
Source: Studholme *et al.* 1998.

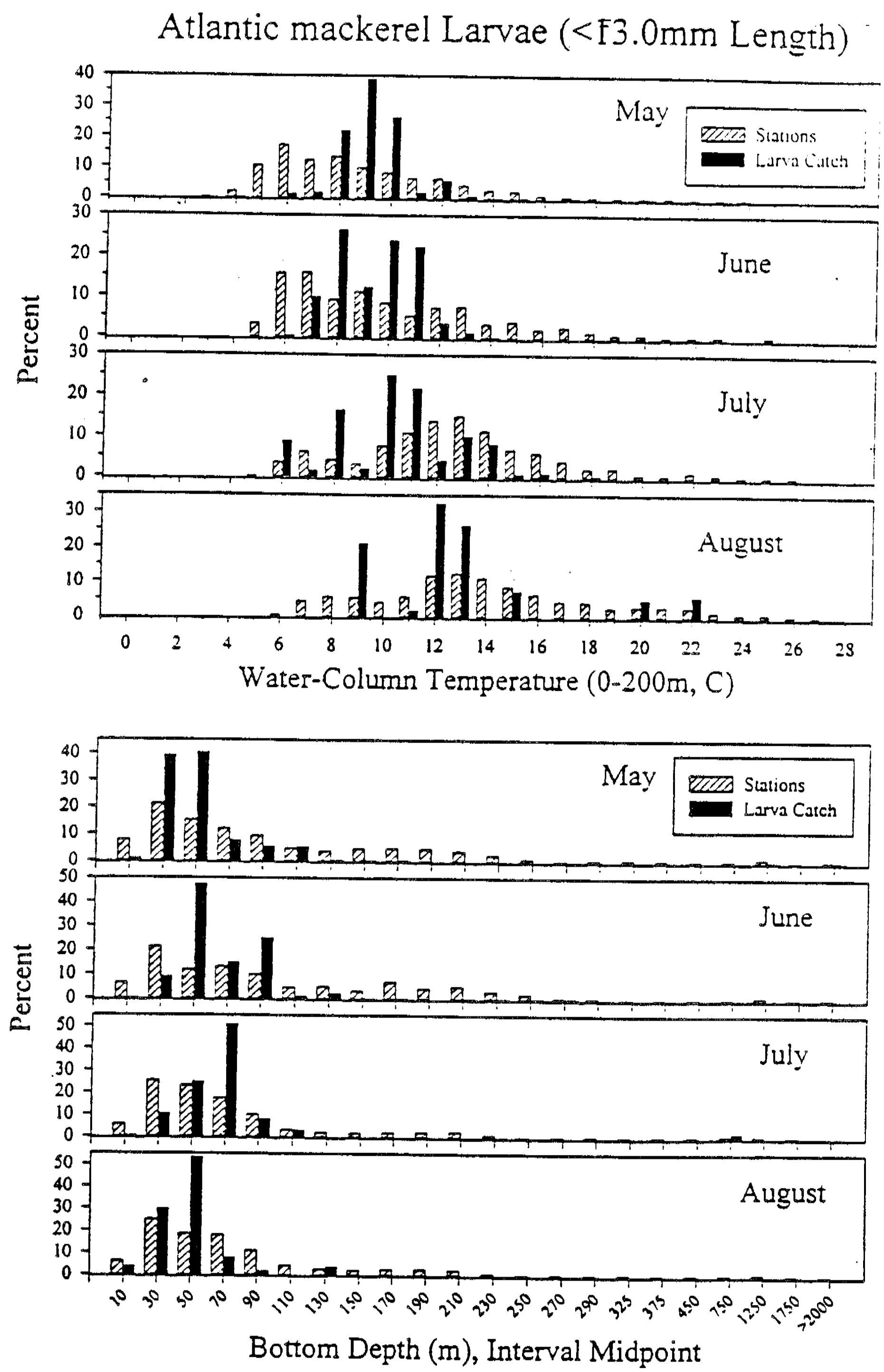


Figure 5. Histograms of monthly larval abundance relative to water temperature and depth from MARMAP surveys, May through August 1977-1987. Open bars represent the proportion of all stations which were surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m²).
Source: Studholme et. al. 1998.

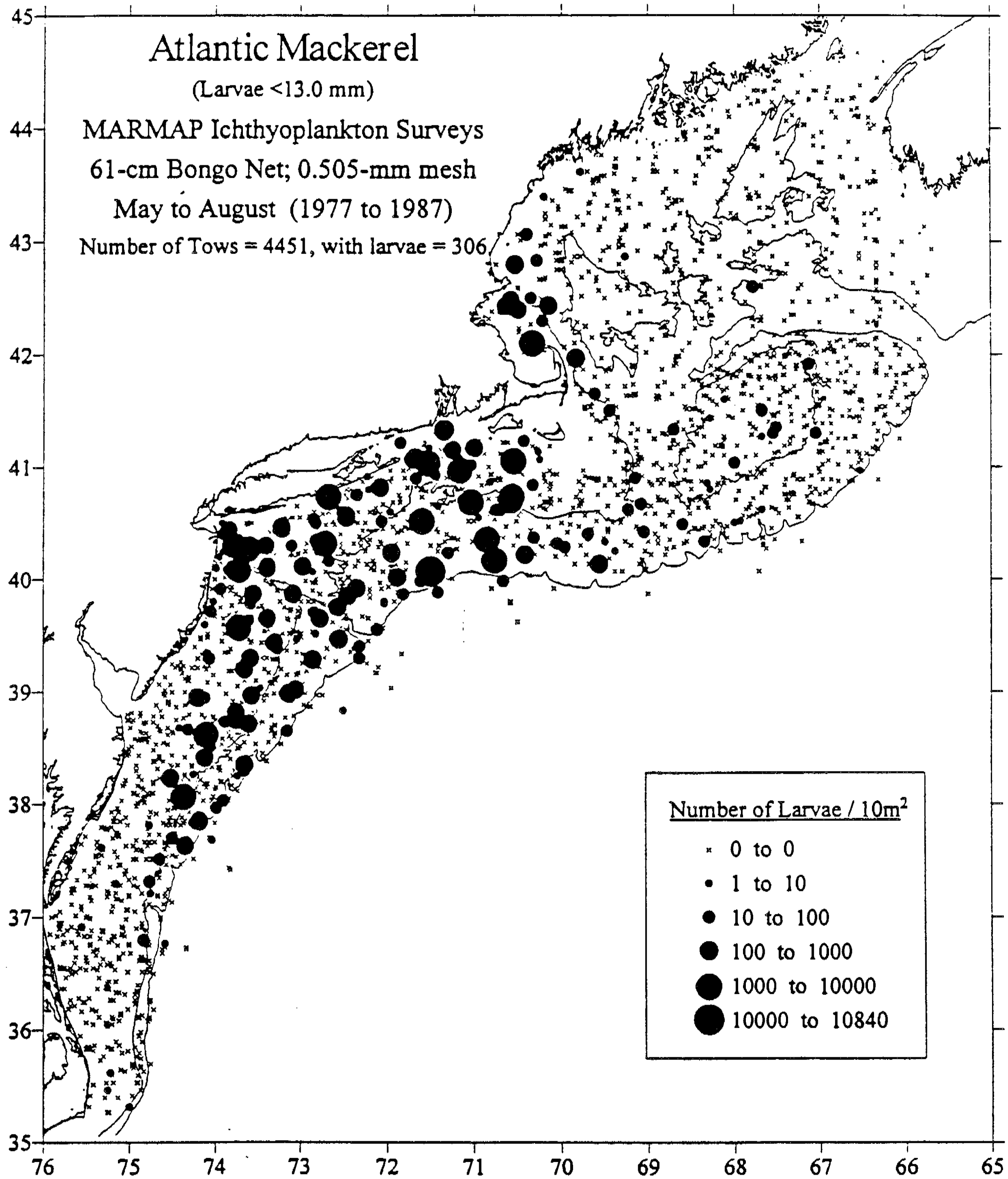


Figure 6. Distribution of Atlantic mackerel larvae collected during MARMAP offshore ichthyoplankton surveys, May through August 1977-1987.
Source: Studholme *et al.* 1988.

ATLANTIC MACKEREL

National Marine Fisheries Service Groundfish Surveys

Juvenile Fish: total fish length < 26 cm

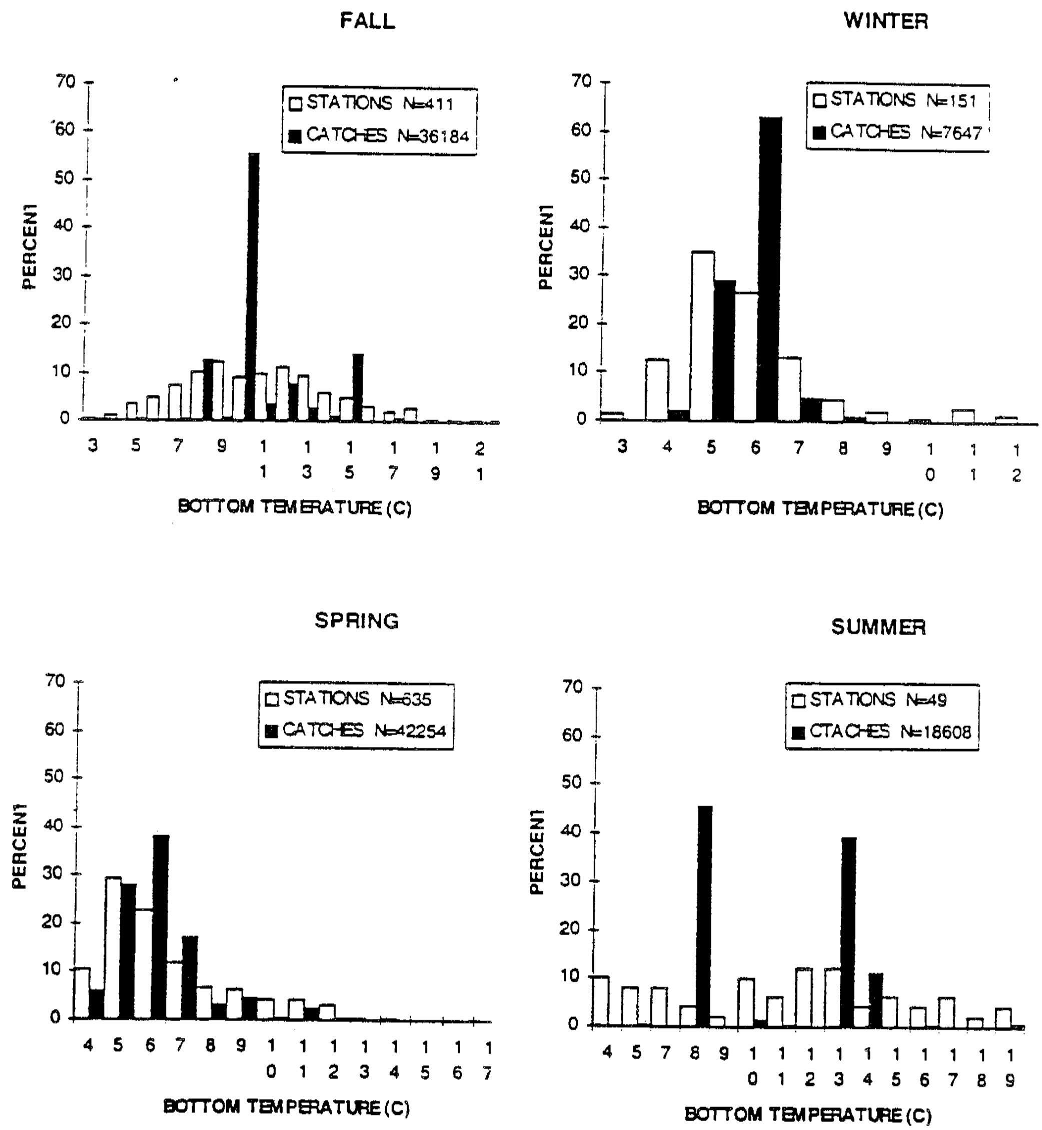


Figure 7. Histograms of juvenile Atlantic mackerel abundance relative to water temperature from NMFS trawl surveys (spring 1968-1997, summer 1964-1995, fall 1963-1997, winter 1964-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m²).
Source: Studholme *et al.* 1998.

ATLANTIC MACKEREL

National Marine Fisheries Service Groundfish Surveys

Juvenile Fish: total fish length < 26 cm

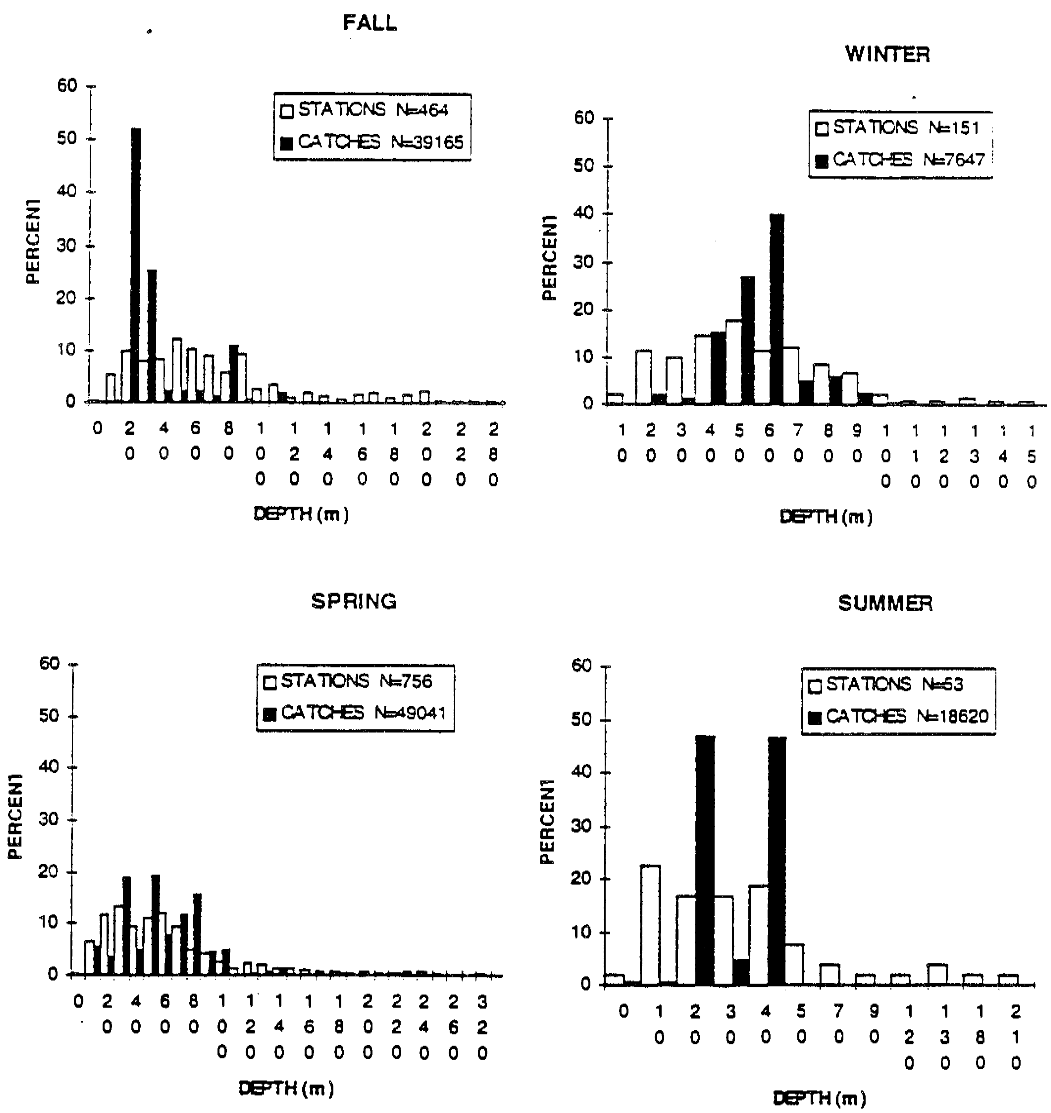


Figure 8. Histograms of juvenile Atlantic mackerel abundance relative to depth from NMFS trawl surveys (spring 1968-1997, summer 1964-1995, fall 1963-1997, winter 1964-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m²).
Source: Studholme *et al.* 1998.

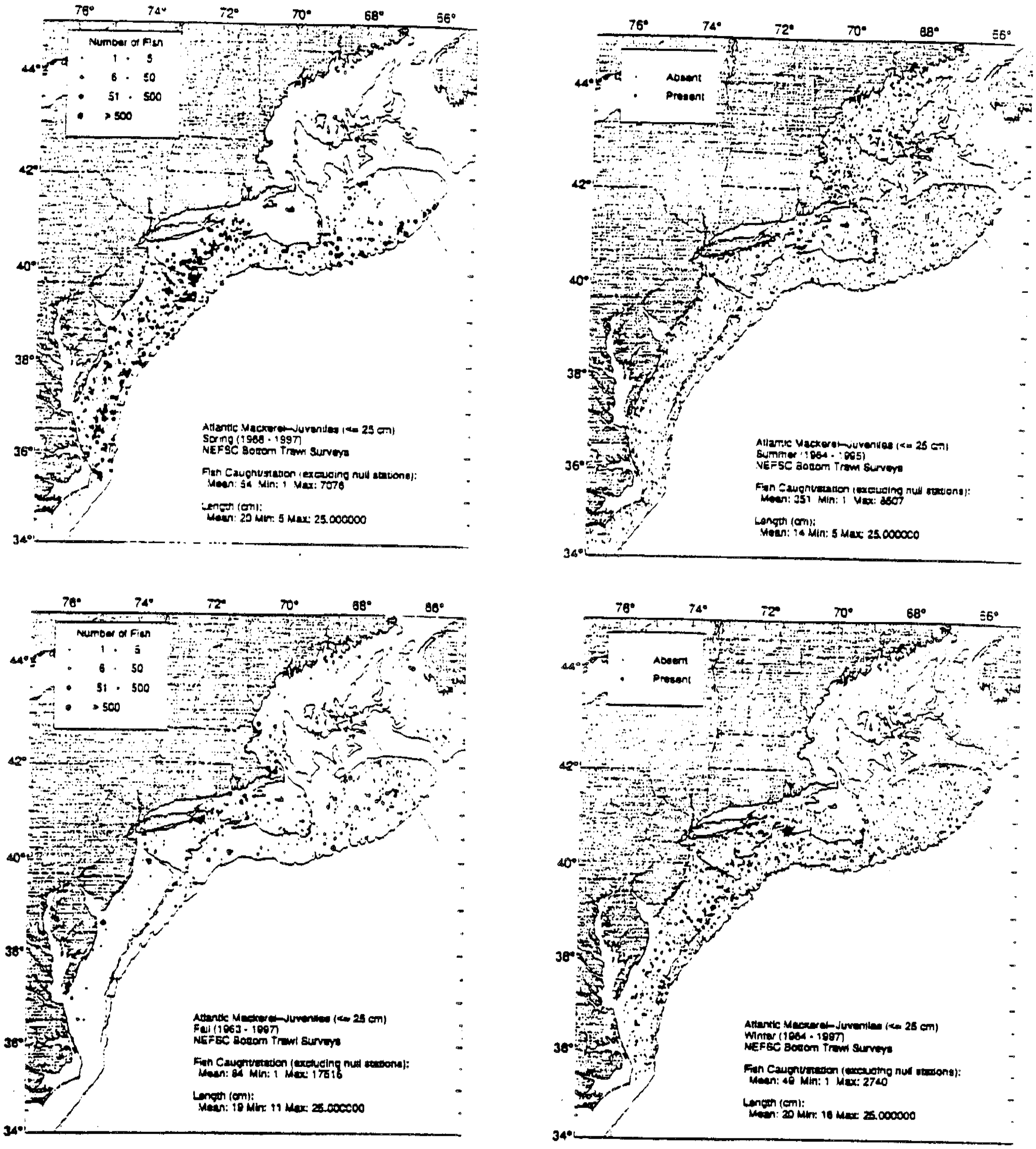


Figure 9a-d. Distribution of juvenile Atlantic mackerel collected during NMFS trawl surveys, a) spring 1968-1997, b) summer1964-1995, c) autumn 1963-1997, d) winter 1964-1997. Densities are represented in spring and autumn plots, while only presence and absence is represented in summer and winter.
Source: Studholme *et al.* 1998.

ATLANTIC MACKEREL

National Marine Fisheries Service Groundfish Surveys

Adult Fish: total fish length >= 26 cm

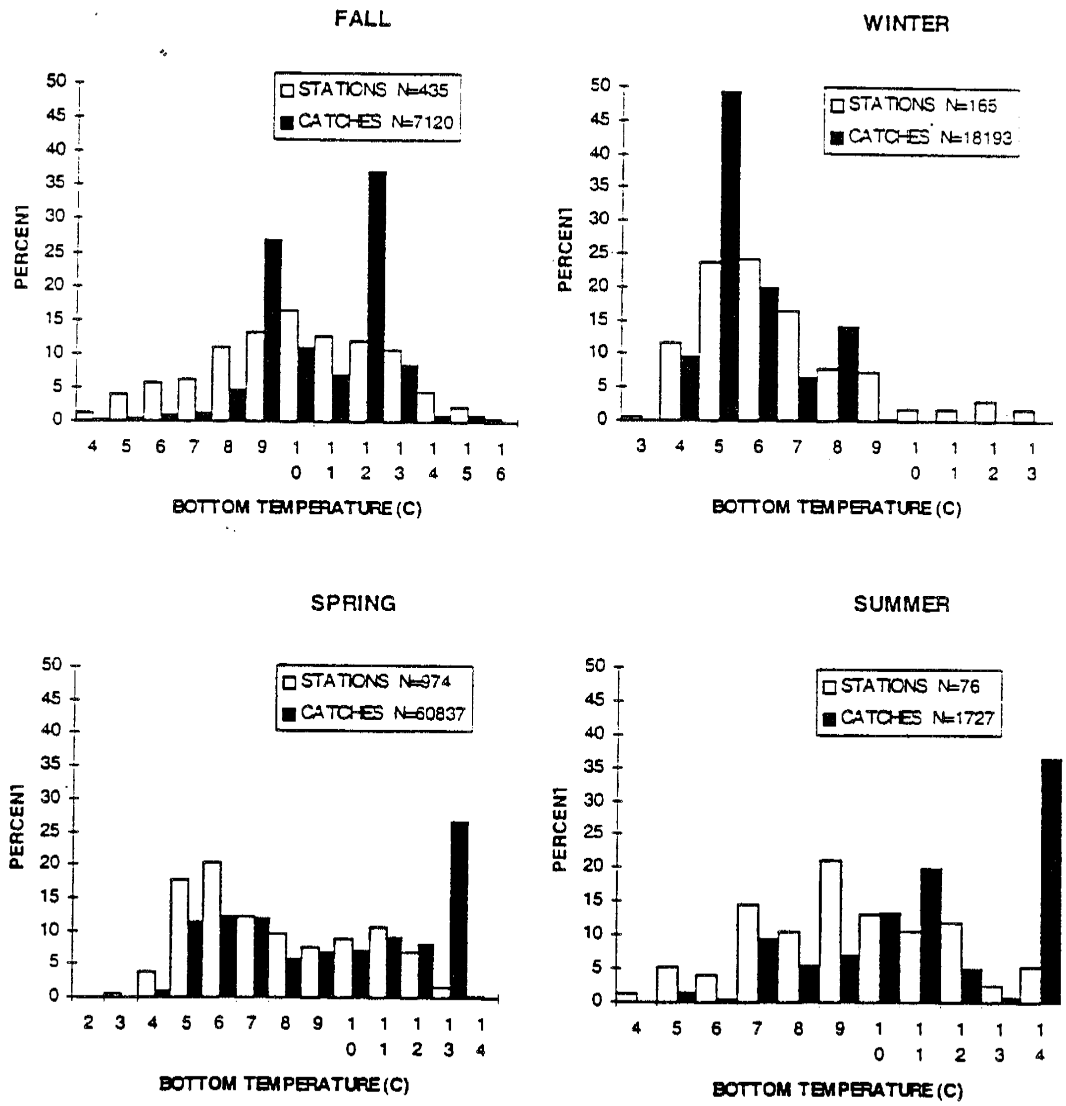


Figure 10. Histograms of adult Atlantic mackerel abundance relative to water temperature from NMFS trawl surveys. Open bars represent the proportion of all stations surveyed, while solid bars represent the proportion of the sum of all standardized catches.
Source: Studholme et al. 1998.

ATLANTIC MACKEREL

National Marine Fisheries Service Groundfish Surveys

Adult Fish: total fish length >= 26 cm

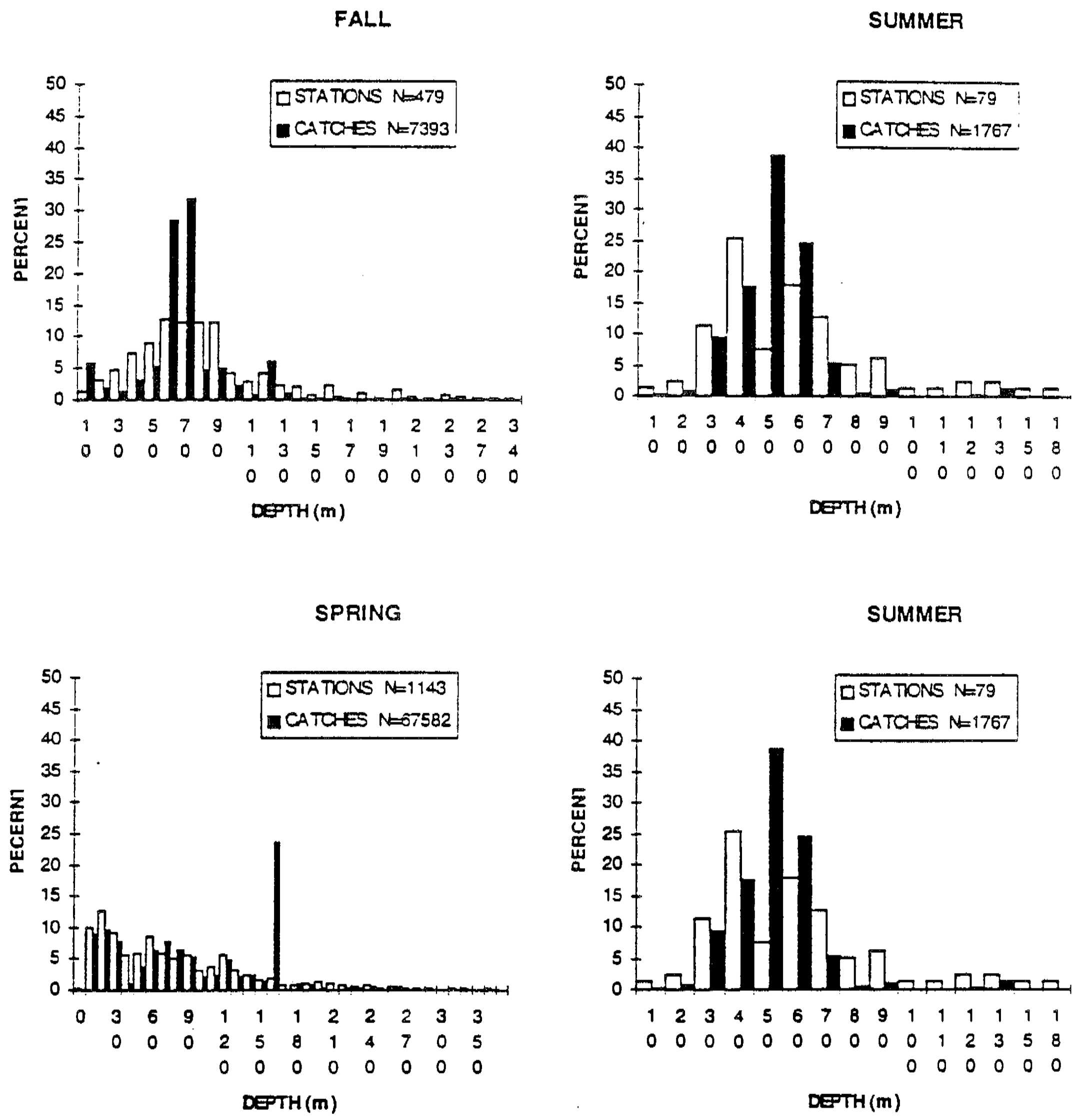


Figure 11. Histograms of adult Atlantic mackerel abundance relative to depth NMFS trawl surveys. Open bars represent the proportion of all stations surveyed, while solid bars represent the proportion of the sum of all standardized catches.
Source: Studholme et al. 1998.

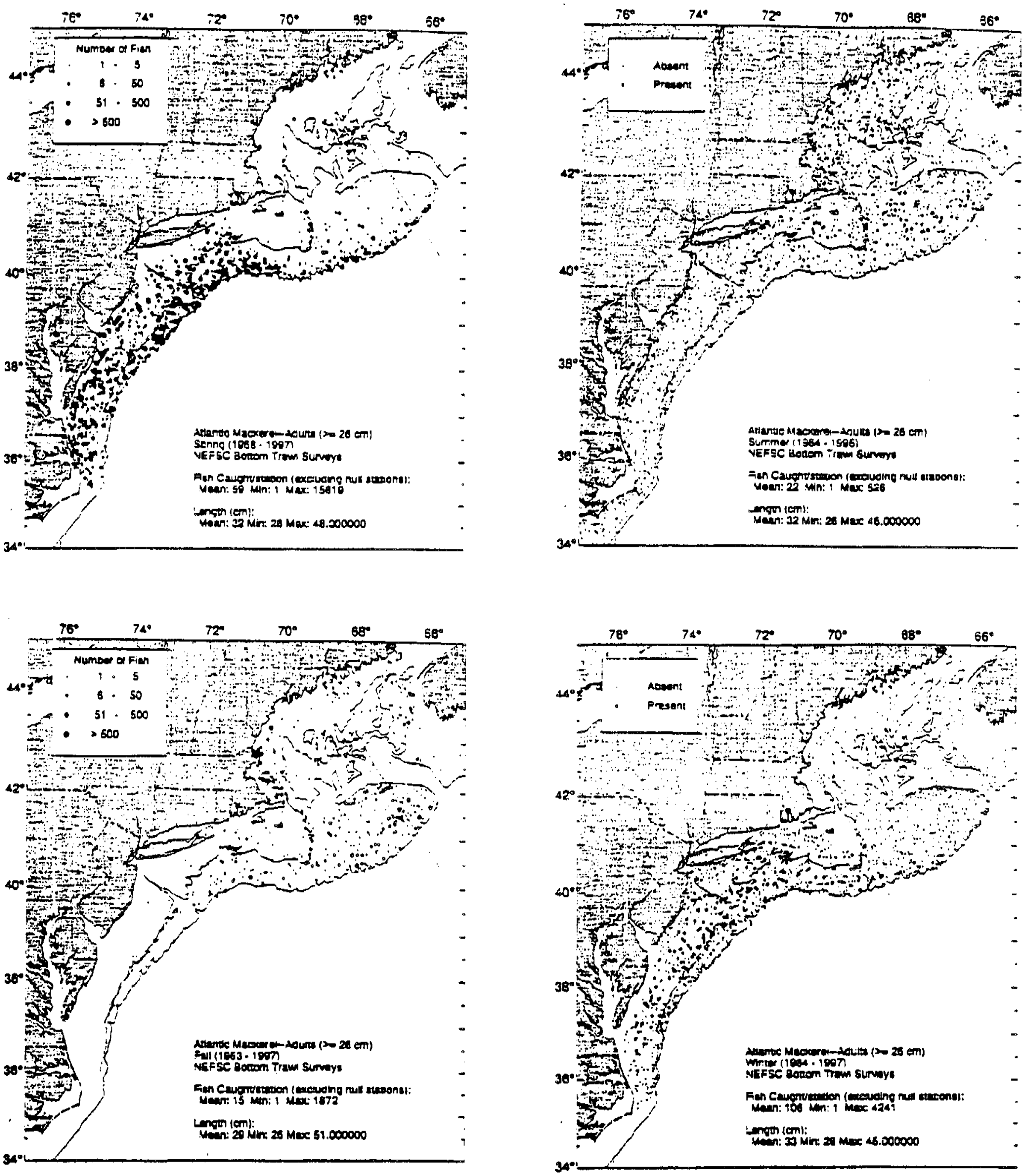


Figure 12a-d. Distribution of adult Atlantic mackerel collected during NMFS trawl surveys, a) spring 1968-1997, b) summer1964-1995, c) autumn 1963-1997, d) winter 1964-1997. Densities are represented in spring and autumn plots, while only presence and absence is represented in summer and winter.
Source: Studholme *et al.* 1998.

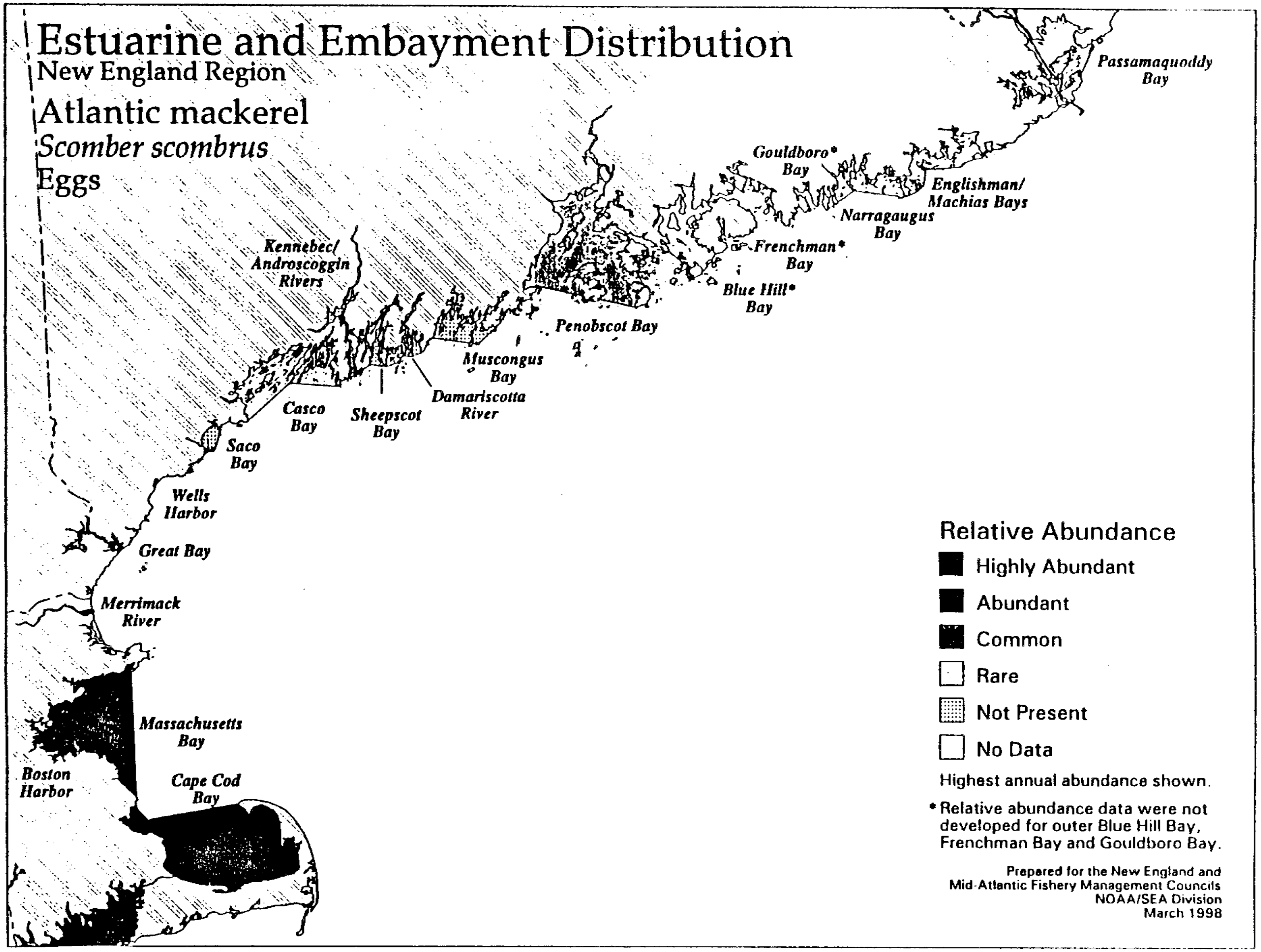


Figure 13a. Relative of abundance and distribution of Atlantic mackerel eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

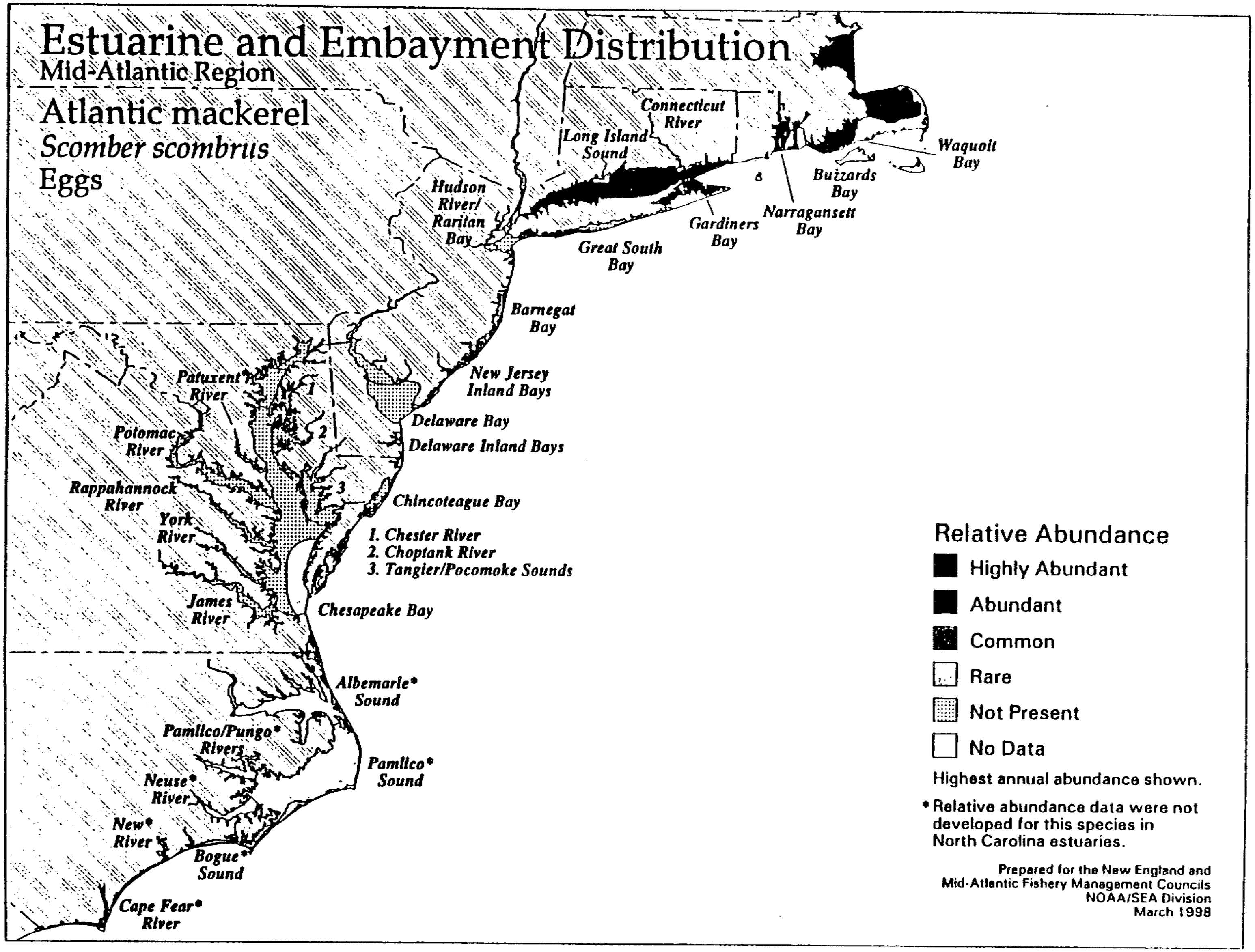


Figure 13a(continued). Relative of abundance and distribution of Atlantic mackerel eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

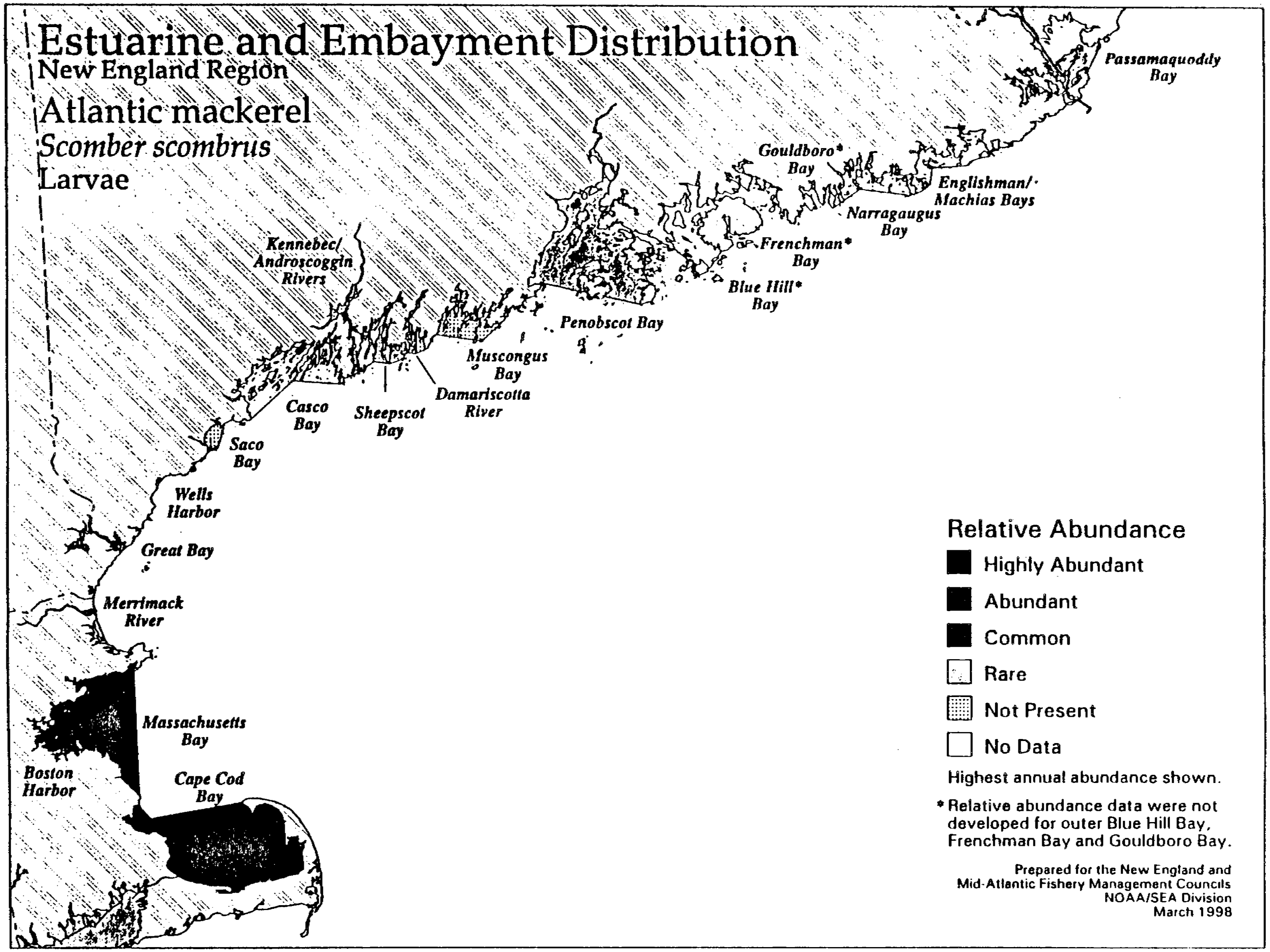


Figure 13b. Relative of abundance and distribution of Atlantic mackerel larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

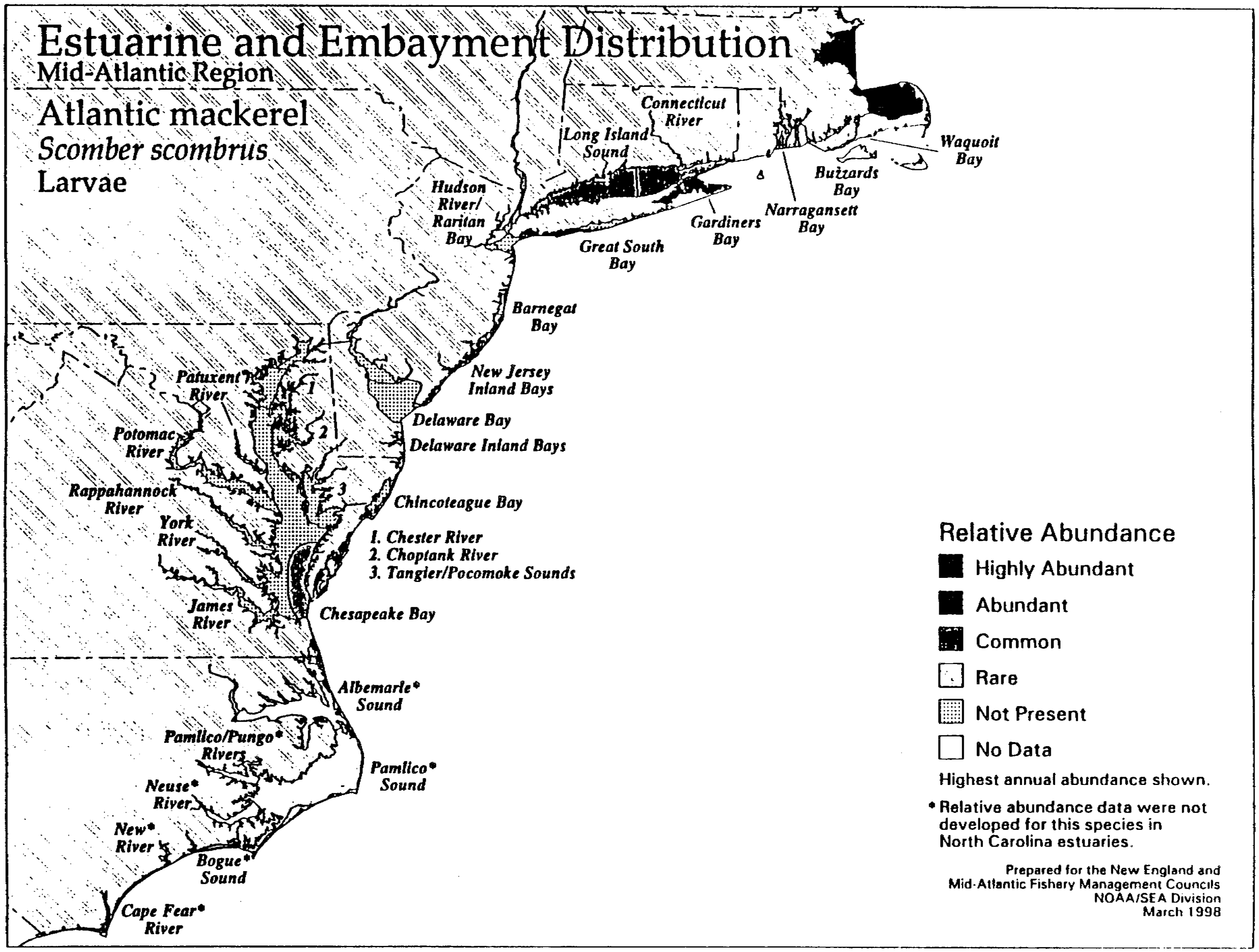


Figure 13b(continued). Relative of abundance and distribution of Atlantic mackerel larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

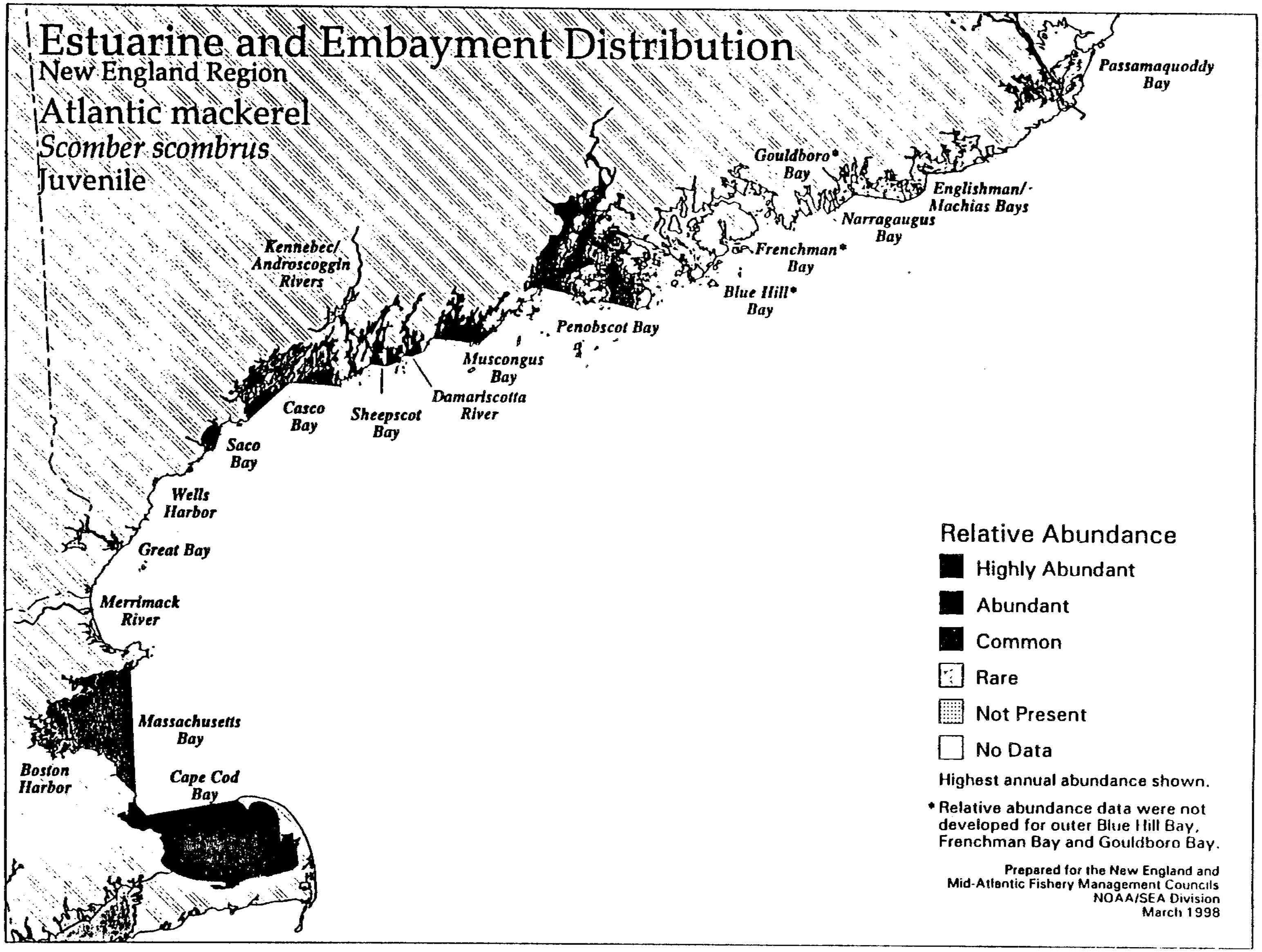


Figure 13c. Relative of abundance and distribution of juvenile Atlantic mackerel in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

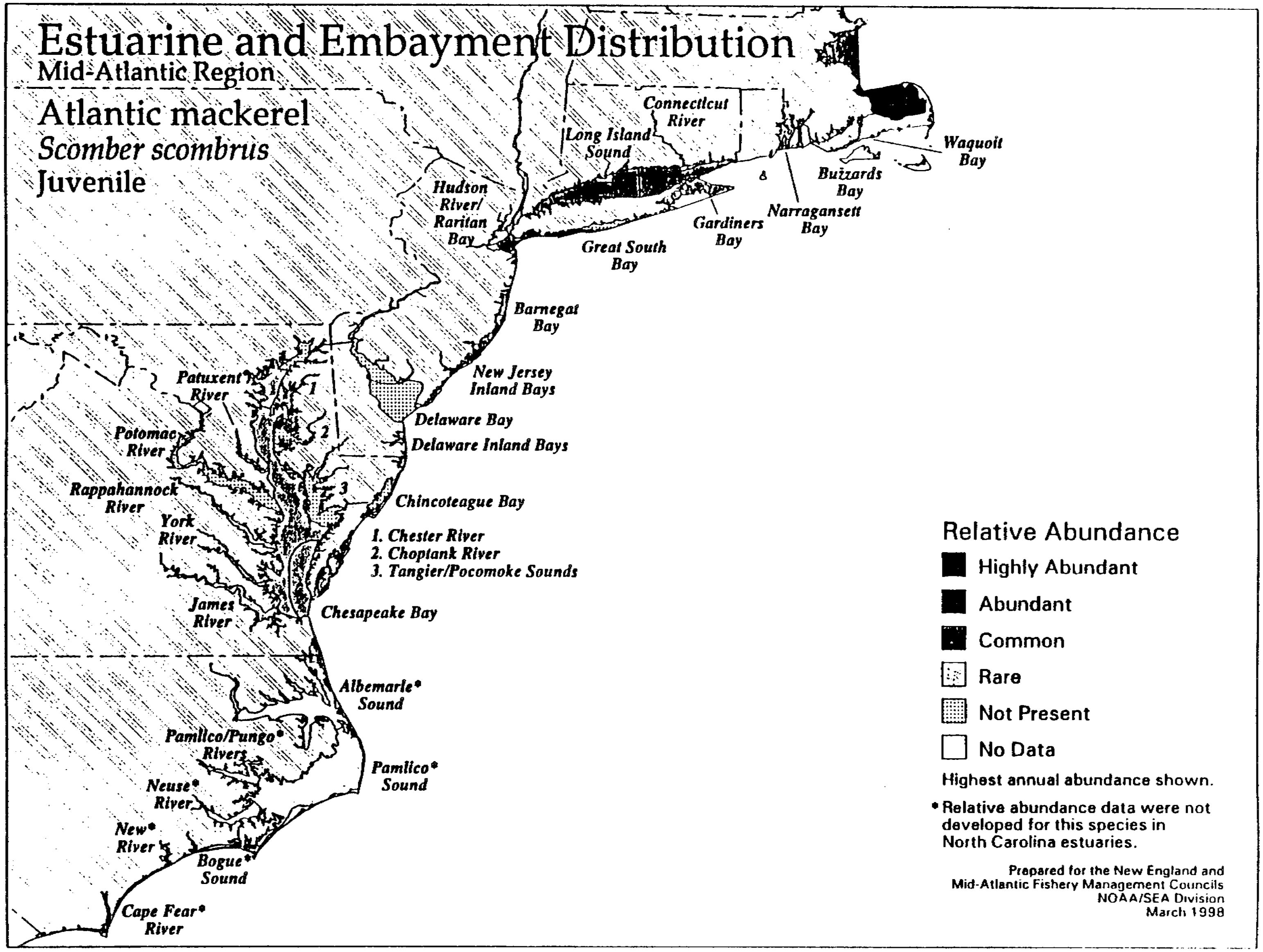


Figure 13c(continued). Relative of abundance and distribution of juvenile Atlantic mackerel in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

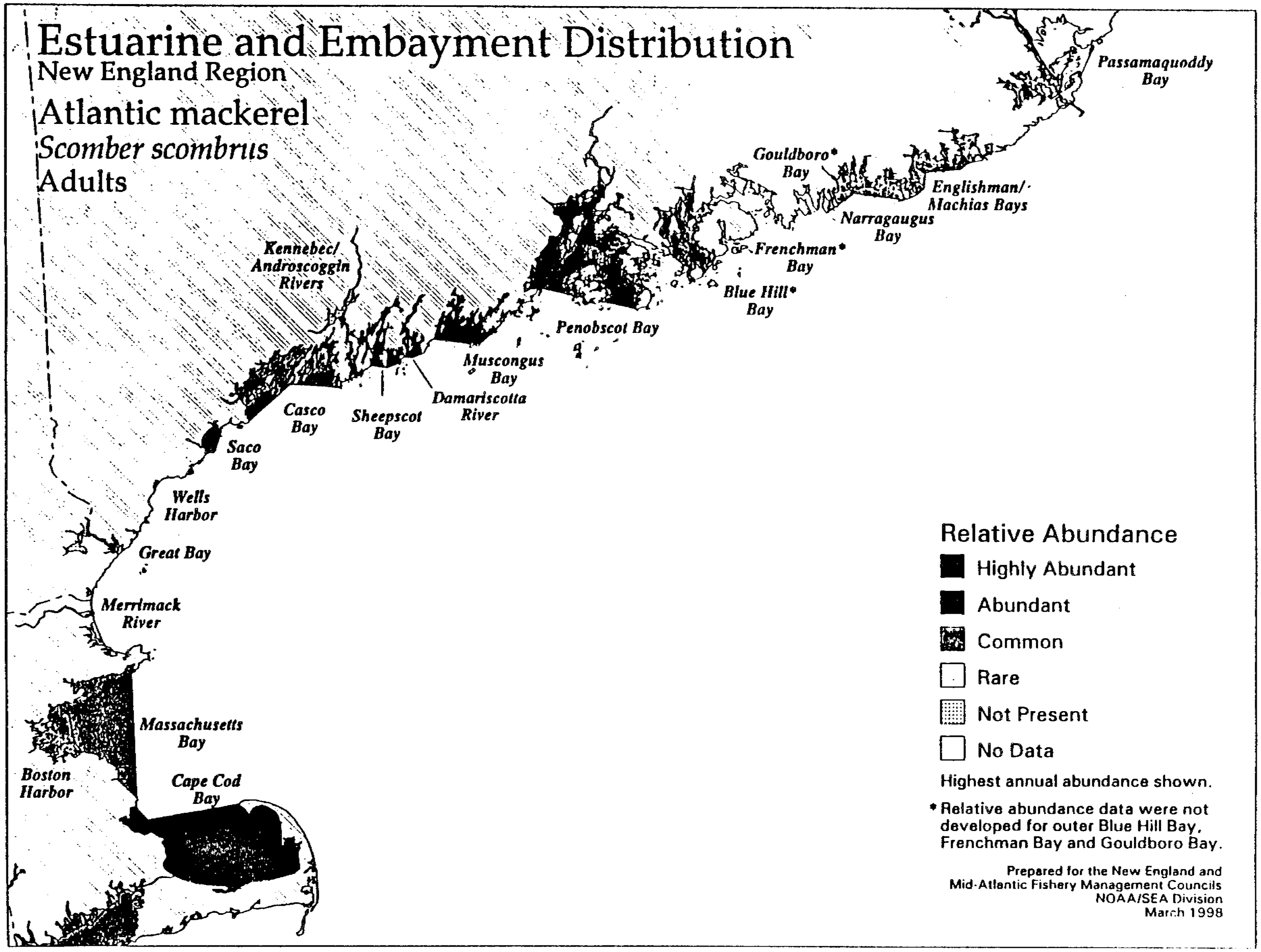


Figure 13d. Relative of abundance and distribution of adult Atlantic mackerel in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

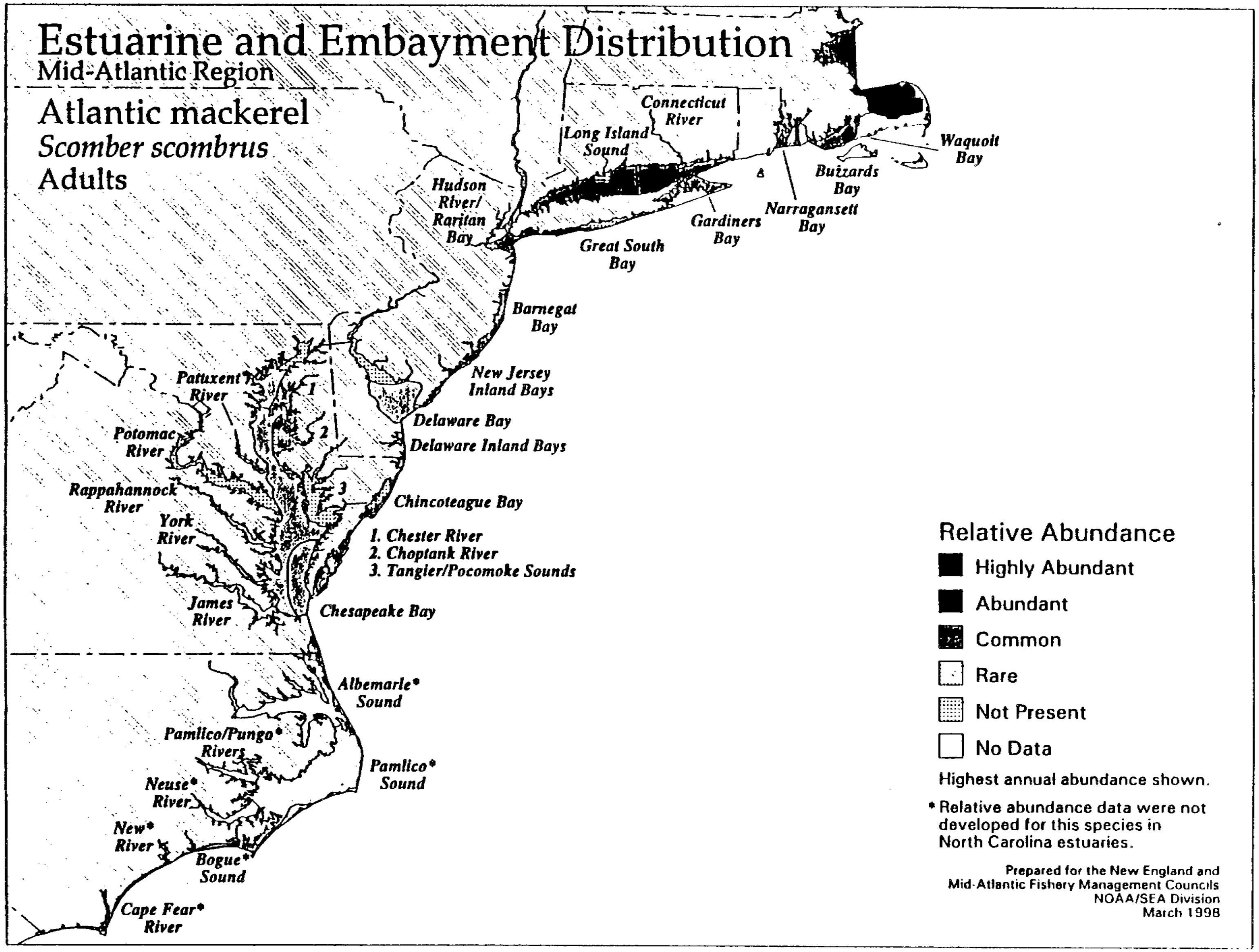


Figure 13d(continued). Relative of abundance and distribution of adult Atlantic mackerel in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

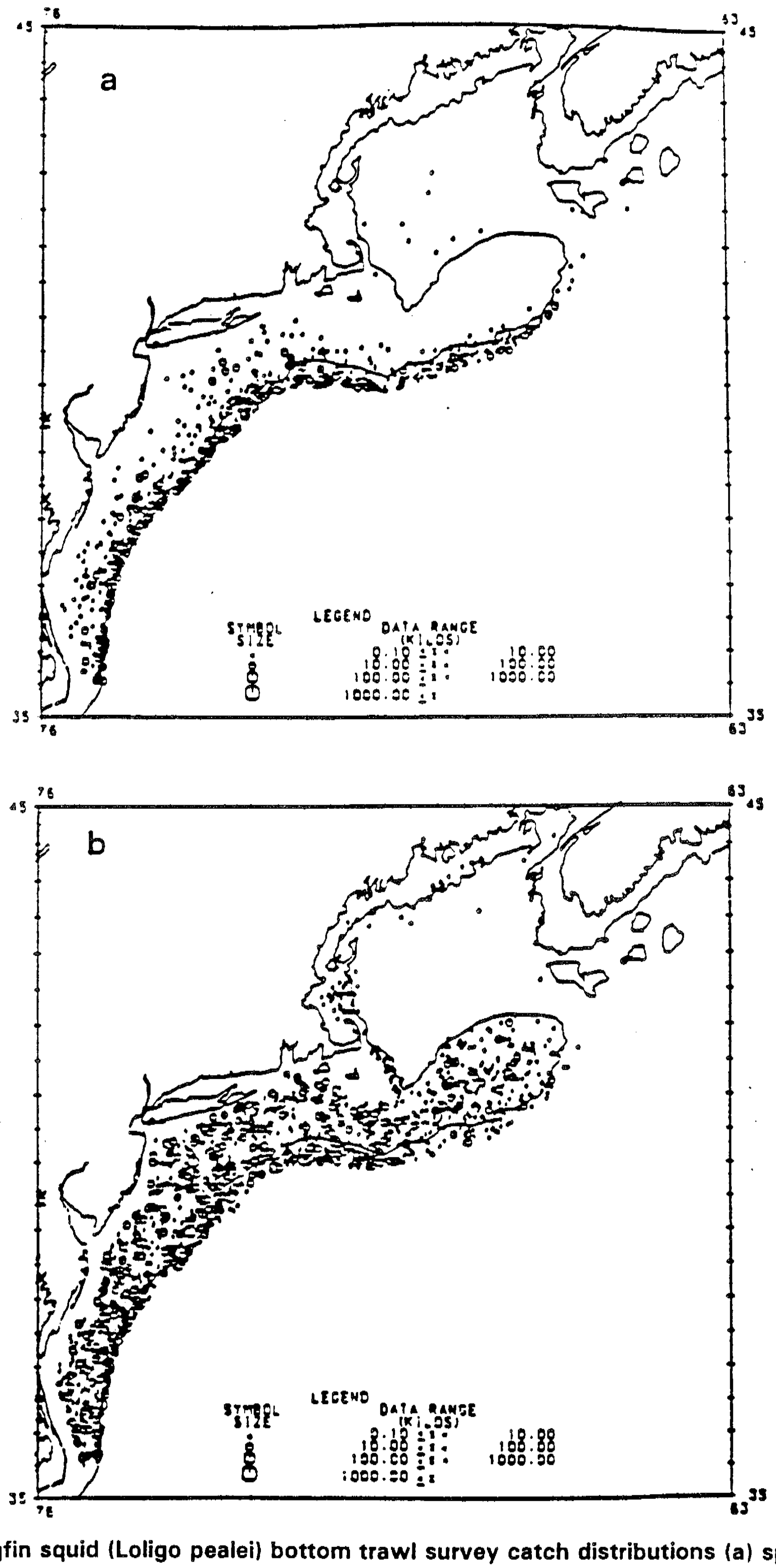


Figure 14. Longfin squid (Loligo pealei) bottom trawl survey catch distributions (a) spring and (b) fall.
Source: Chang 1985.

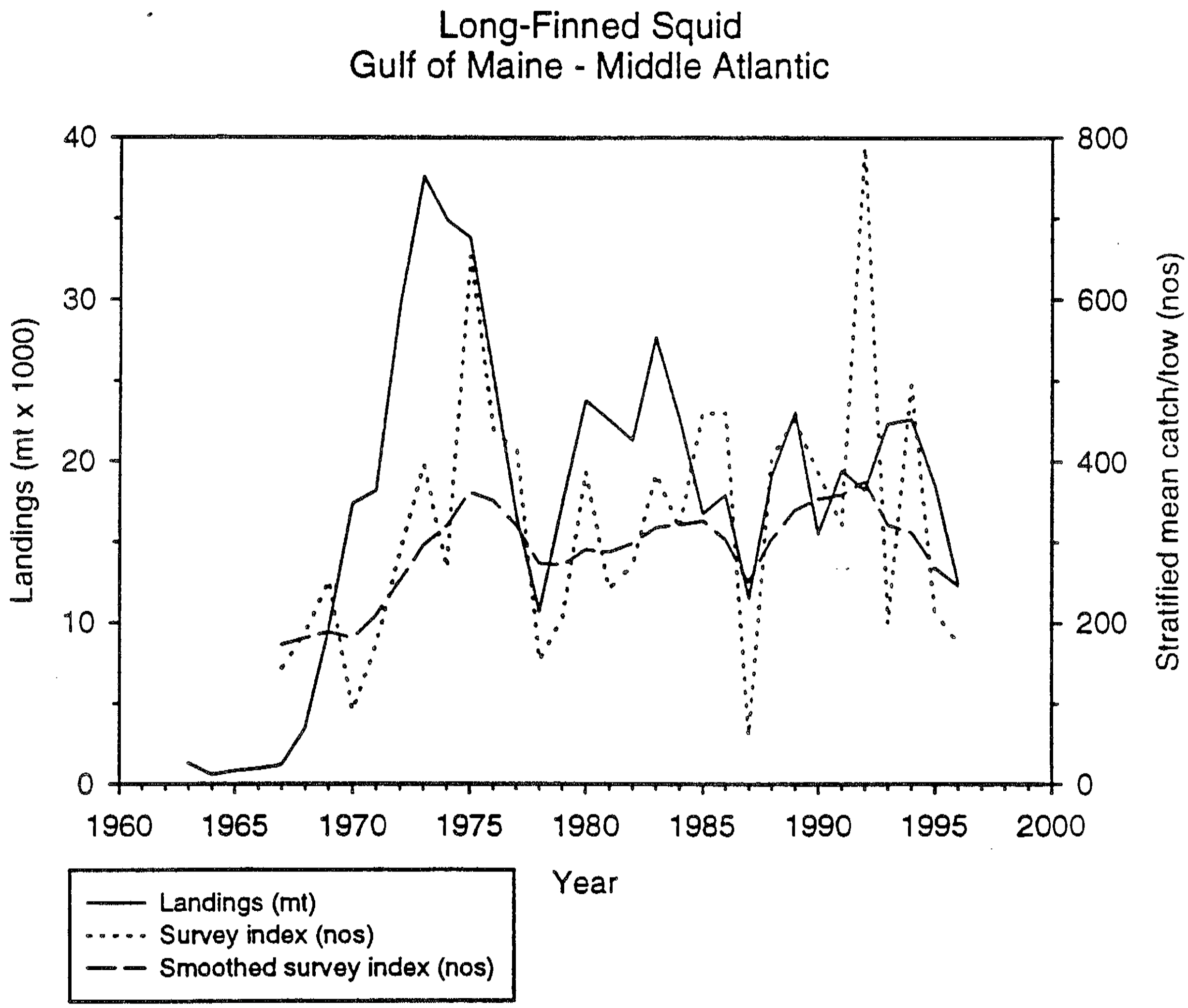


Figure 15. Commercial landings and survey indices of *Loligo* for the Gulf of Maine and Middle Atlantic, 1963-1996.
Source: Cargnelli *et al.* 1998a.

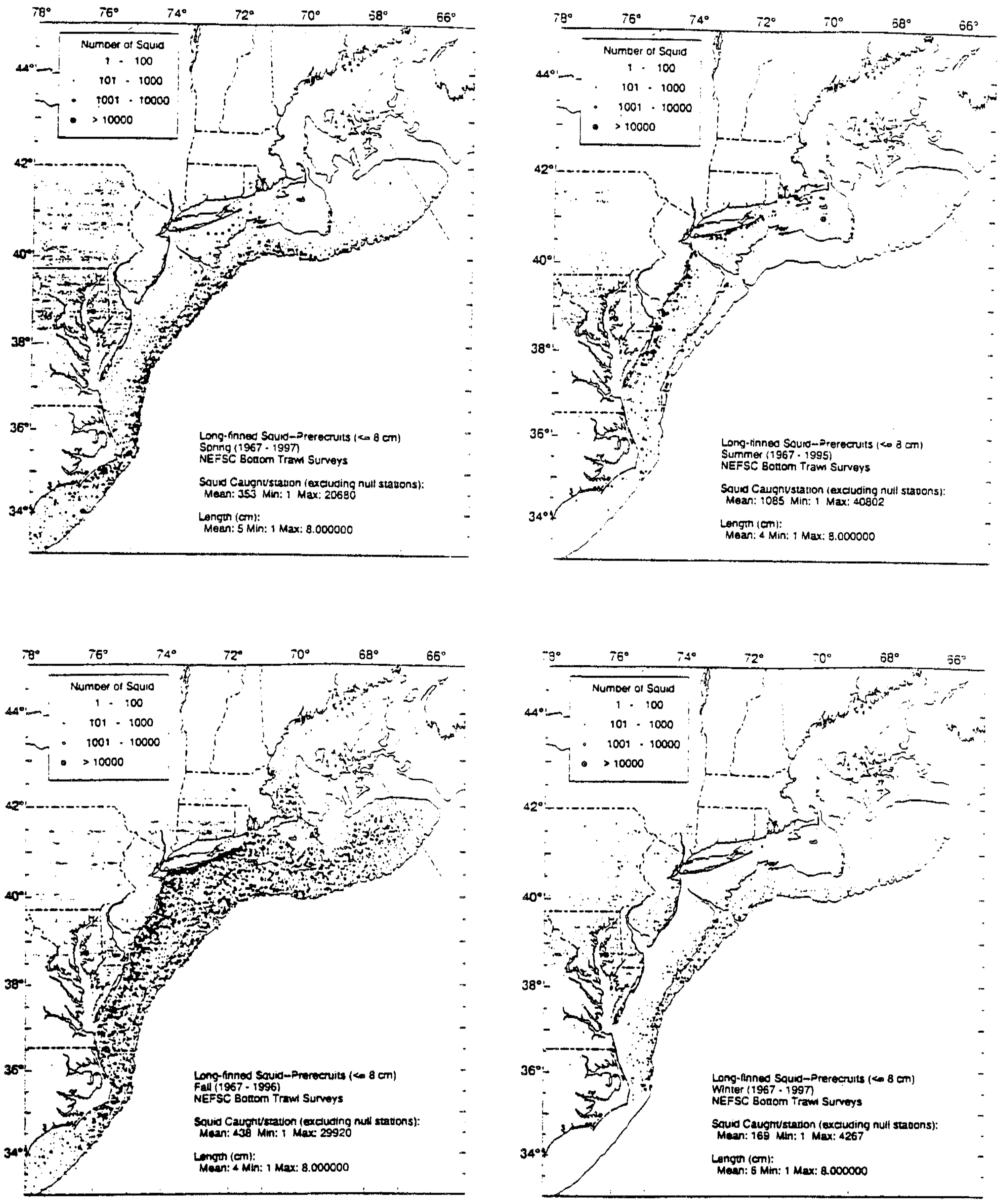


Figure 16. Distribution of *Loligo* prerecruits (≤ 8 cm) collected during NEFSC bottom trawl surveys in (a) spring, (b) summer, (c) fall, and (d) winter, during 1967-1997. Densities (number per tow) are represented by dot size.
Source: Cargnelli *et al.* 1998a.

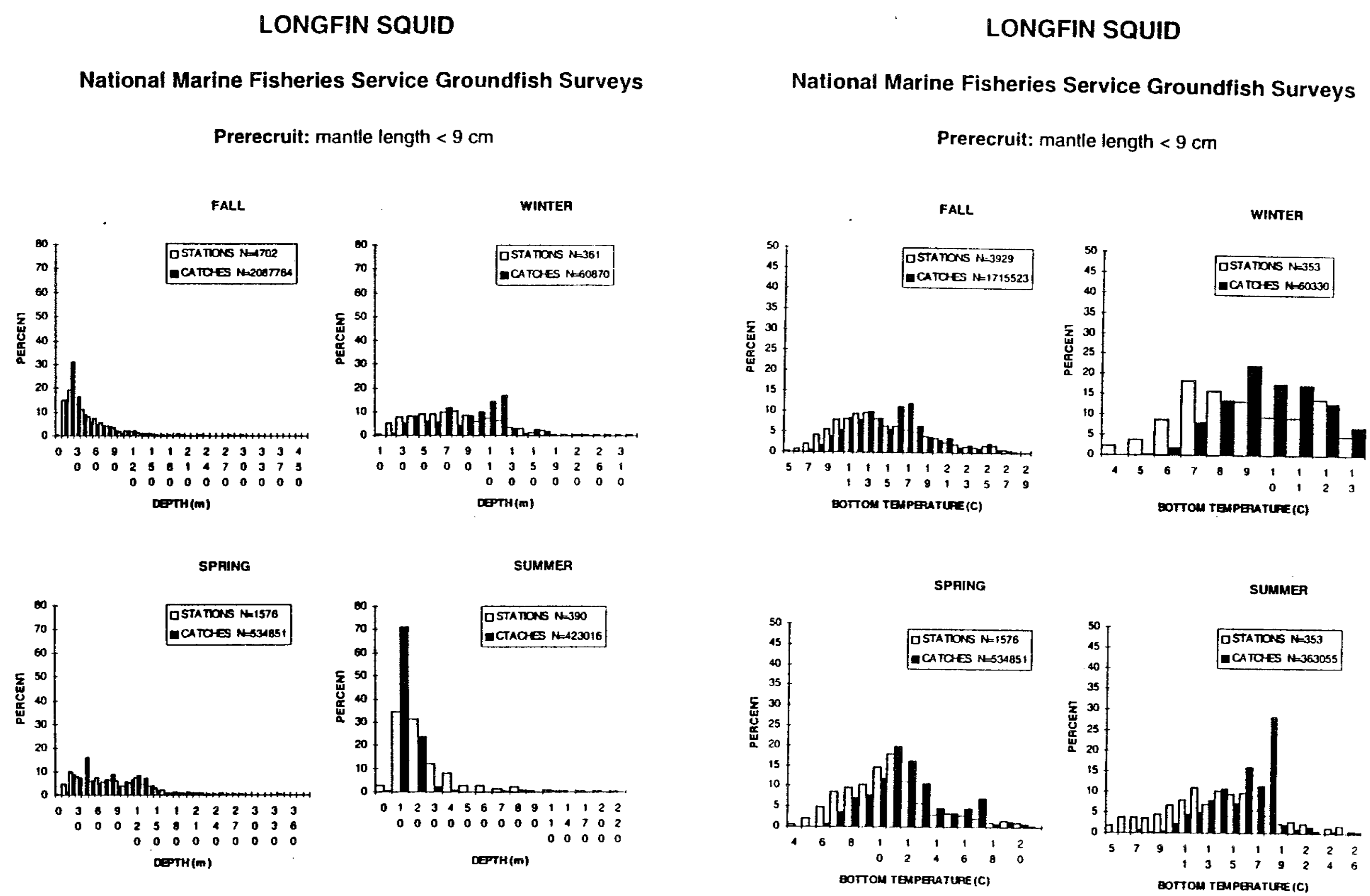


Figure 17. Histograms of *Loligo* prerecruit (≤ 9 cm) abundance relative to (a) depth and (b) water temperature, from NEFSC bottom trawl surveys (spring, summer, fall, and winter, 1967-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m^2).
Source: Cargnelli *et al.* 1998a.

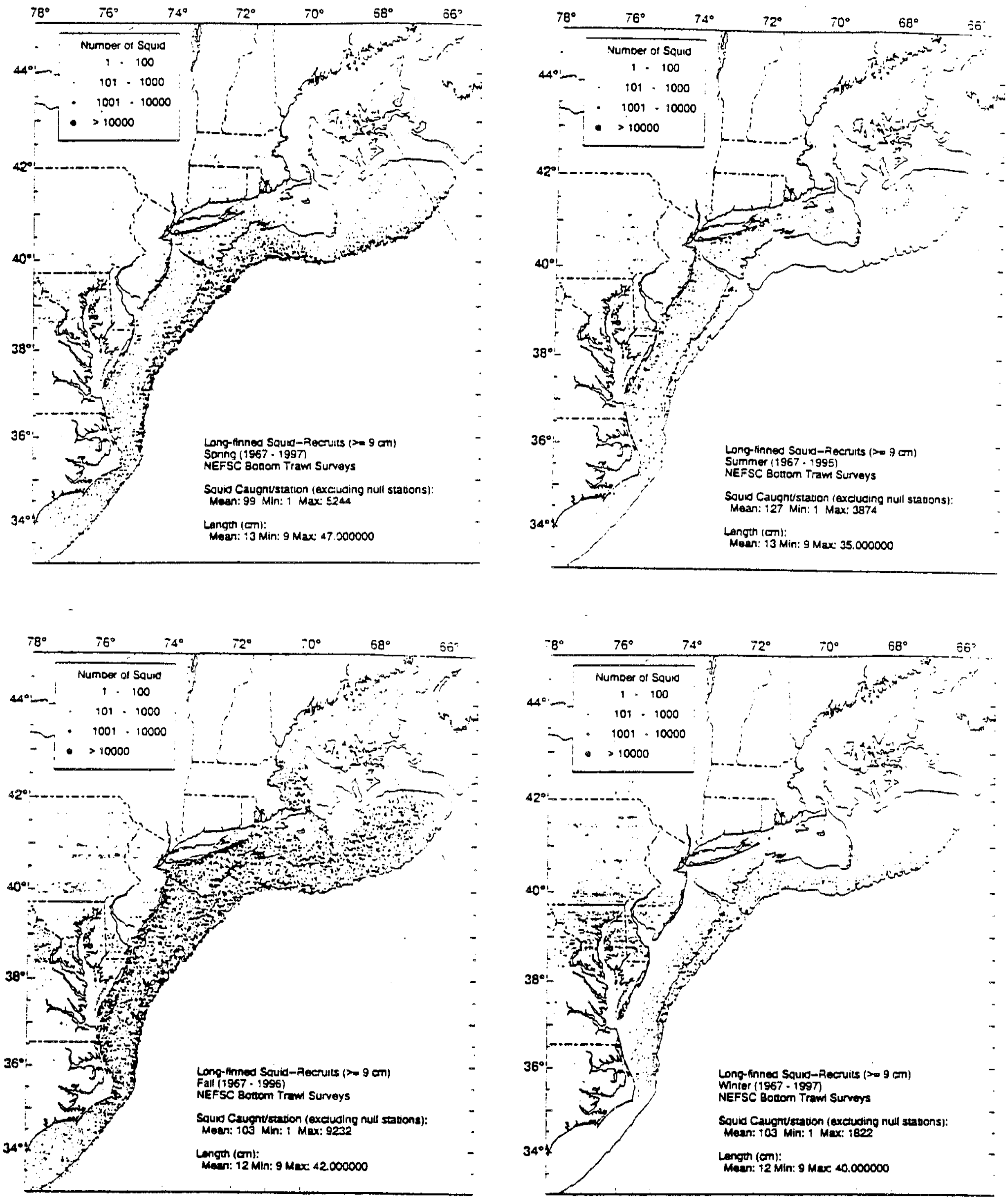


Figure 18. Distribution of *Loligo* recruits (≥ 9 cm) collected during NEFSC bottom trawl surveys in (a) spring, (b) summer, (c) fall, and (d) winter, during 1967-1997. Densities (number per tow) are represented by dot size.
Source: Cargnelli *et al.* 1998a.

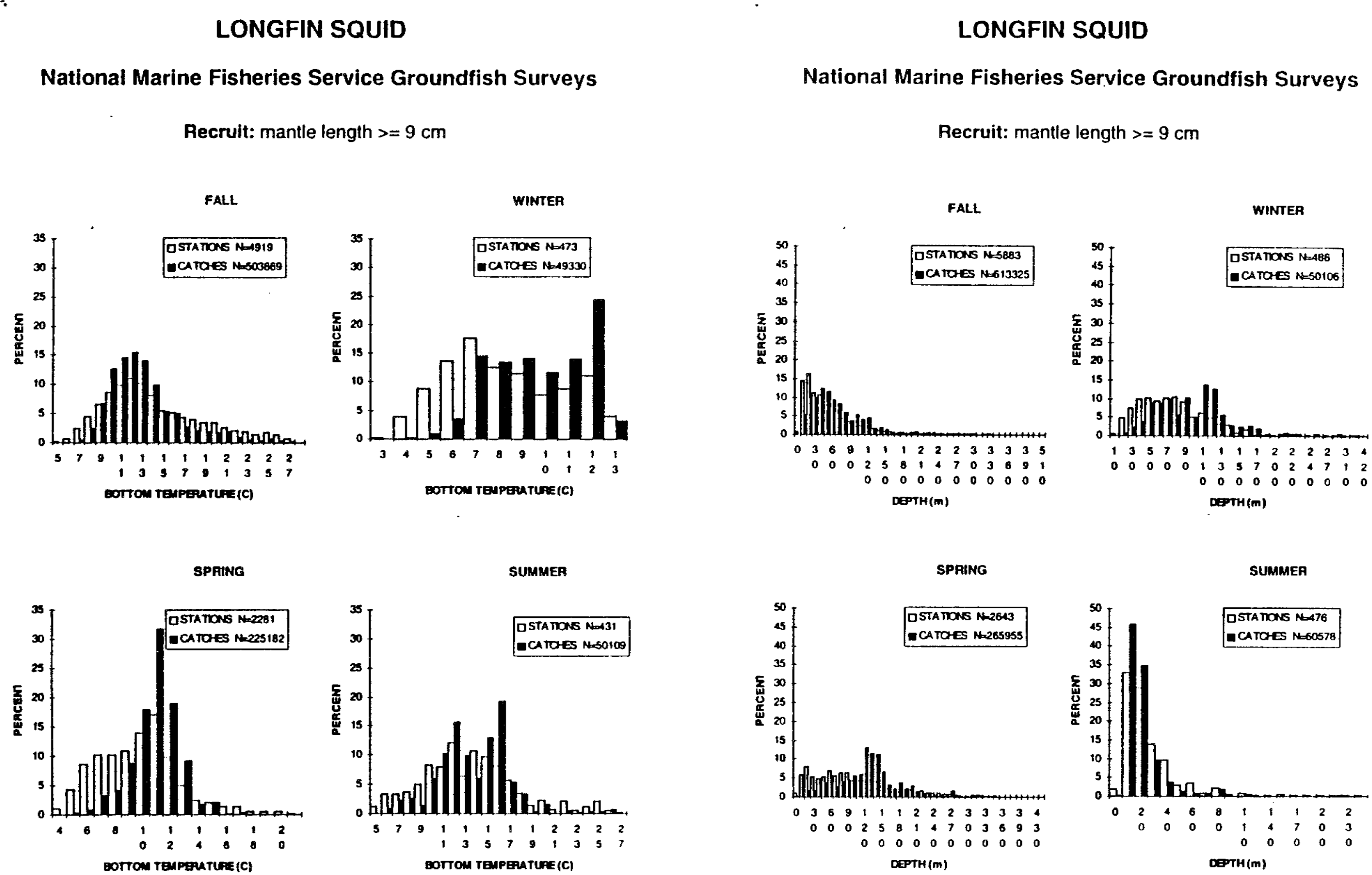
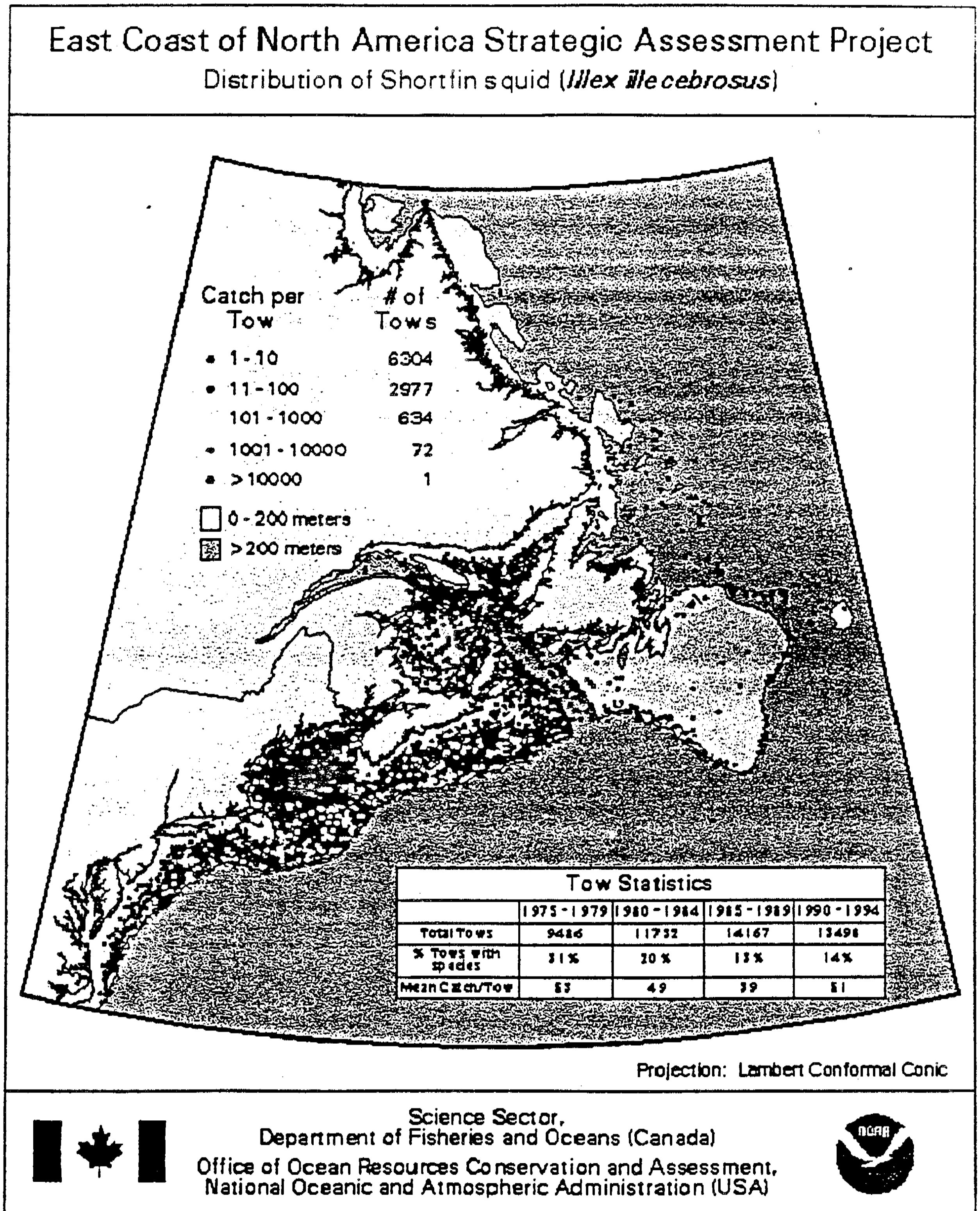


Figure 19. Histograms of *Loligo* recruit (≥ 9 cm) abundance relative to (a) depth and (b) water temperature, from NEFSC bottom trawl surveys (spring, summer, fall, and winter, 1967-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m^2).
Source: Cargnelli *et al.* 1998a.



Tow Statistics

	1975-1979	1980-1984	1985-1989	1990-1994
Total Tows	9486	11732	14167	13498
% Tows with spedes	31%	20%	13%	14%
Mean Catch/Tow	53	49	39	51

Figure 20. Overall distribution of *Illex* in the northwest Atlantic Ocean during 1975-1994. Data from the NOAA/Canada DFO East Coast of North America Strategic Assessment Project (http://www-orca.nos.noaa.gov/projects/ecnasap/ecnasap_table1.html). Source: Cargnelli *et al.* 1998b.

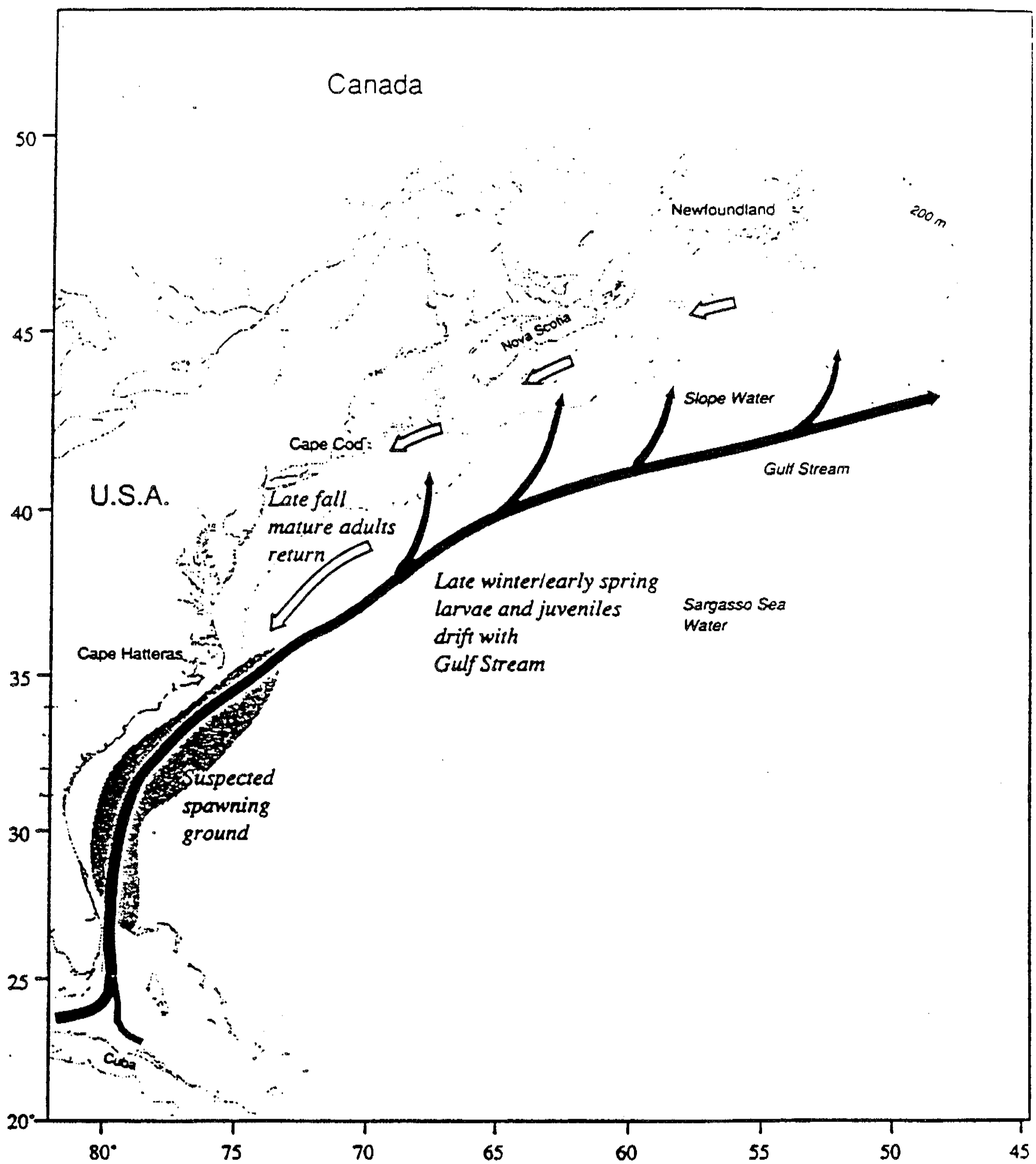


Figure 21. Hypothetical migration path of *Illex*.
Source: Black *et al.* 1987 in Cargnelli *et al.* 1998b.

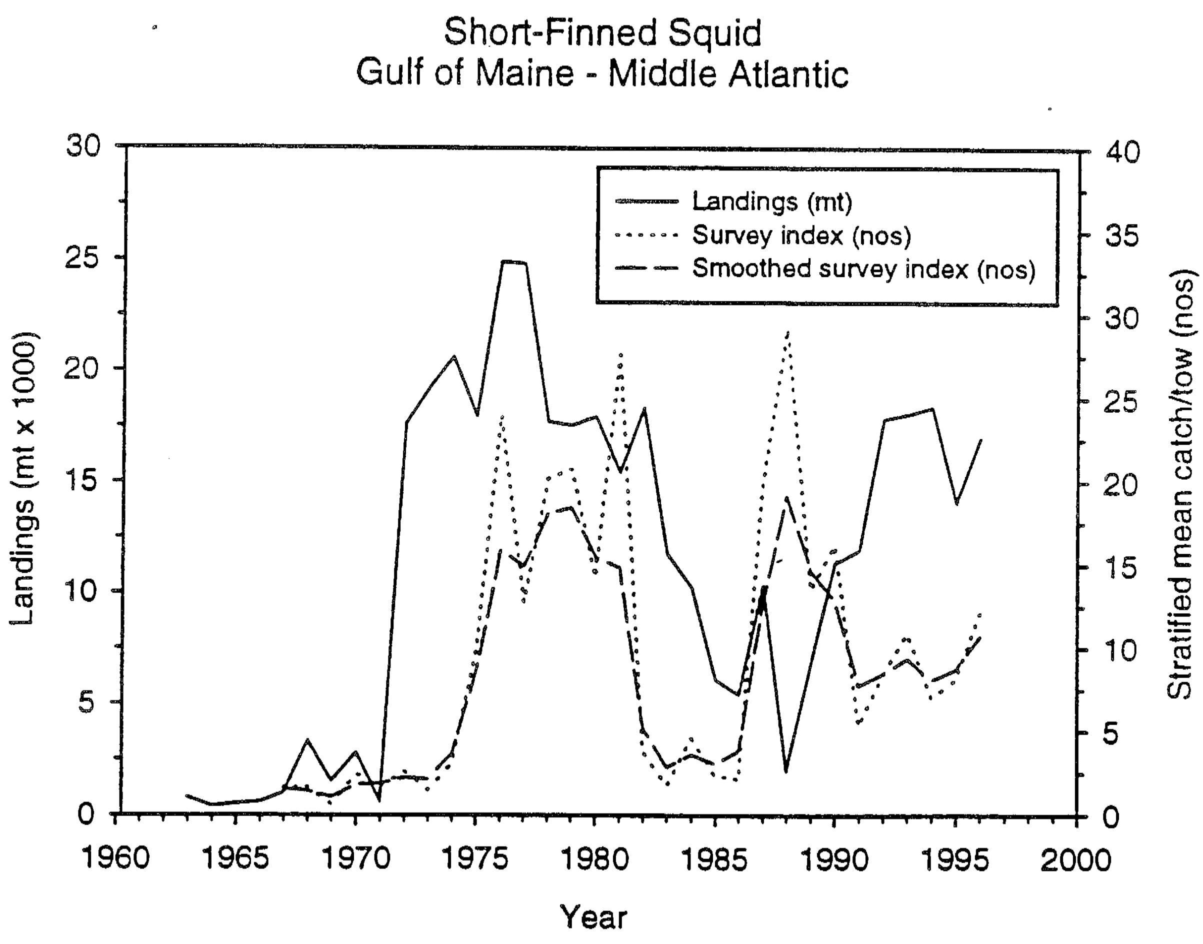
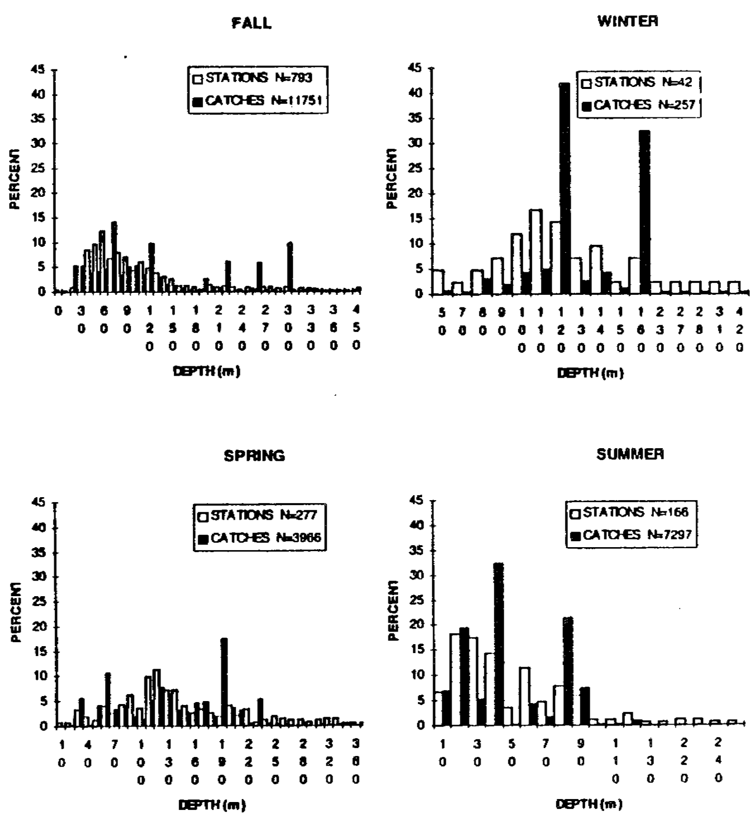


Figure 22. Commercial landings and survey indices of *Illex* for the Gulf of Maine and Middle Atlantic, 1963-1996.
Source: Cargnelli *et al.* 1998b.

SHORTFIN SQUID

National Marine Fisheries Service Groundfish Surveys

Prerecruit: mantle length < 11 cm



SHORTFIN SQUID

National Marine Fisheries Service Groundfish Surveys

Prerecruit: mantle length < 11 cm

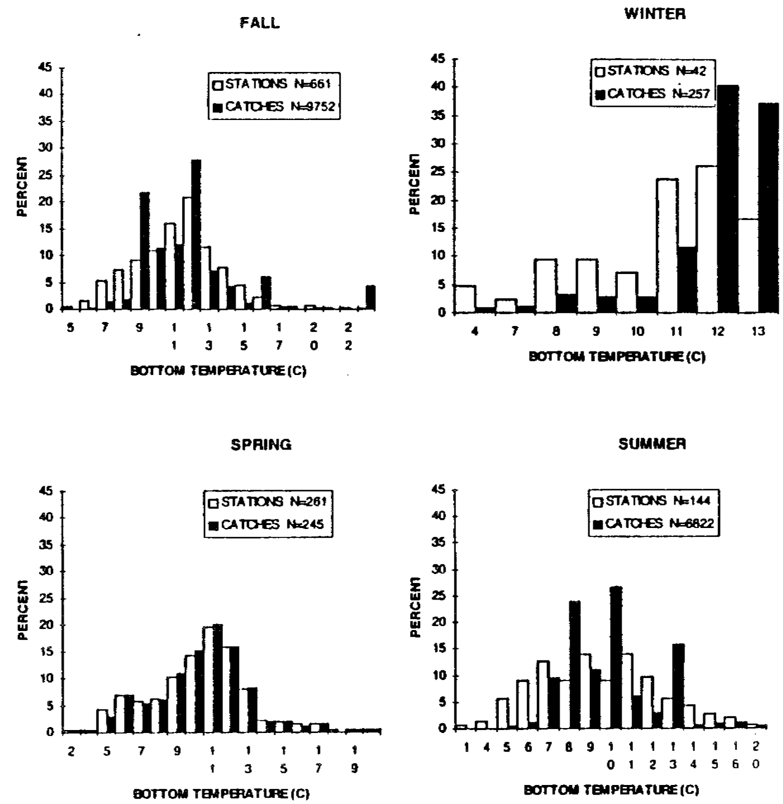


Figure 23. Histograms of *Illex* prerecruit (< 11 cm) abundance relative to (a) depth and (b) water temperature from NEFSC bottom trawl surveys (spring, summer, fall, and winter, 1963-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m^2).
Source: Cargnelli *et al.* 1998b.

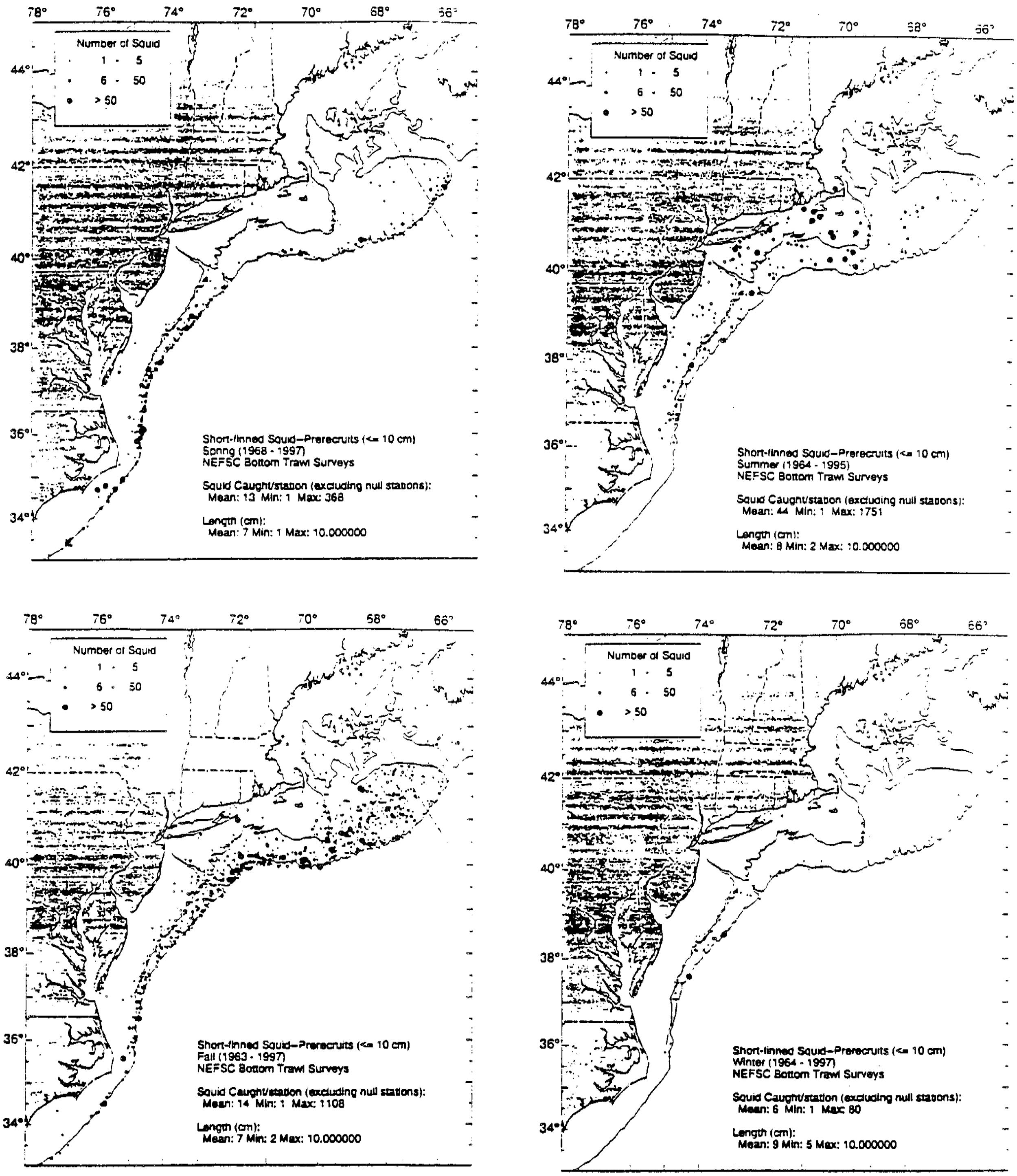


Figure 24. Distribution of *Illex* prerecruits (≤ 10 cm) collected during NEFSC bottom trawl surveys in (a) spring, (b) summer, (c) fall, and (d) winter, 1963-1997. Densities (number per tow) are represented by dot size.
Source: Cargnelli *et al.* 1998b.

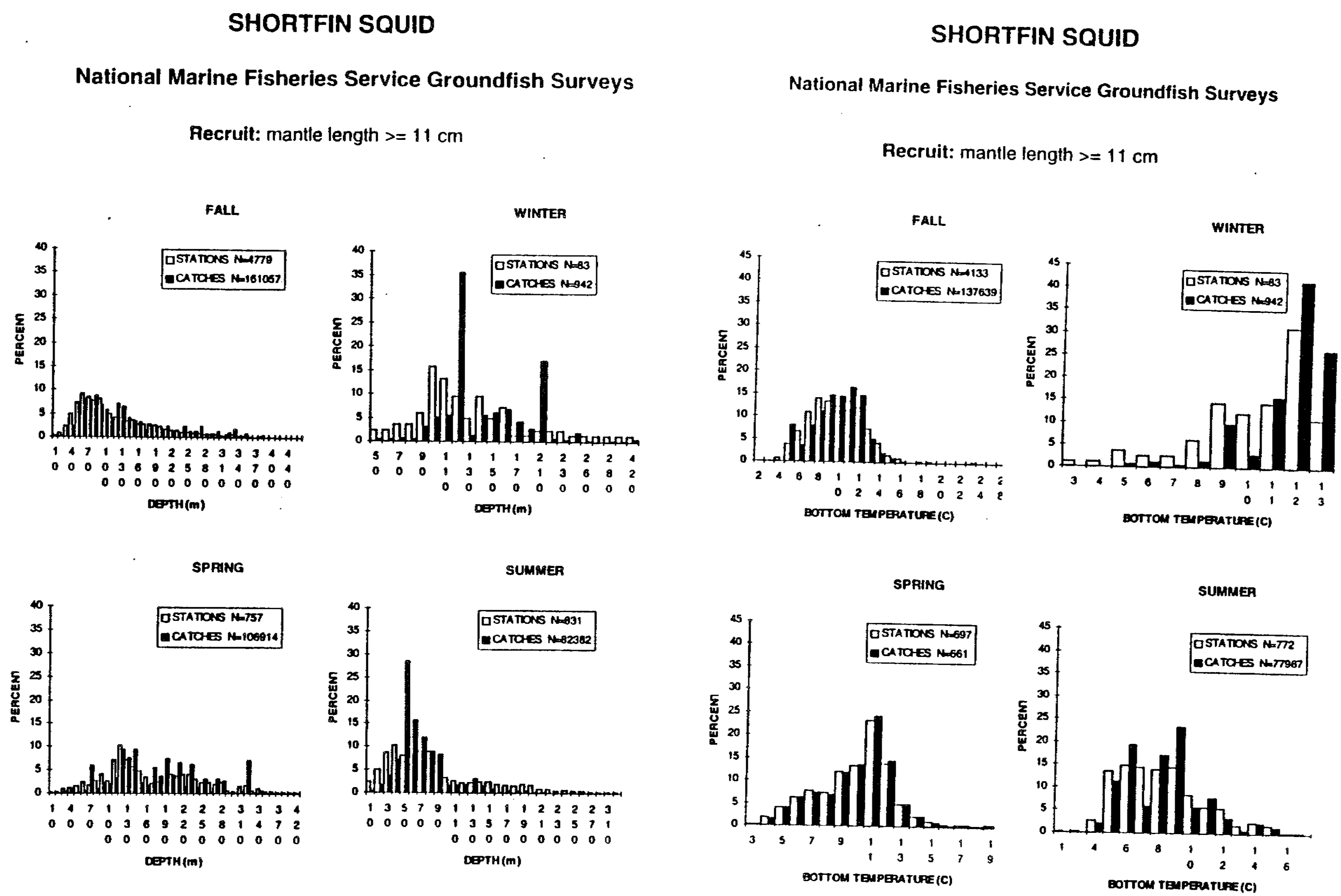


Figure 25. Histograms of *Illex* recruit (≥ 11 cm) abundance relative to (a) depth and (b) water temperature, from NEFSC bottom trawl surveys (spring, summer, fall, and winter, 1963-1997). Open bars represent the proportion of all stations surveyed; solid bars represent the proportion of the sum of all standardized catches (number/10m²).
Source: Cargnelli *et al.* 1998b.

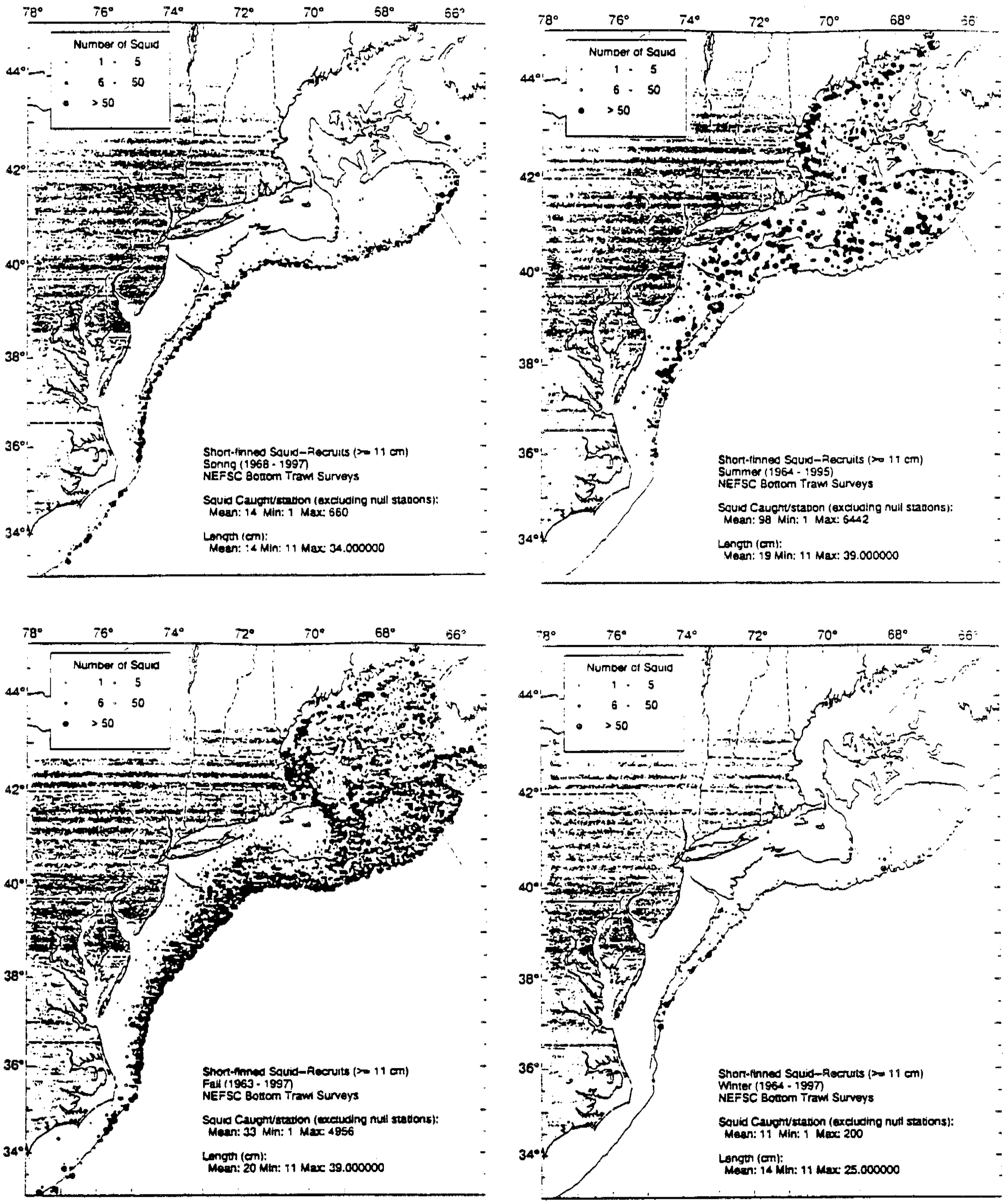
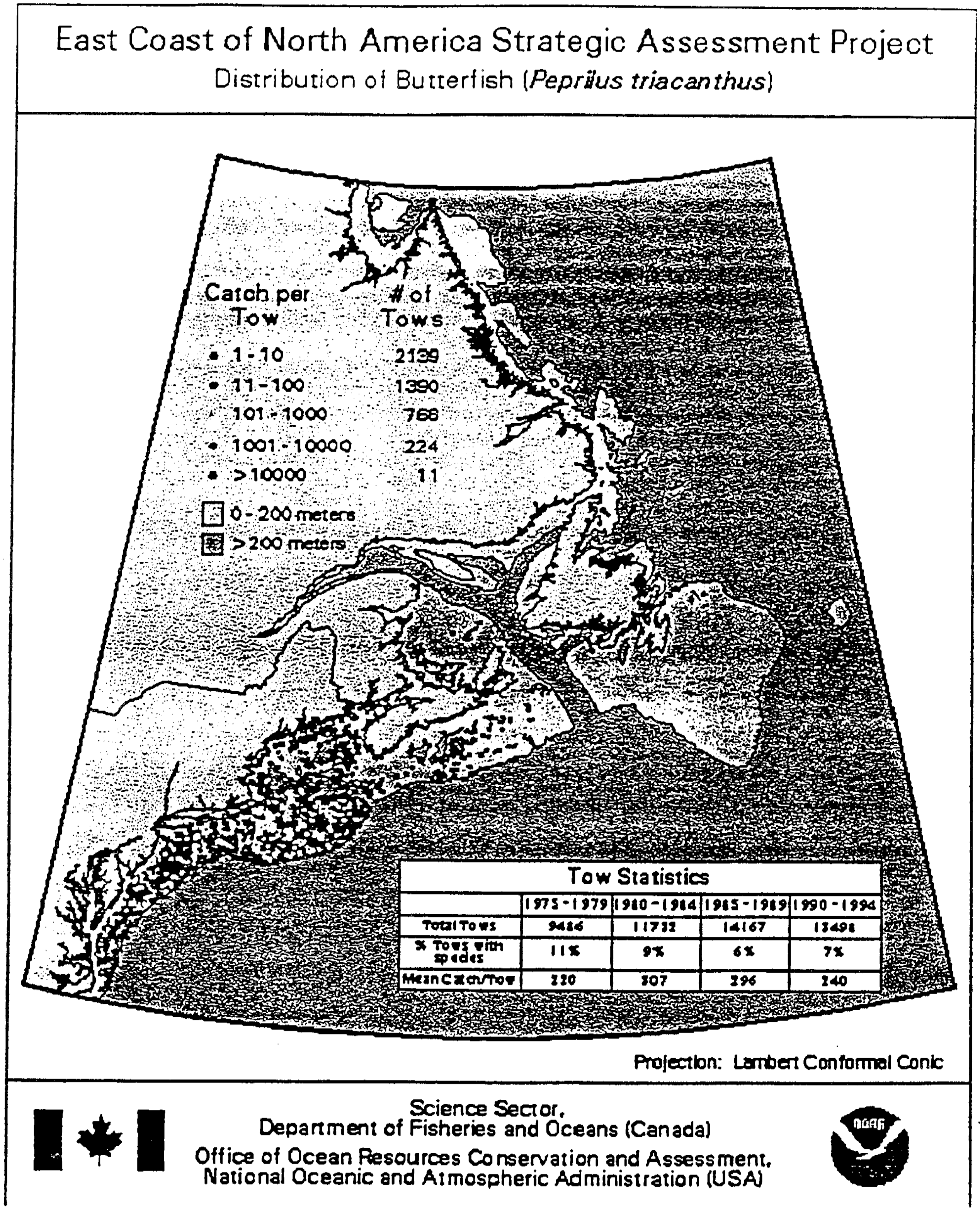


Figure 26. Distribution of *Illex* recruits (≥ 11 cm) collected during NEFSC bottom trawl surveys in (a) spring, (b) summer, (c) fall, and (d) winter. Densities (number per tow) are represented by dot size.
Source: Cargnelli *et al.* 1998b.



Tow Statistics				
	1975-1979	1980-1984	1985-1989	1990-1994
Total Tows	9486	11732	14167	13498
% Tows with species	11%	9%	6%	7%
Mean Catch/Tow	220	307	296	240

Figure 27. Distribution of butterfish from Newfoundland to Cape Hatteras from the East Coast of North America Strategic Assessment Project (NOAA/NOS and DFO, Canada). Source: EFH Butterfish Team 1998.

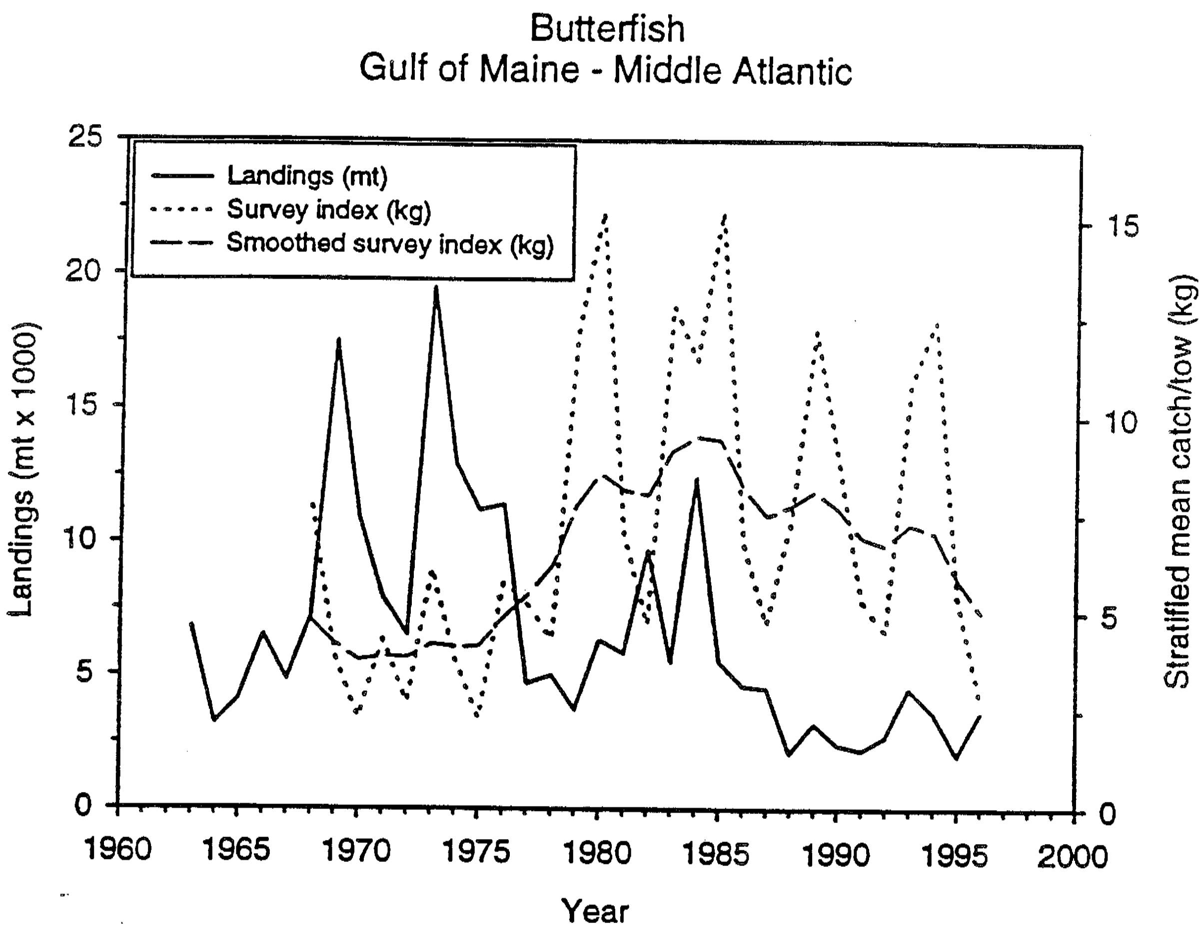


Figure 28. Commercial landings and NEFSC bottom trawl survey indices for butterfish from the Gulf of Maine to the Middle Atlantic (NEFSC 1994, in press).
Source: EFH Butterfish Team 1998.

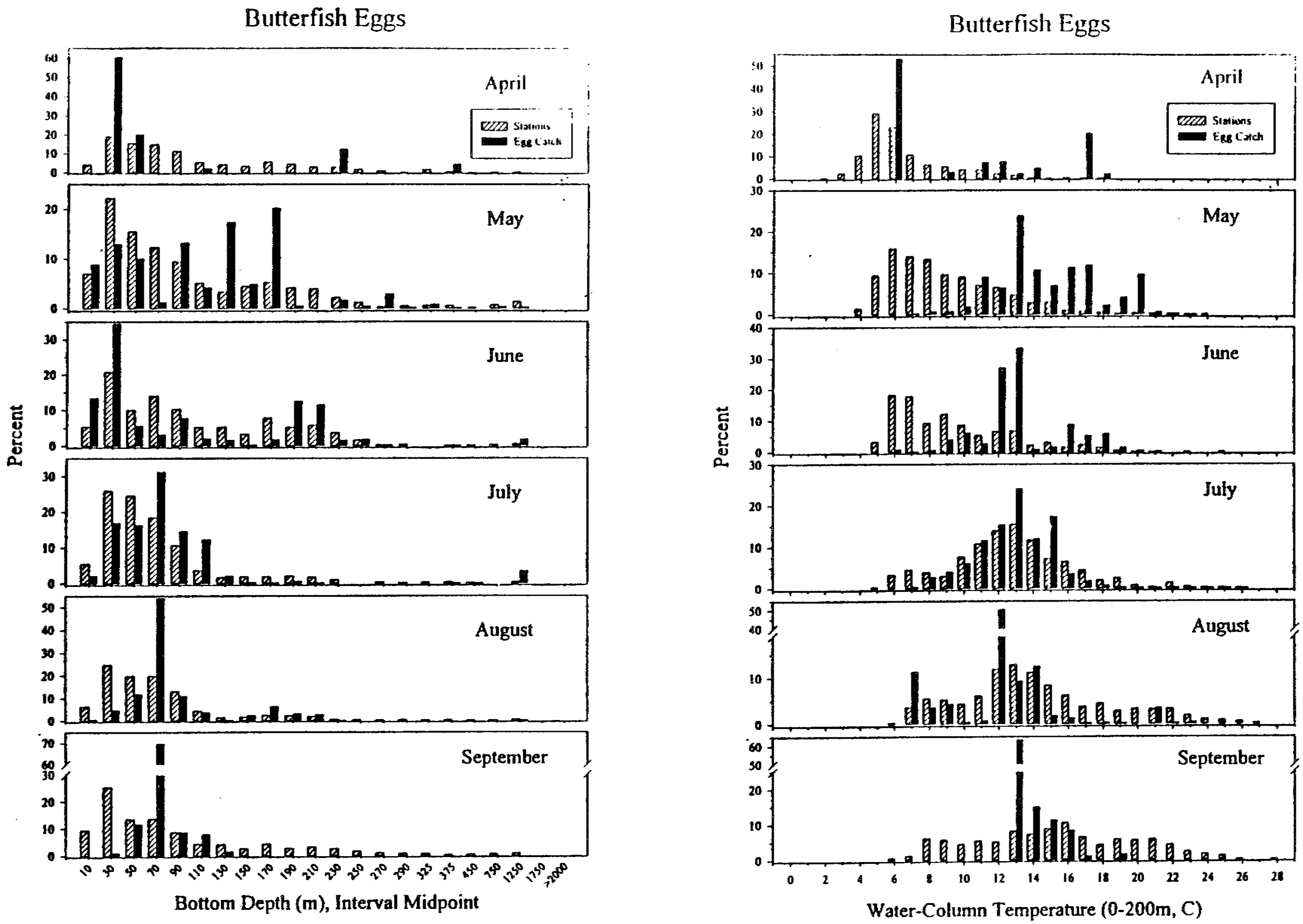


Figure 29. Distribution of samples containing butterfish eggs relative to (a) bottom depth and (b) surface water temperatures during MARMAP ichthyoplankton surveys (1987-1997), by month, for all years combined.
Source: EFH Butterfish Team 1998.

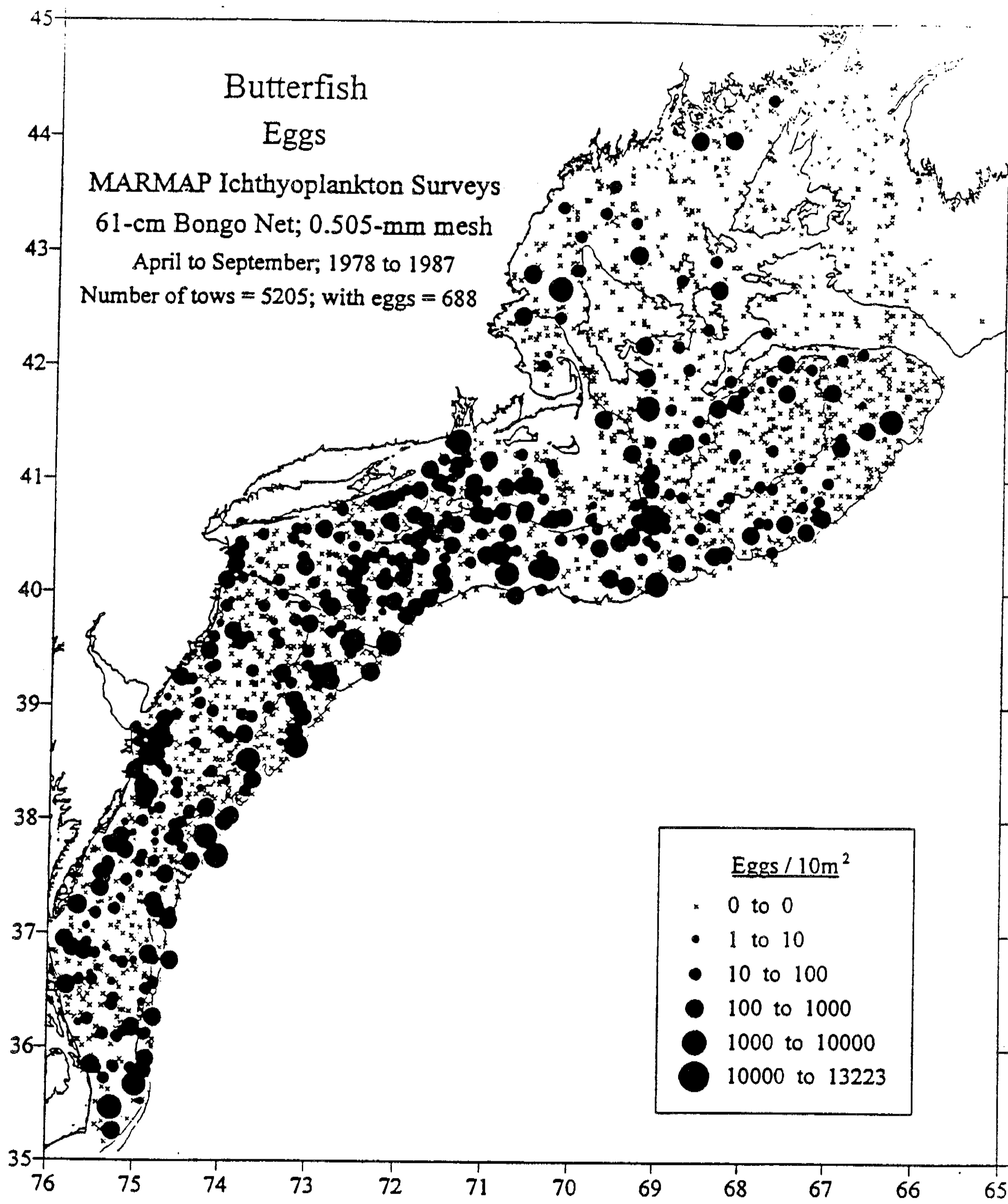


Figure 30. Distribution of butterfish eggs during MARMAP Ichthyoplankton Survey (1978-1987) for all months and years combined. Eggs were collected from April through September. Source: EFH Butterfish Team 1998.

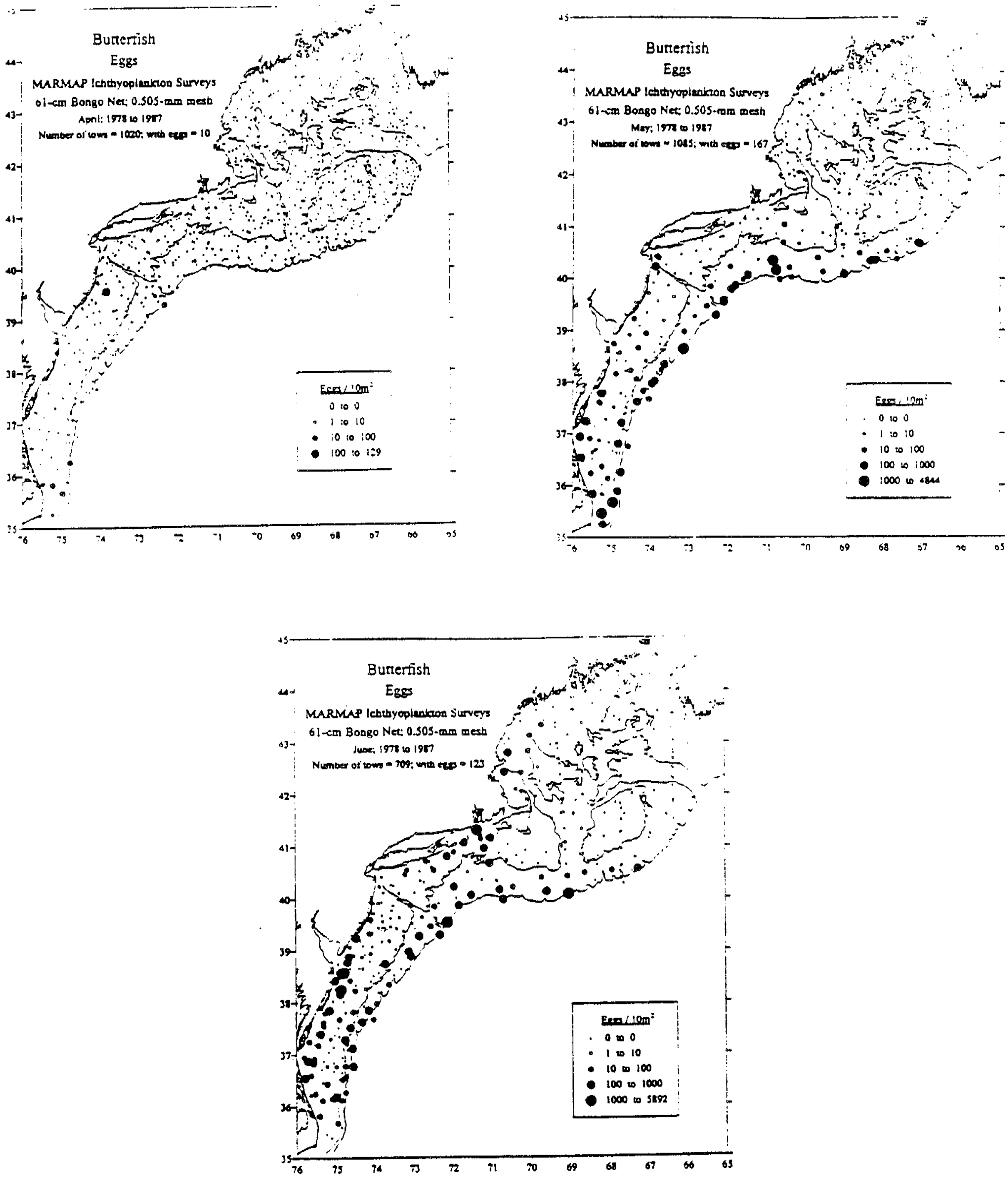


Figure 31. Distribution of butterfish eggs during MARMAP Ichthyoplankton Survey (1978-1987), for the months of (a) April, (b) May, and (c) June, all years combined. Source: EFH Butterfish Team 1998.

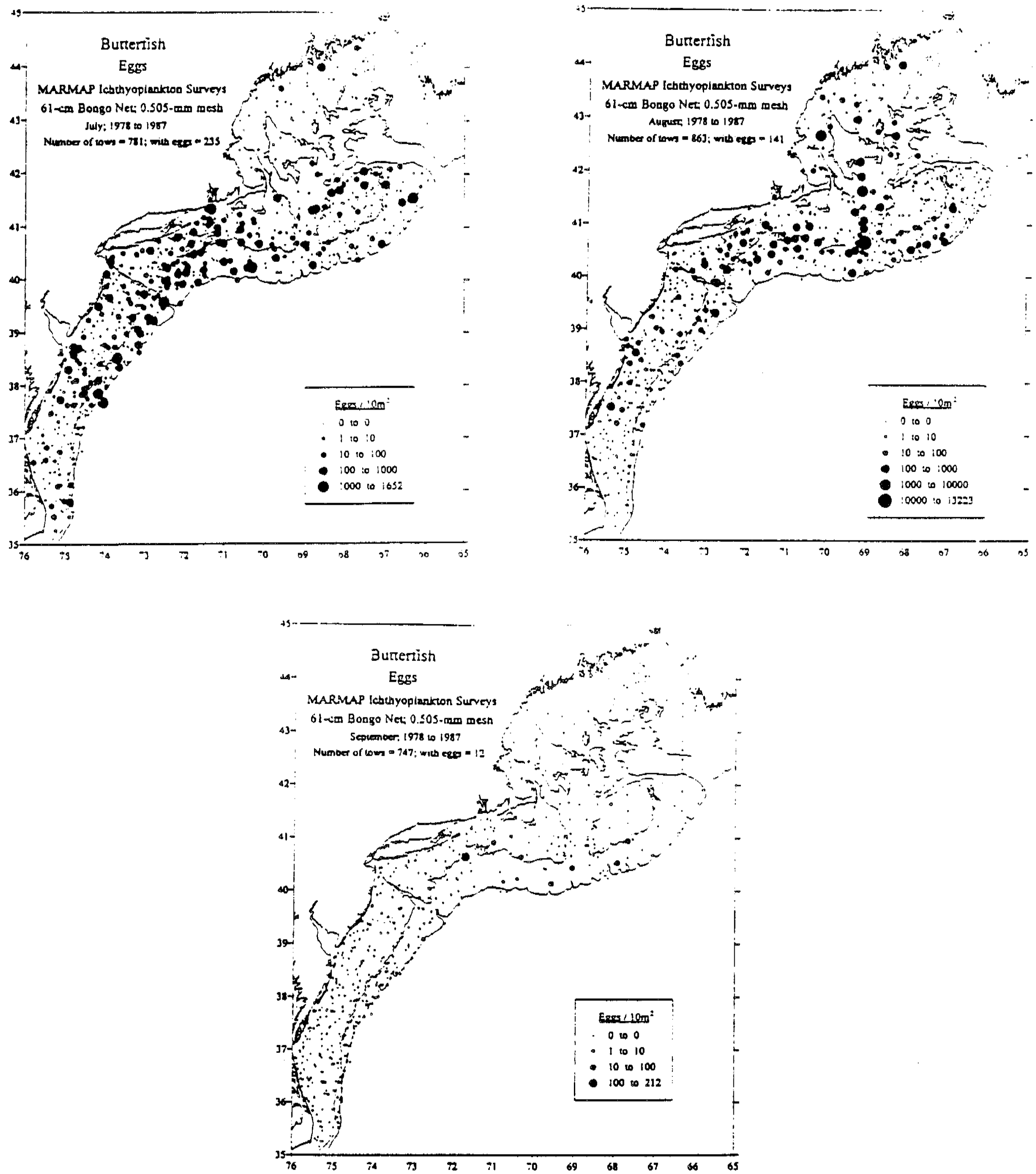


Figure 31 (continued). Distribution of butterfish eggs during MARMAP Ichthyoplankton Survey (1978-1987), for the months of (d)July, (e) August, and (f) September, all years combined. Source: EFH Butterfish Team 1998.

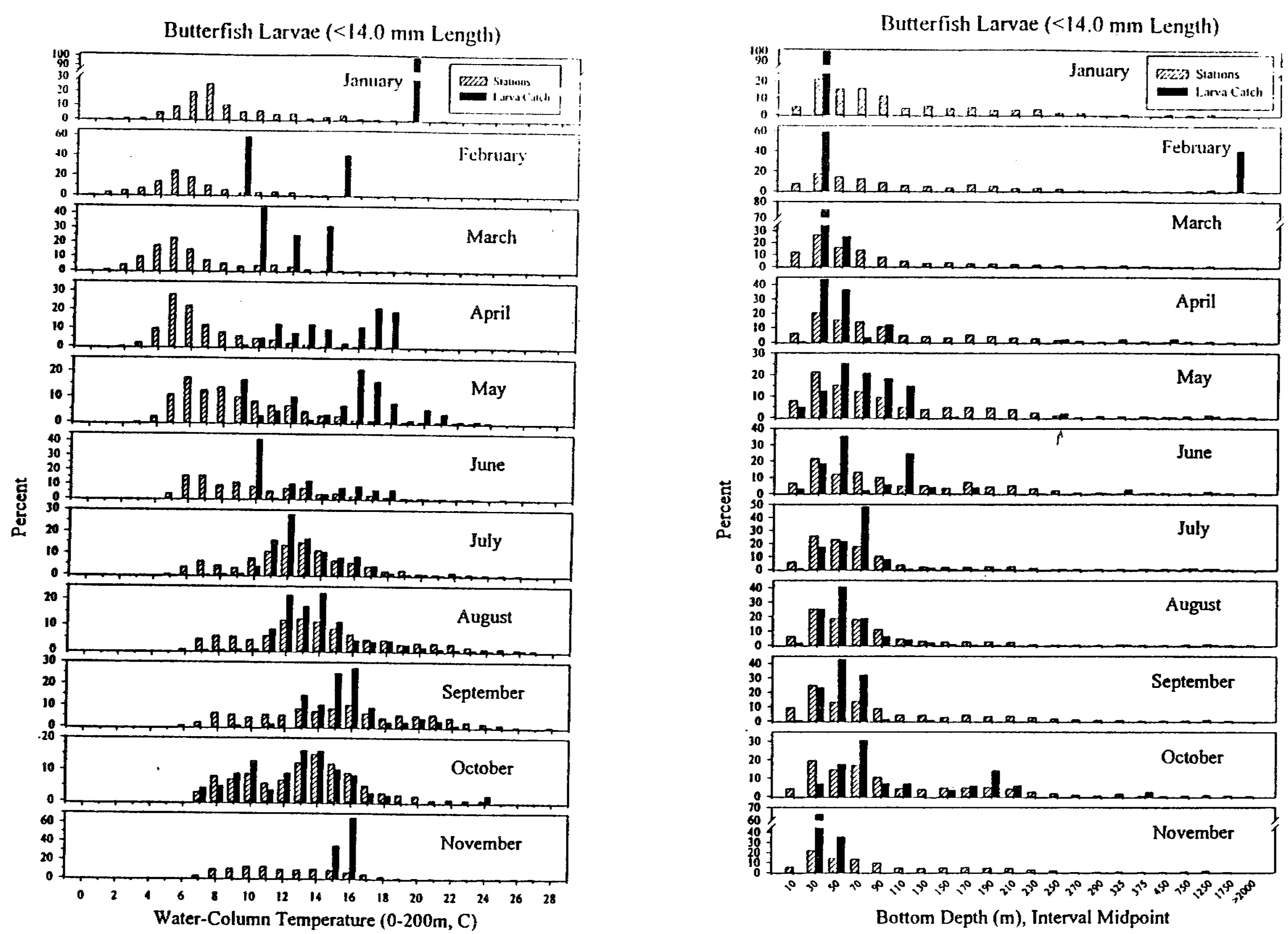


Figure 32. Distribution of samples containing butterfish larvae relative to (a) bottom depth and (b) surface water temperatures during MARMAP ichthyoplankton surveys (1987-1997), by month, for all years combined.
Source: EFH Butterfish Team 1998.

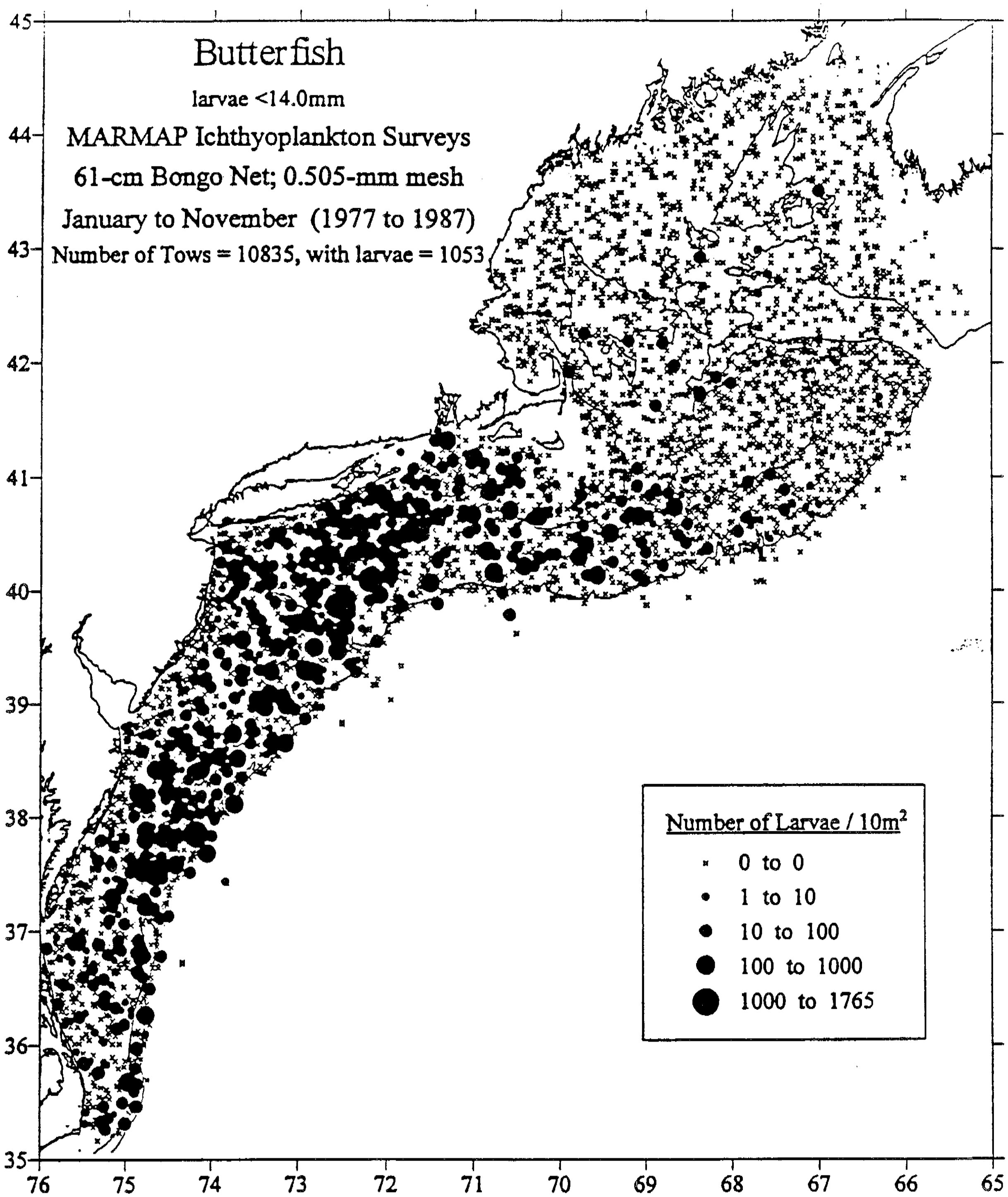


Figure 33. Distribution of butterfish larvae during MARMAP Ichthyoplankton Survey (1978-1987) for all months and years combined. Larvae were collected from January through November. Source: EFH Butterfish Team 1998.

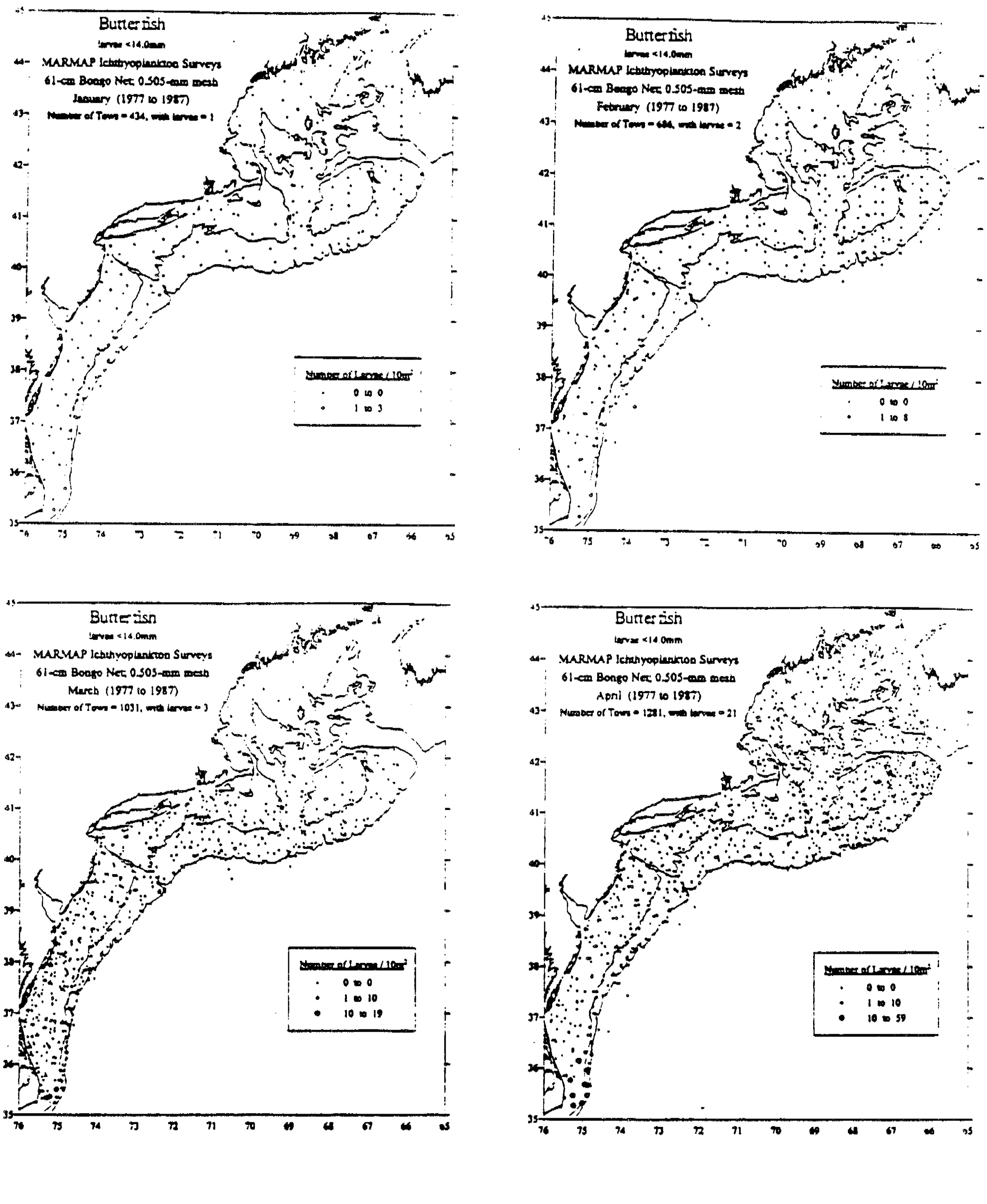


Figure 34. Distribution of butterfish larvae during MARMAP Ichthyoplankton Survey (1978-1987), for the months of (a) January, (b) February, (c) March, and (d) April, all years combined. Source: EFH Butterfish Team 1998.

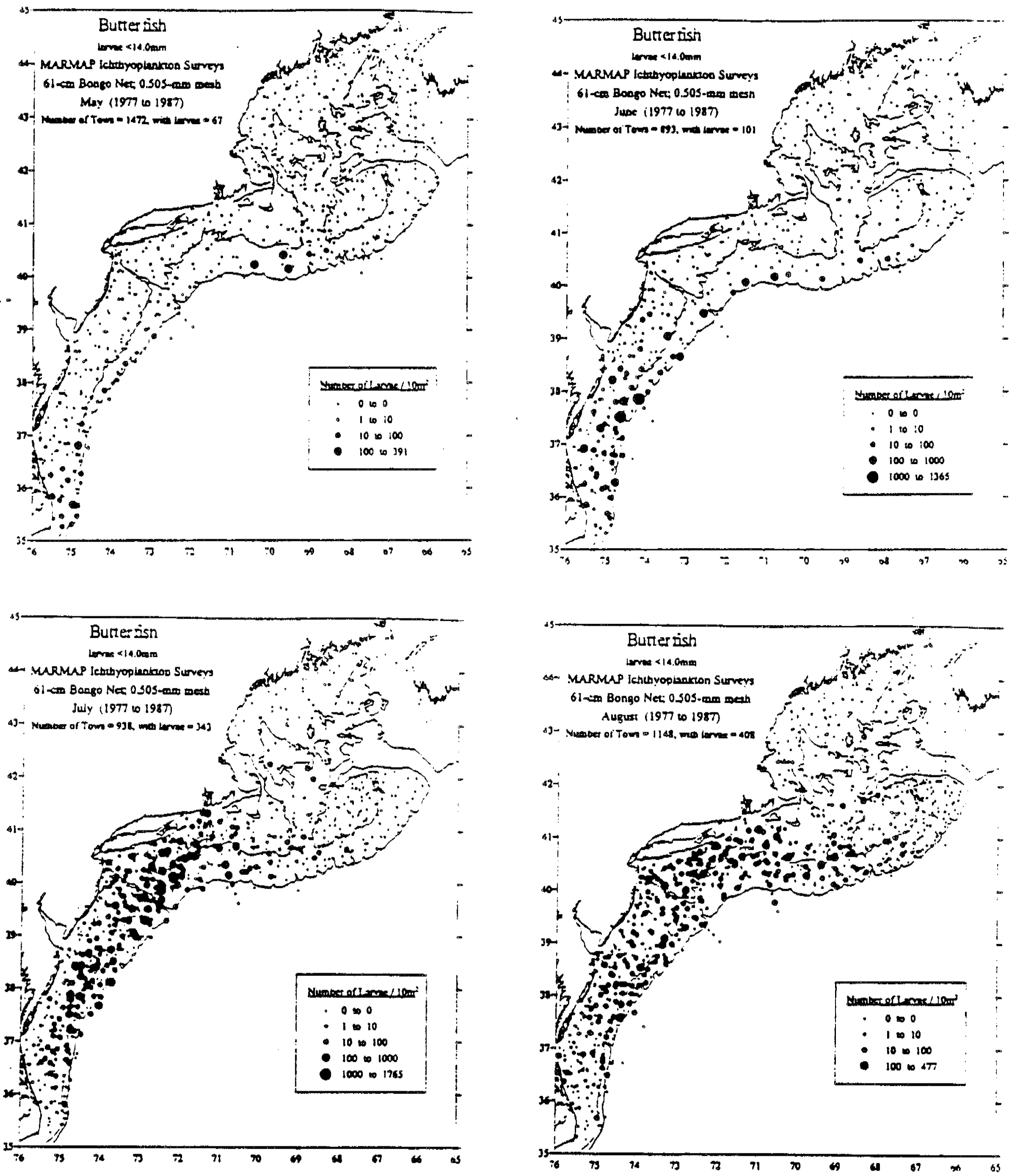


Figure 34 (continued). Distribution of butterfish larvae during MARMAP Ichthyoplankton Survey (1978-1987), for the months of (e) May, (f) June, (g) July, and (h) August, all years combined. Source: EFH Butterfish Team 1998.

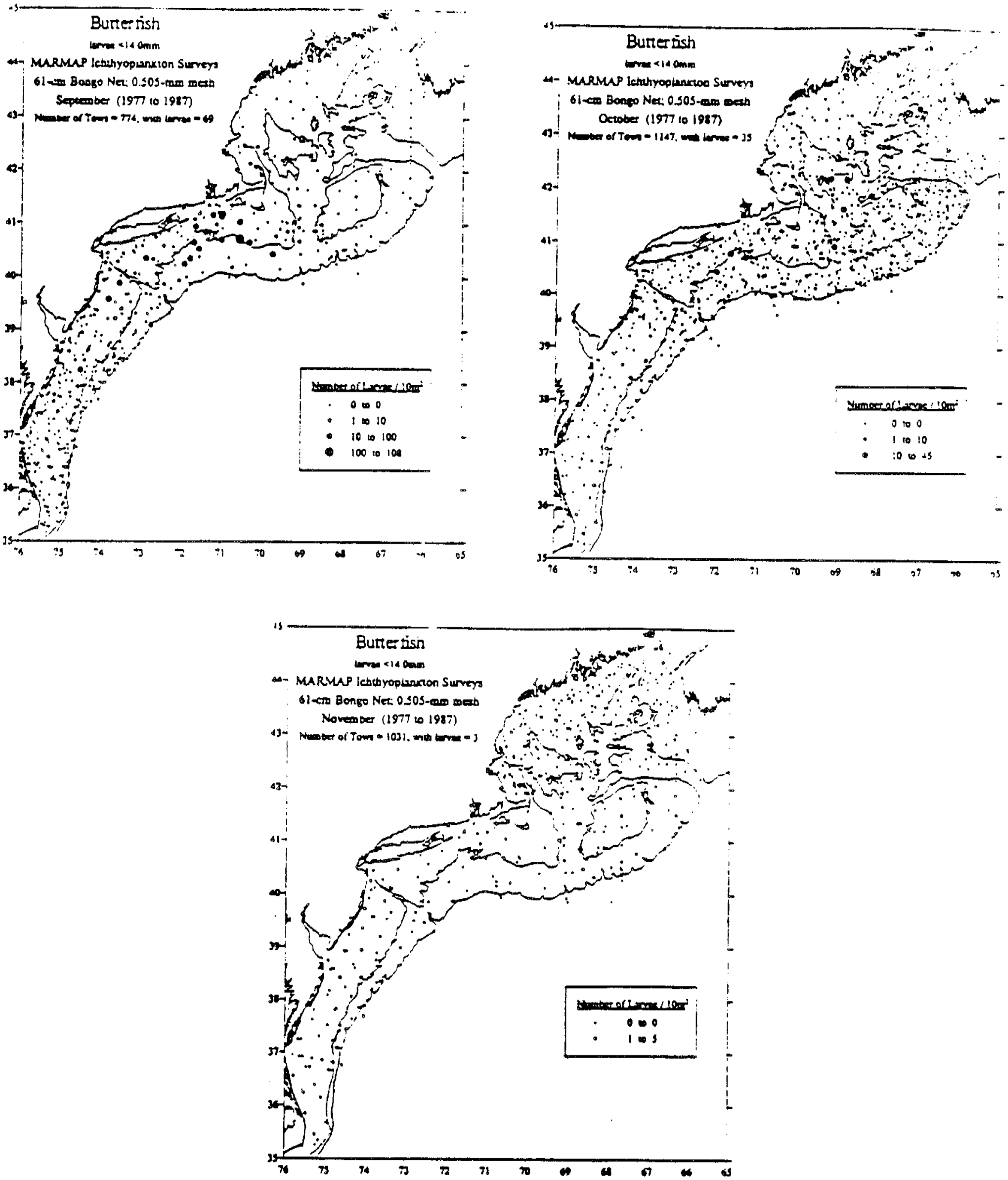


Figure 34 (continued). Distribution of butterfish larvae during MARMAP Ichthyoplankton Survey (1978-1987), for the months of (i) September, (j) October, and (k) November, all years combined. Source: EFH Butterfish Team 1998.

BUTTERFISH

National Marine Fisheries Service Groundfish Surveys

Juvenile Fish: total fish length < 12 cm

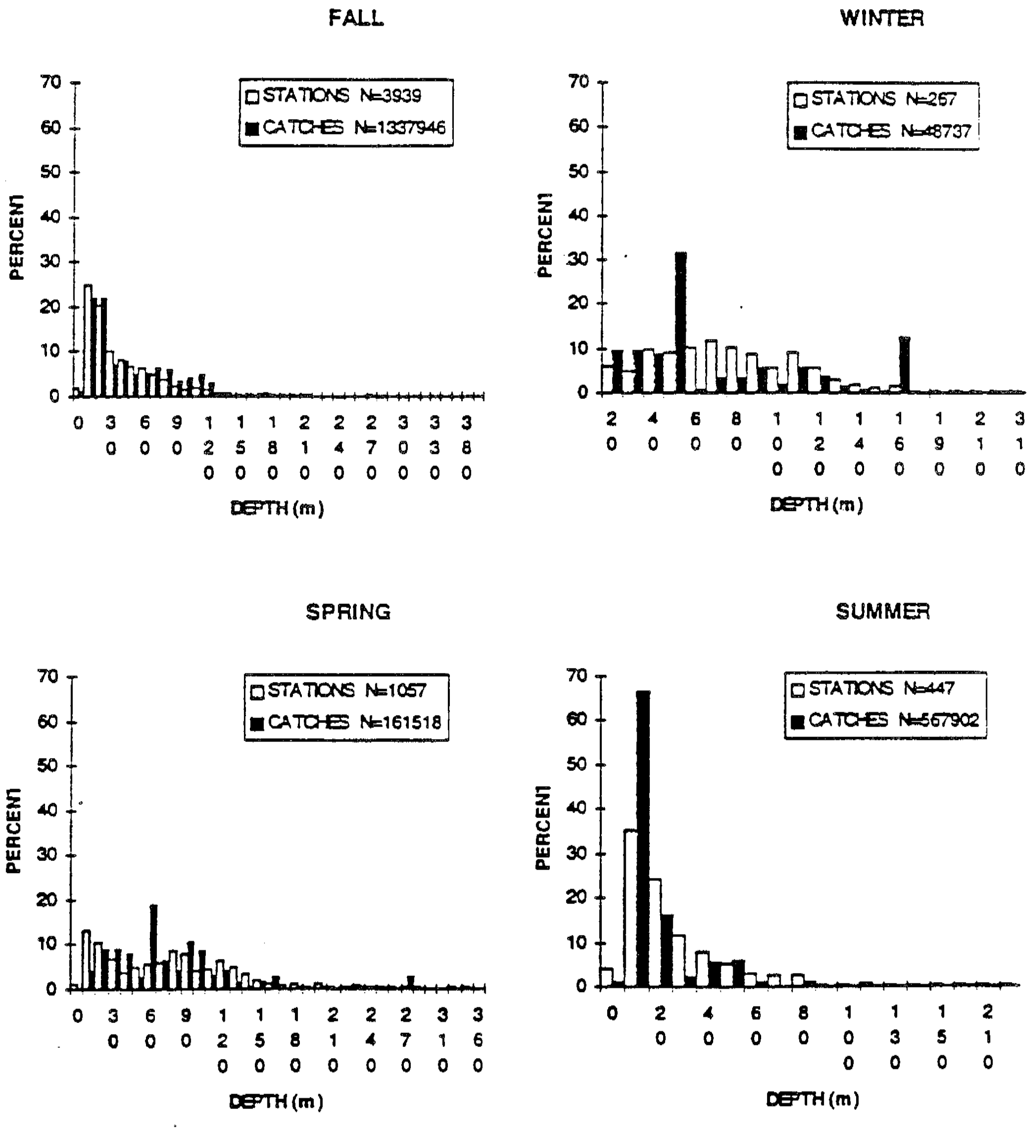


Figure 35. Distribution of bottom depths for trawls containing juvenile butterfish during NEFSC bottom trawl surveys (1964-1997), by season, for all years combined.
Source: EFH Butterfish Team 1998.

BUTTERFISH

National Marine Fisheries Service Groundfish Surveys

Juvenile Fish: total fish length < 12 cm

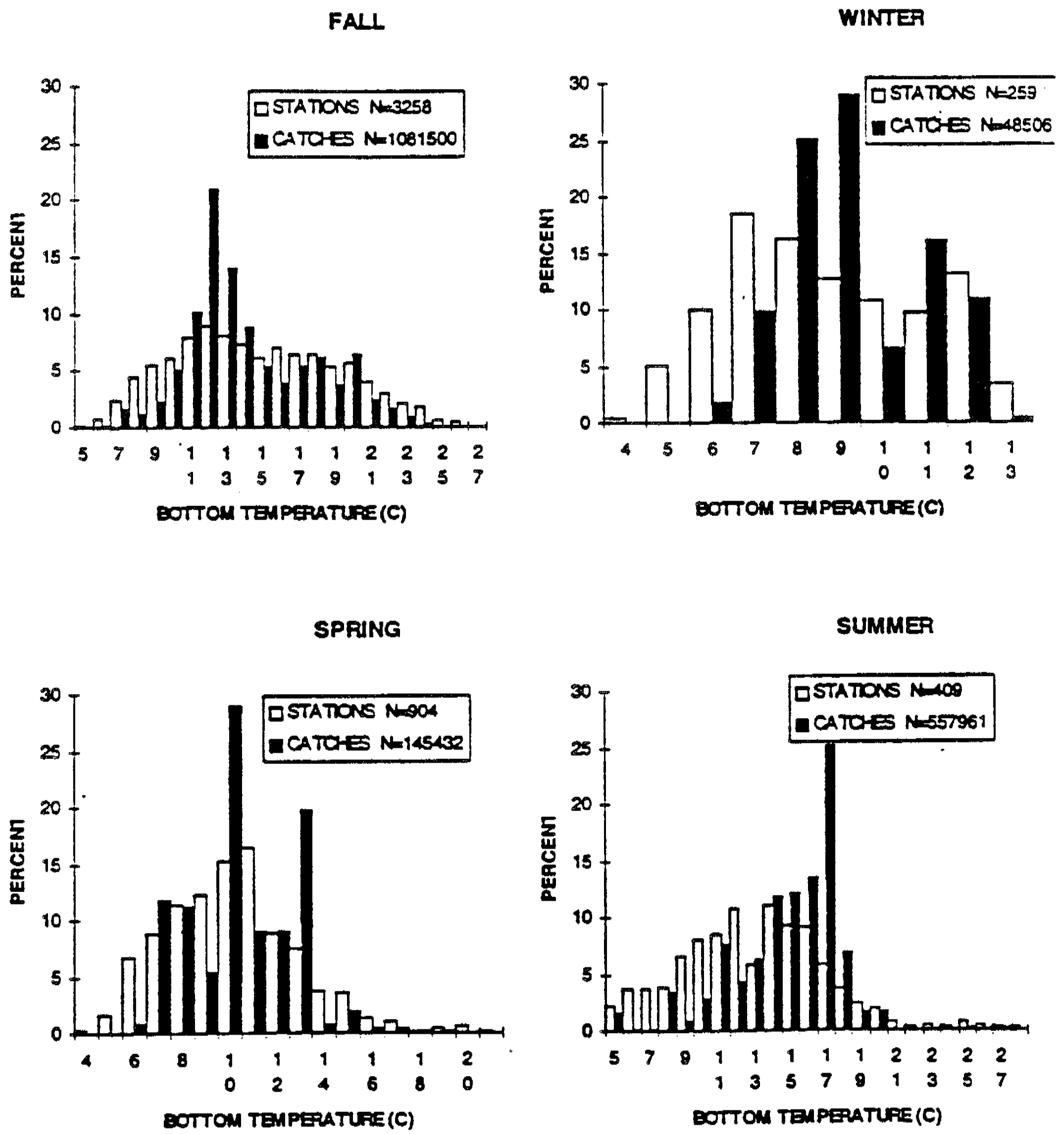


Figure 36. Distribution of bottom water temperatures for trawls containing juvenile butterfish during NEFSC bottom trawl surveys (1964-1997), by season, for all years combined. Source: EFH Butterfish Team 1998.

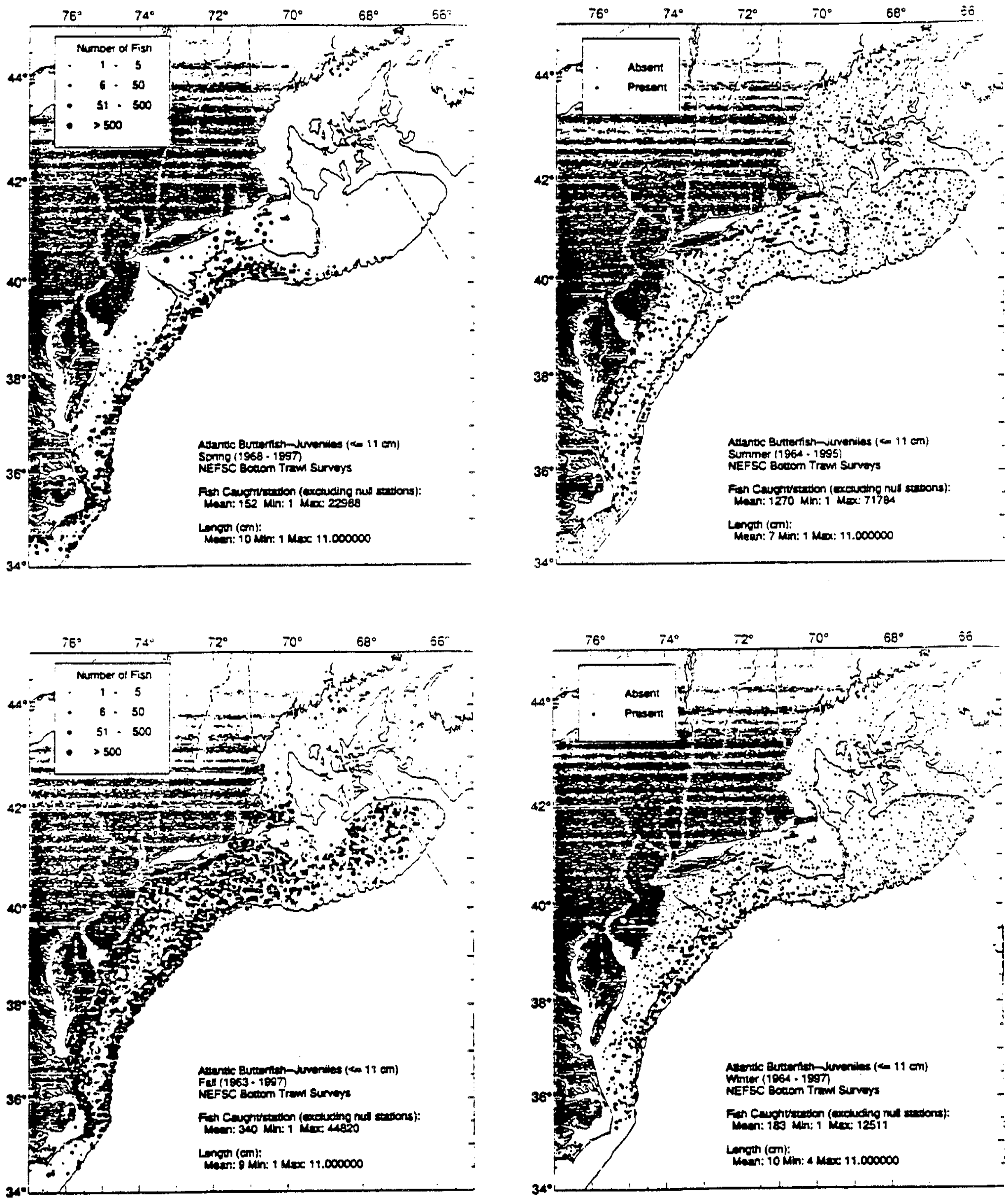


Figure 37. Distribution of juvenile butterfish in the NEFSC bottom trawl survey in (a) spring, 1968-1997, (b) summer, 1964-1995, (c) fall, 1963-1997, and (d) winter, 1964-1997, for all years combined.
Source: EFH Butterfish Team 1998.

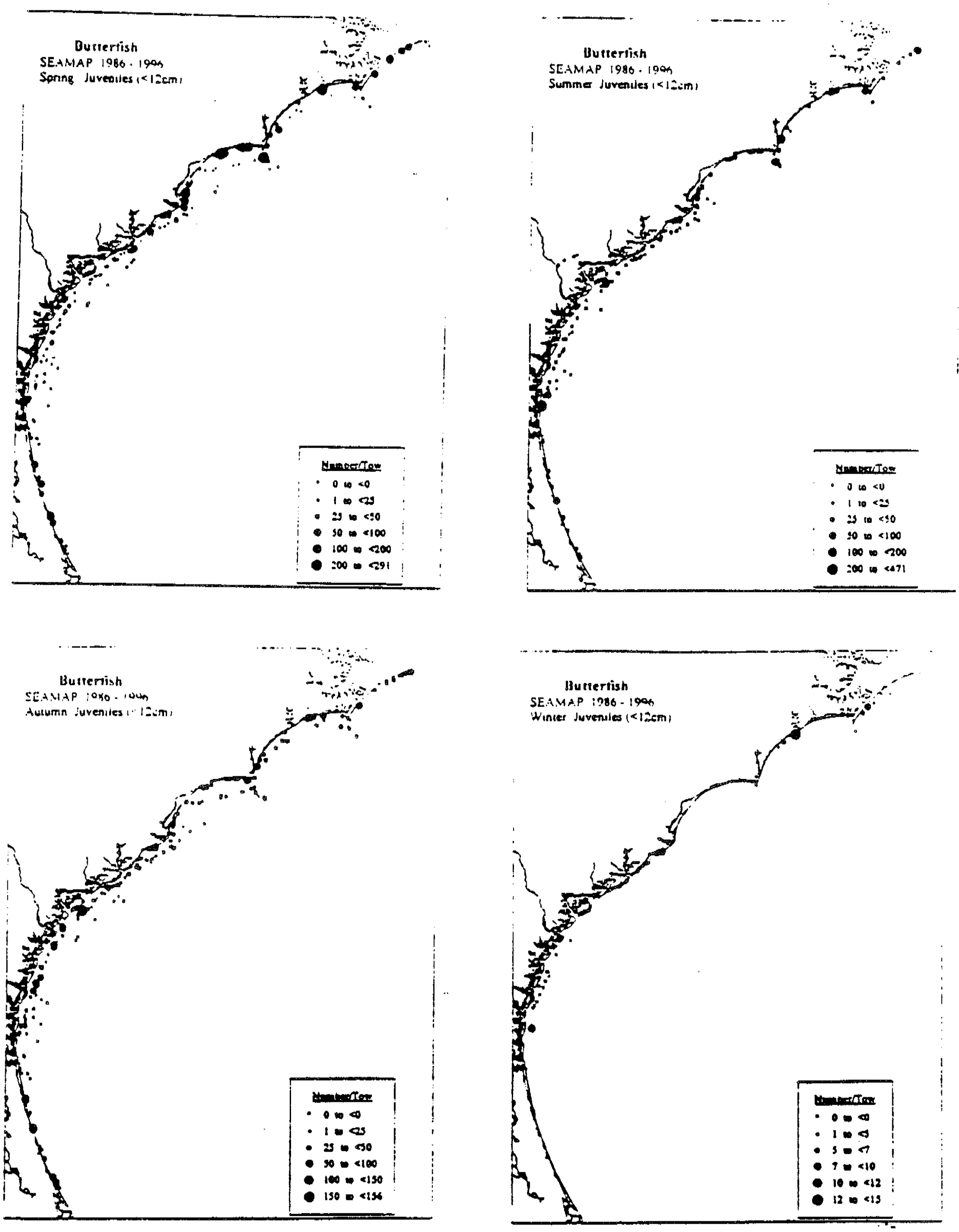


Figure 38. Distribution of juvenile butterfish in the SEAMAP bottom trawl survey in (a) spring 1986-1996, (b) summer 1986-1996, (c) fall 1986-1996, and (d) winter 1986-1996, for all years combined.
Source: EFH Butterfish Team 1998.

BUTTERFISH

National Marine Fisheries Service Groundfish Surveys

Adult Fish: total fish length >= 12 cm

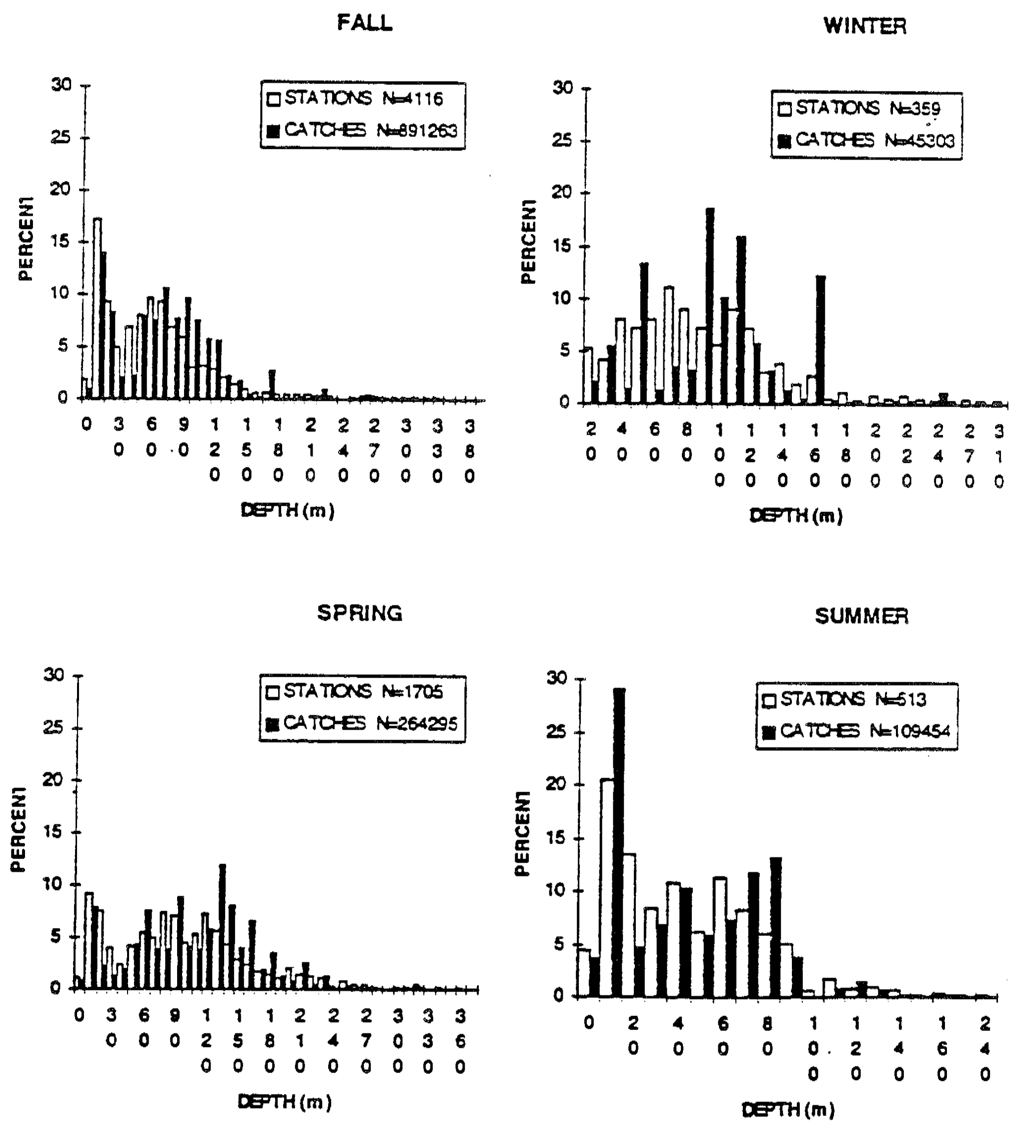


Figure 39. Distribution of bottom depths for trawls containing adult butterfish during NEFSC bottom trawl surveys (1964-1997), by season, for all years combined.
Source: EFH Butterfish Team 1998.

BUTTERFISH

National Marine Fisheries Service Groundfish Surveys

Adult Fish: total fish length >= 12 cm

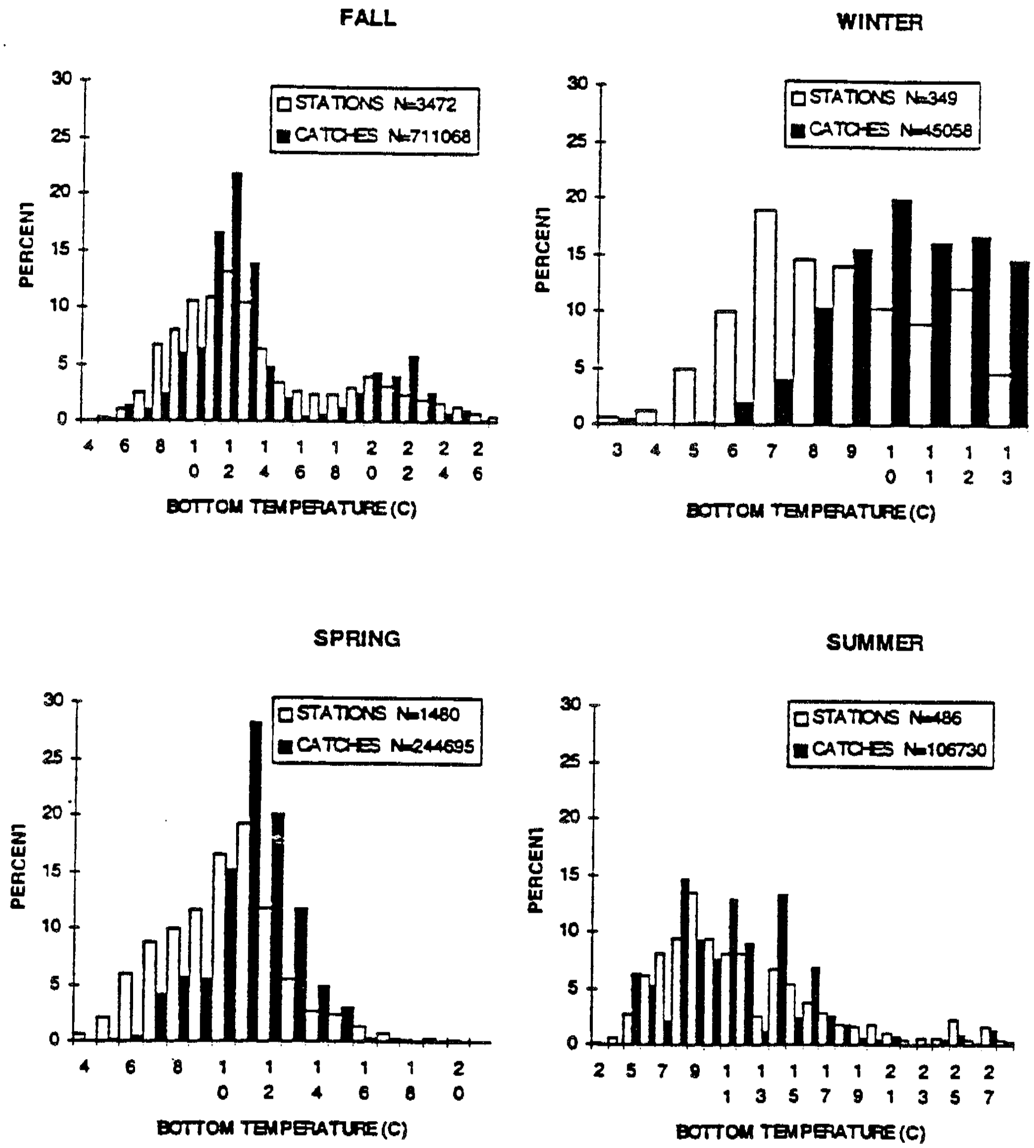


Figure 40. Distribution of bottom water temperatures for trawls containing adult butterfish during NEFSC bottom trawl surveys (1964-1997), by season, for all years combined. Source: EFH Butterfish Team 1998.

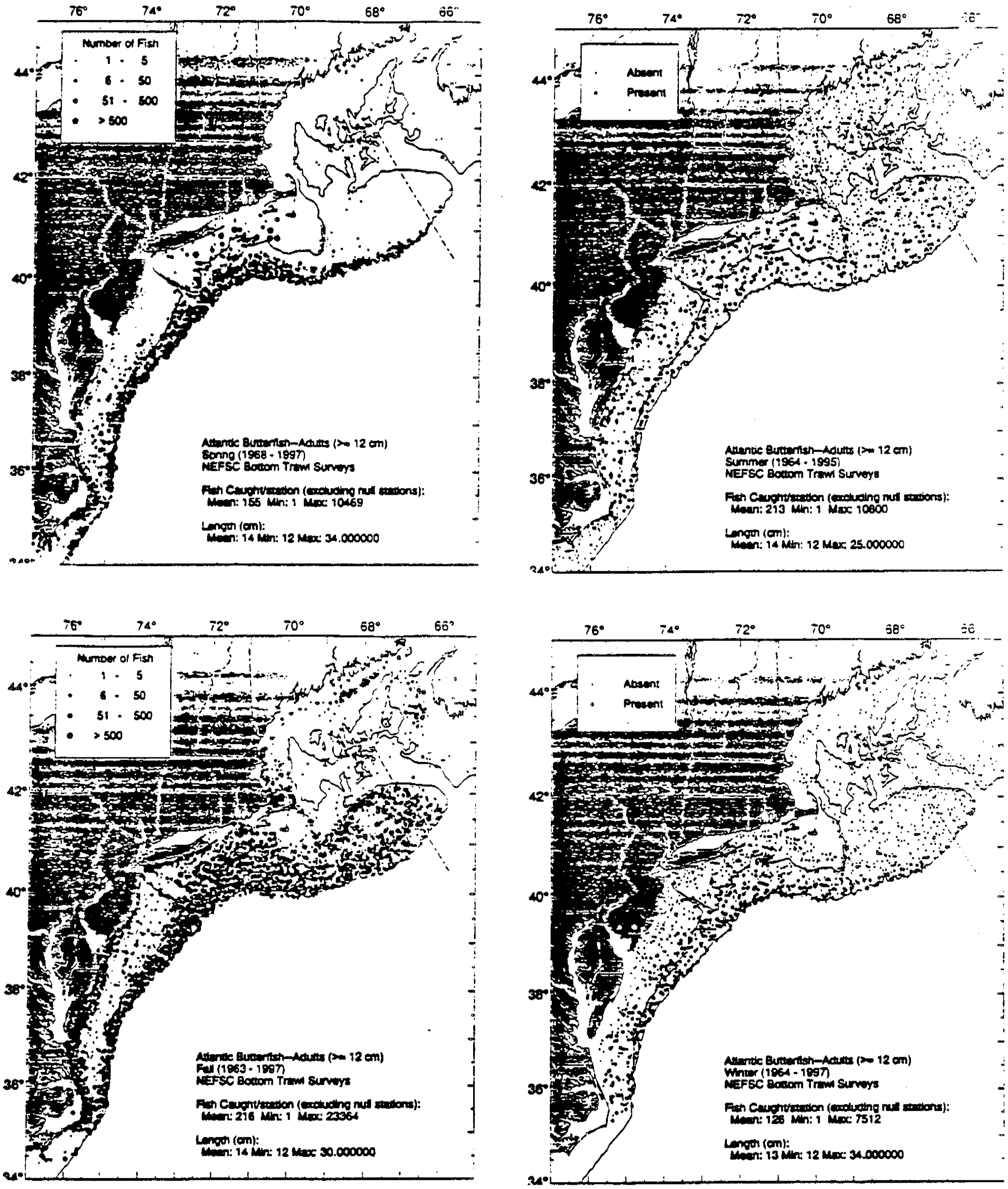


Figure 41. Distribution of adult butterfish in the NEFSC bottom trawl survey in (a) spring 1968-1997, (b) summer 1964-1995, (c) fall 1963-1997, and (d) winter 1964-1997, for all years combined.
Source: EFH Butterfish Team 1998.

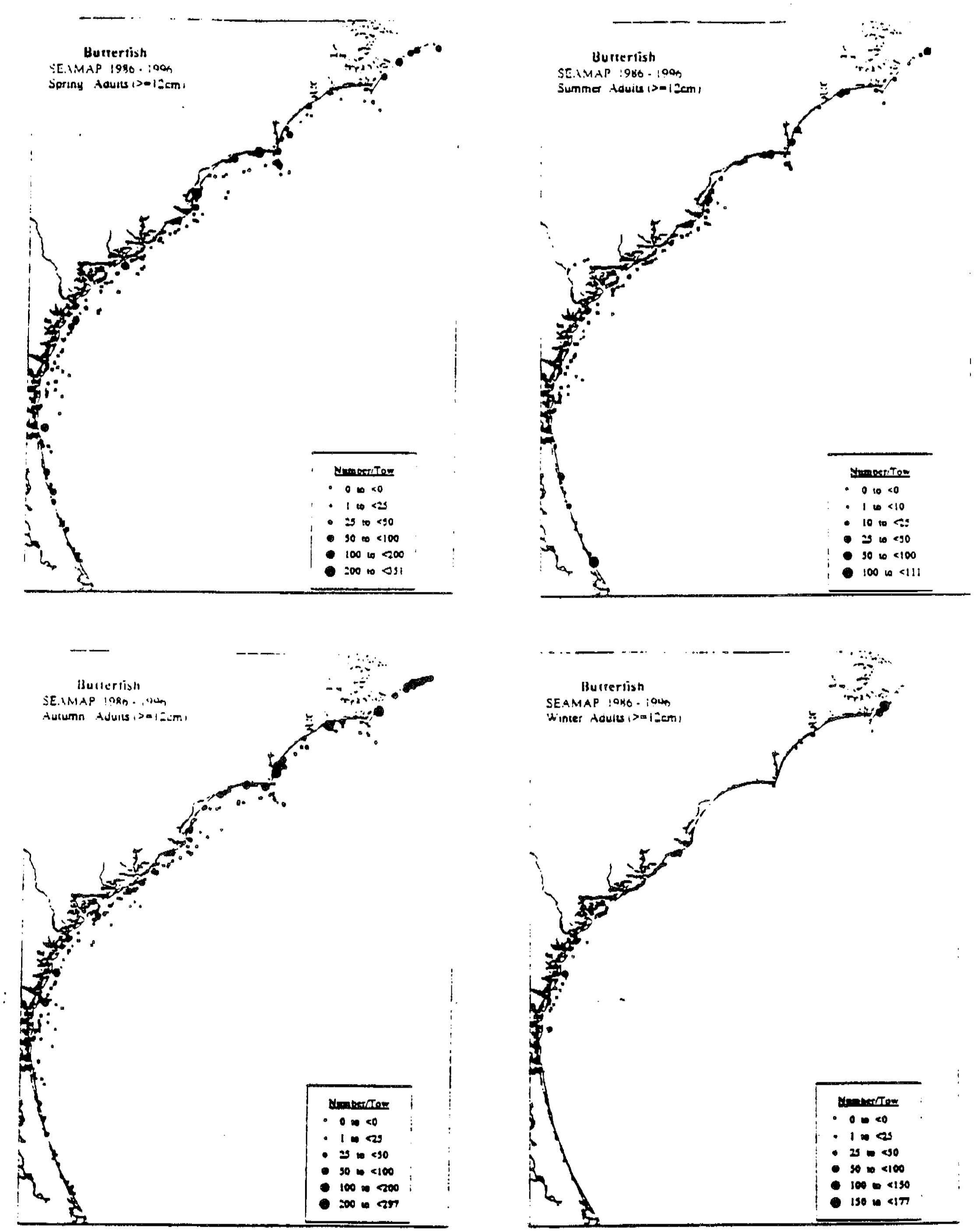


Figure 42. Distribution of adult butterfish in the SEAMAP bottom trawl survey in (a) spring 1986-1996, (b) summer 1986-1996, (c) fall 1986-1996, and (d) winter 1986-1996, for all years combined.
Source: EFH Butterfish Team 1998.

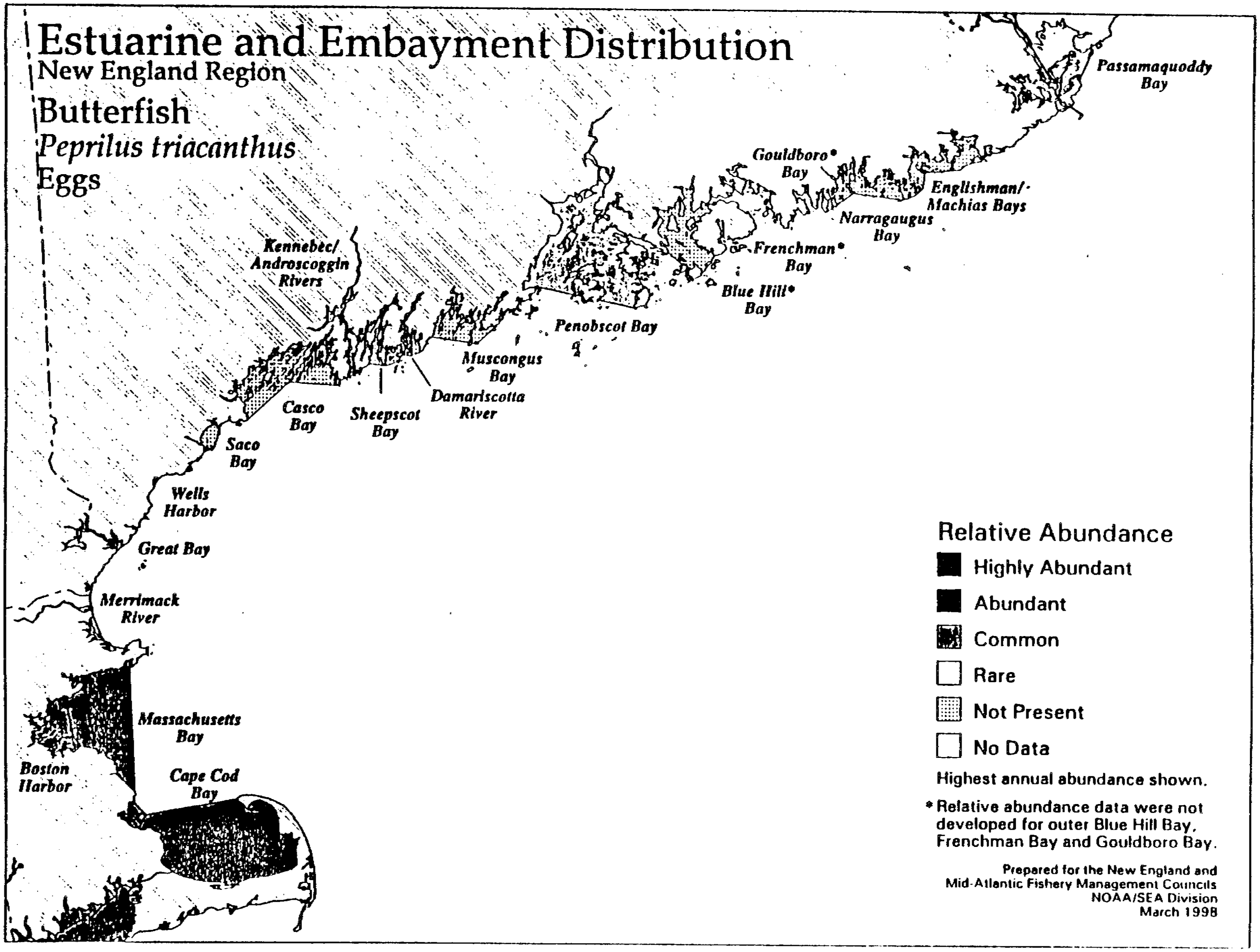


Figure 43a. Relative of abundance and distribution of butterfish eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

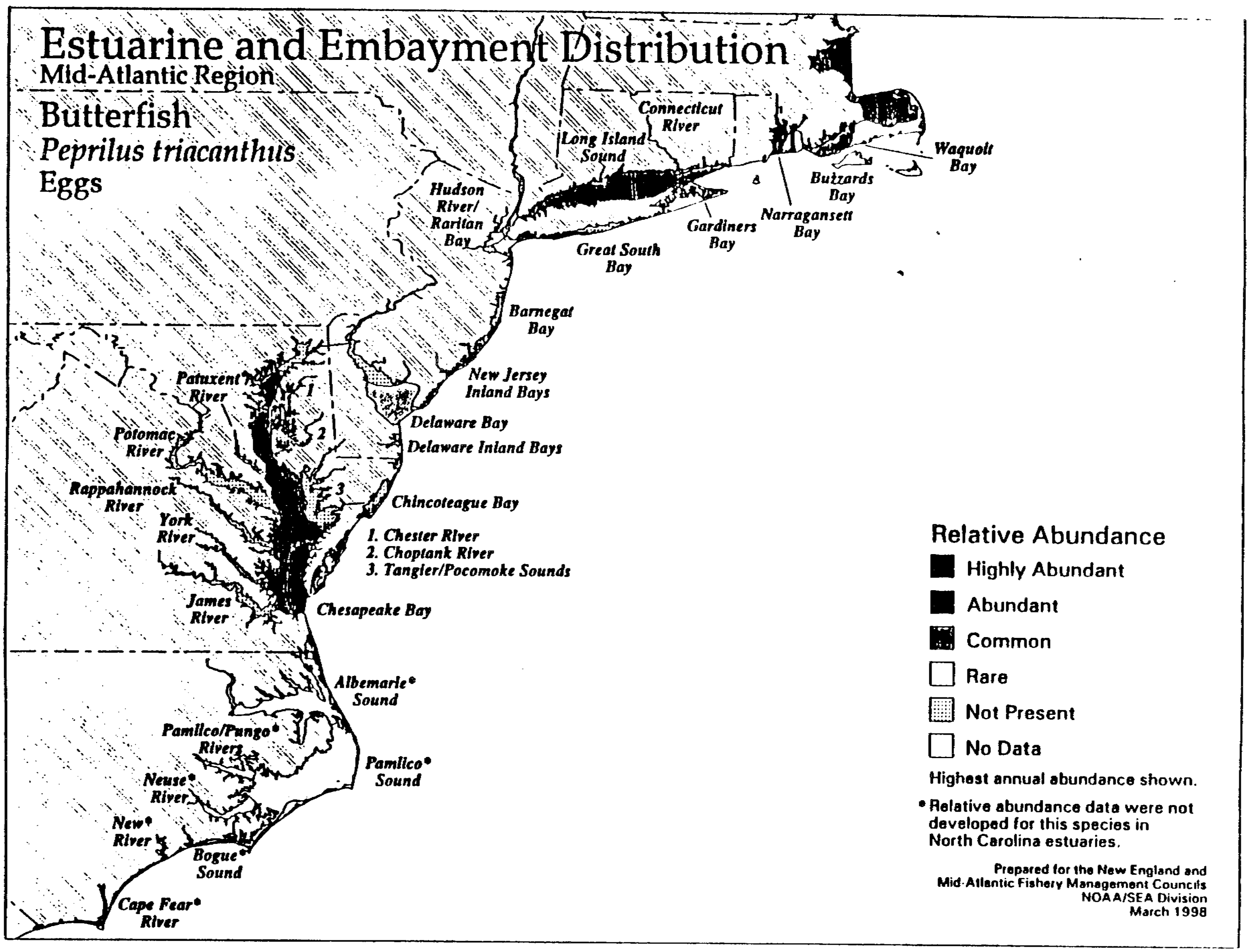


Figure 43a(continued). Relative of abundance and distribution of butterfish eggs in North and Mid-Atlantic estuaries. Those estuaries in which eggs are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

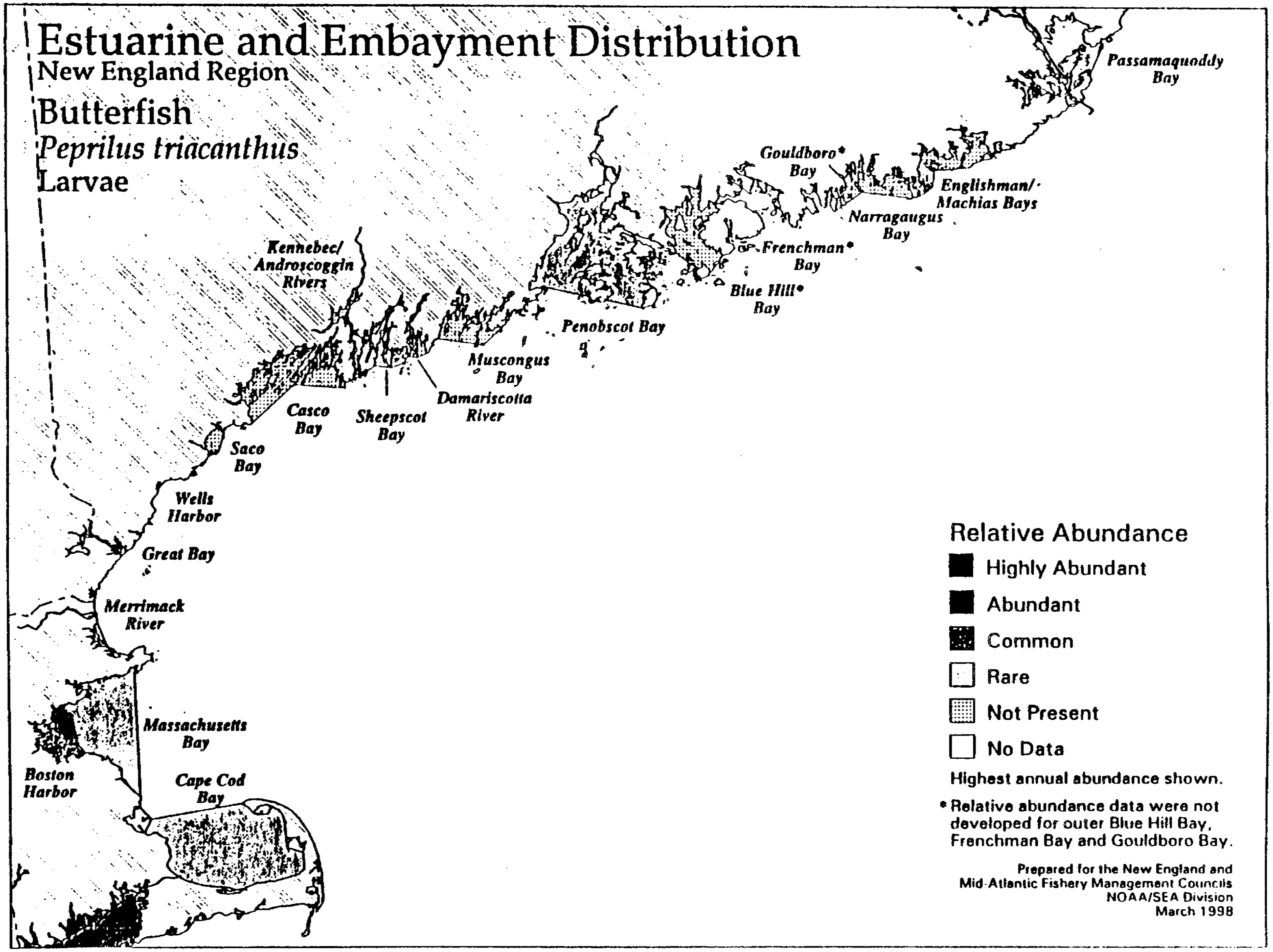


Figure 43b. Relative of abundance and distribution of butterfish larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

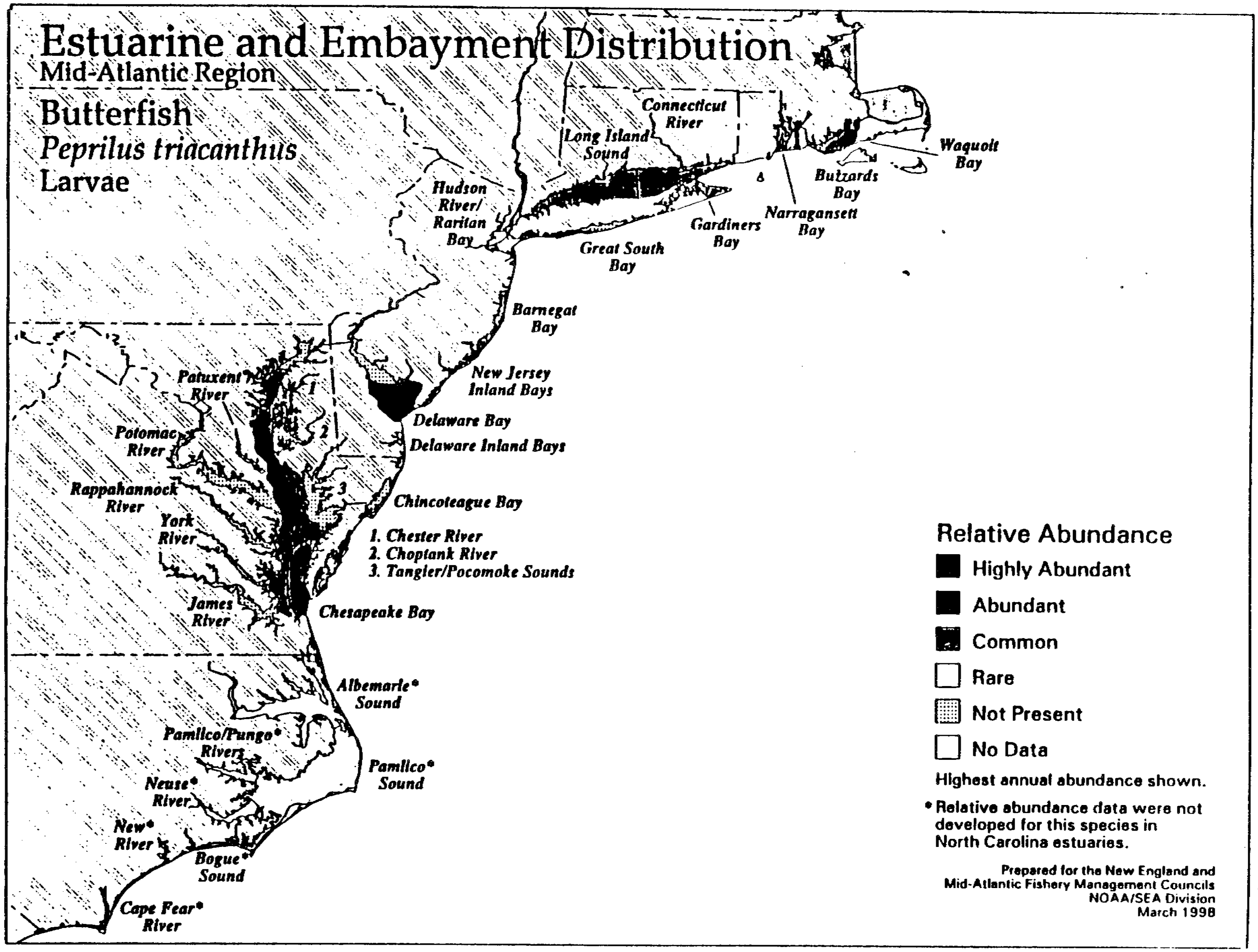


Figure 43b(continued). Relative of abundance and distribution of butterfish larvae in North and Mid-Atlantic estuaries. Those estuaries in which larvae are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

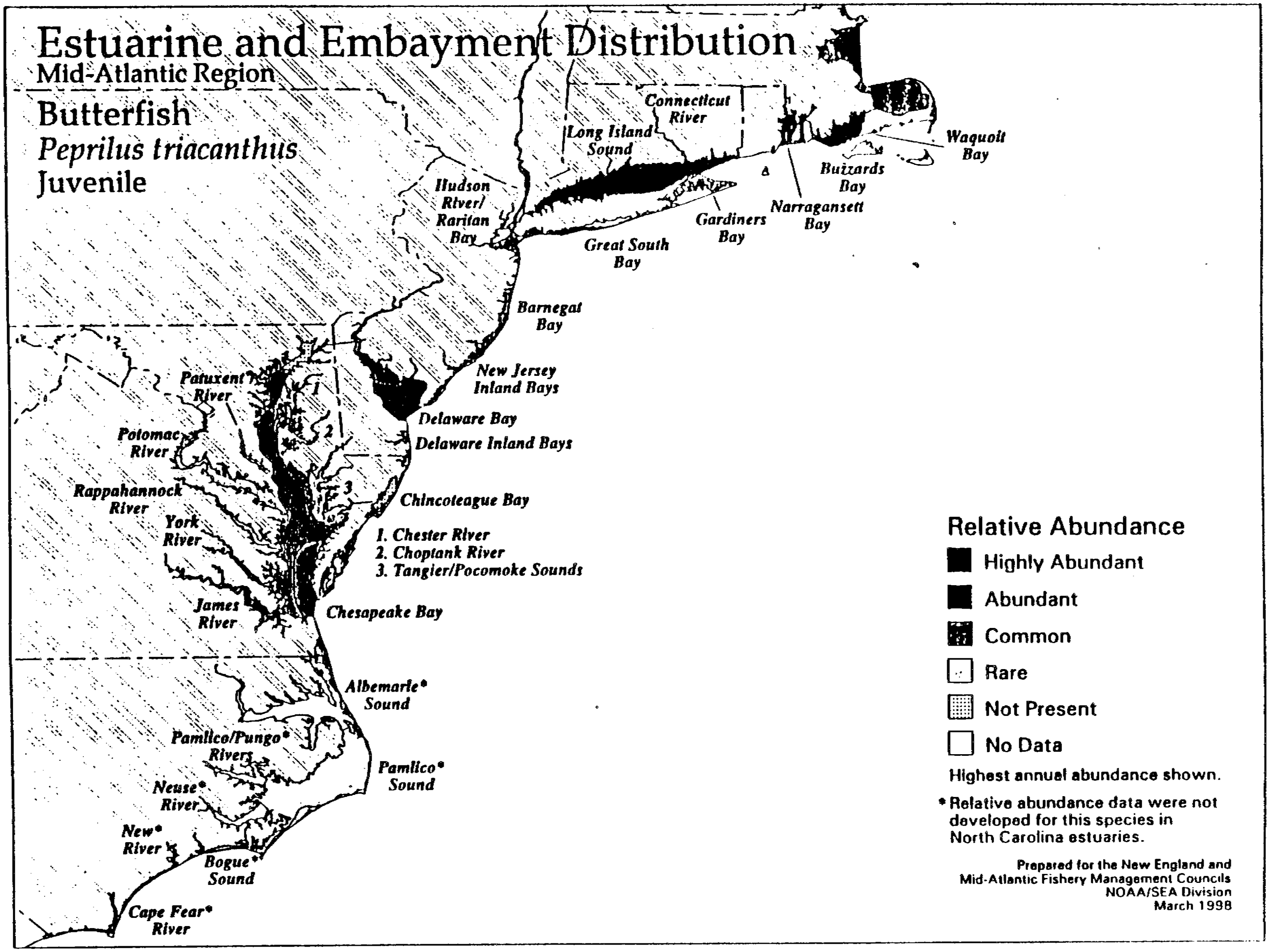


Figure 43c. Relative of abundance and distribution of juvenile butterfish in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as highly abundant, abundant, or common are designated as essential fish habitat. Source: ELMR data.

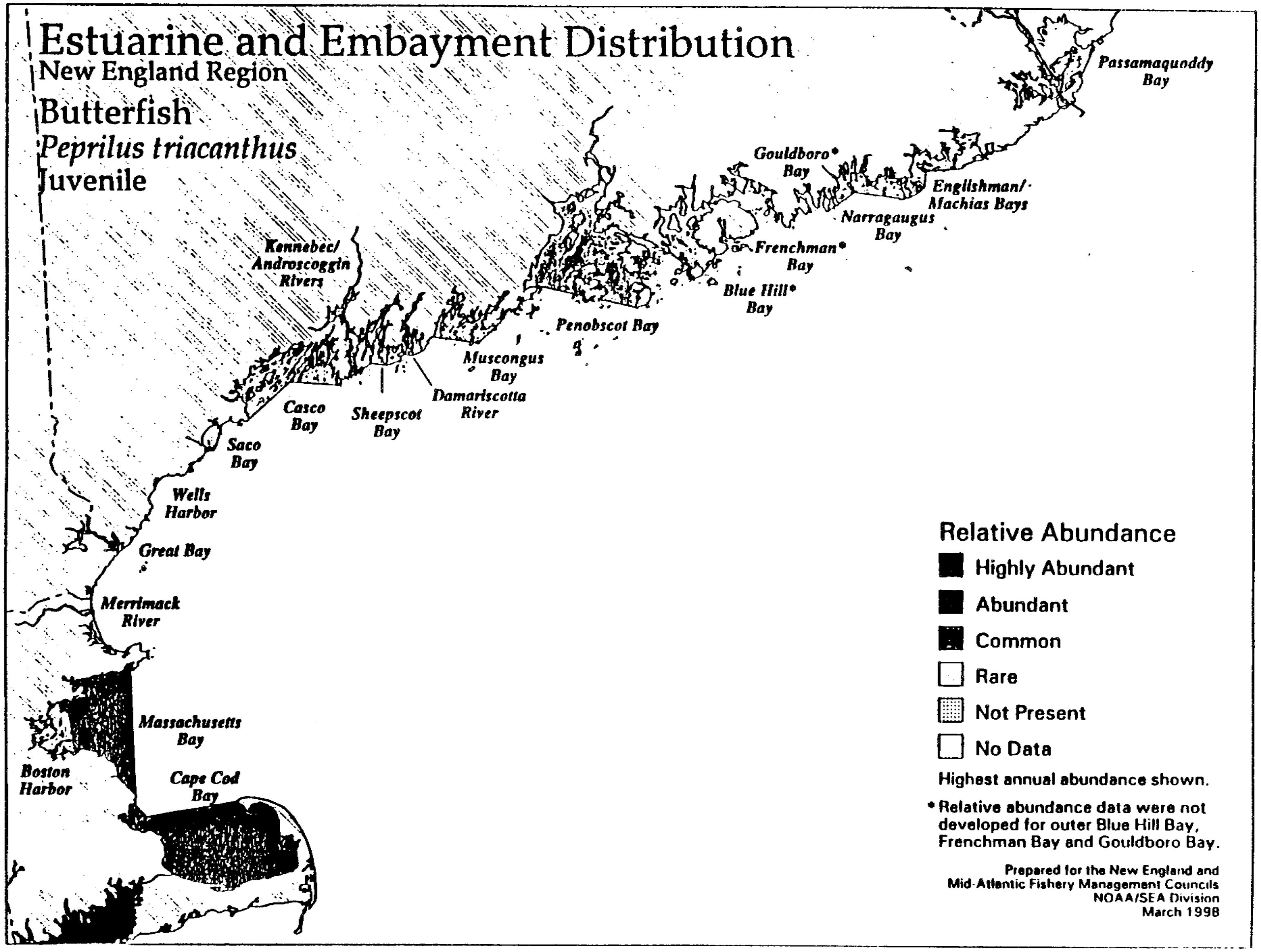


Figure 43c(continued). Relative of abundance and distribution of juvenile butterfish in North and Mid-Atlantic estuaries. Those estuaries in which juveniles are classified as hgihly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

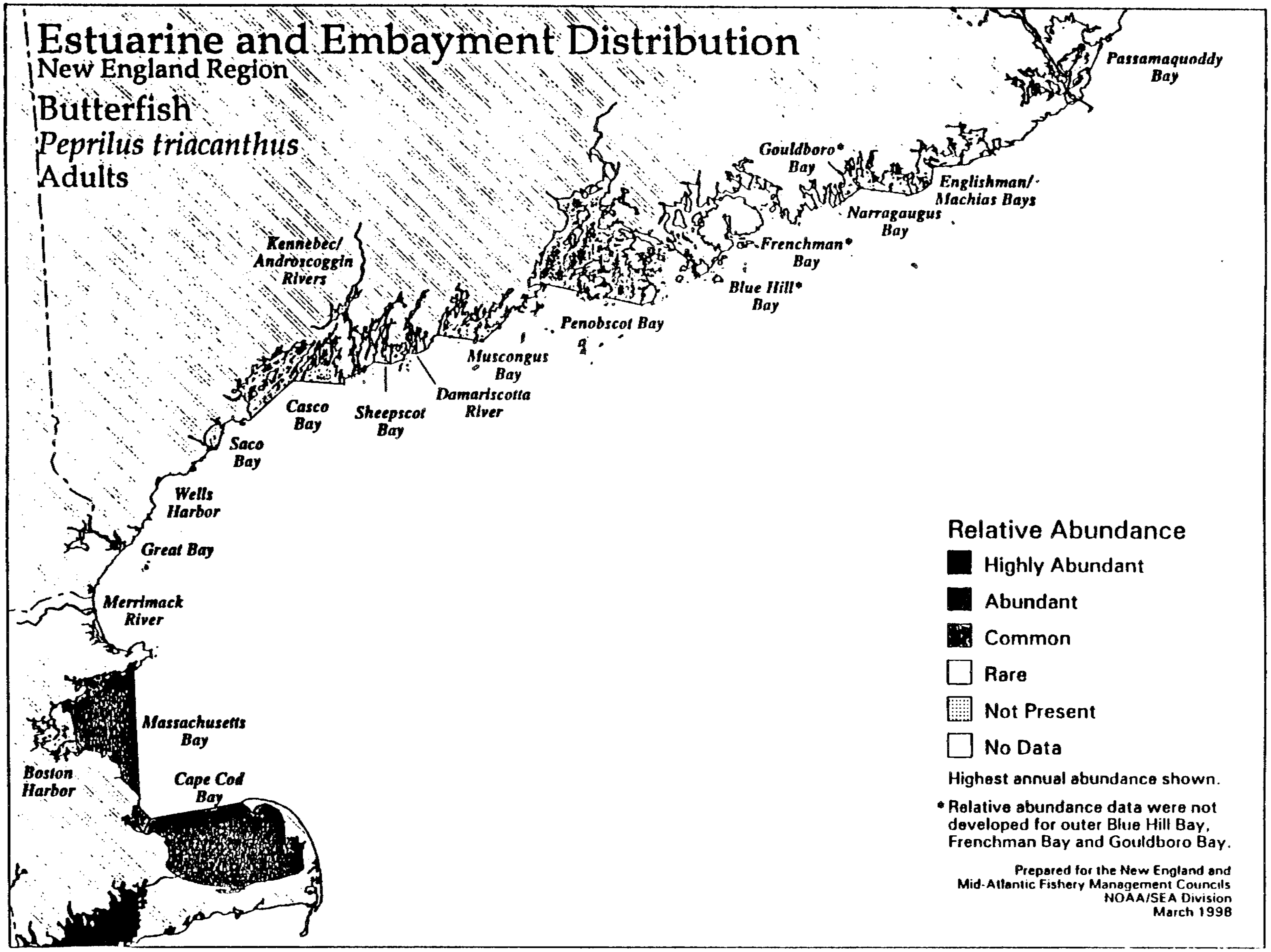


Figure 43d. Relative of abundance and distribution of adult butterfish in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

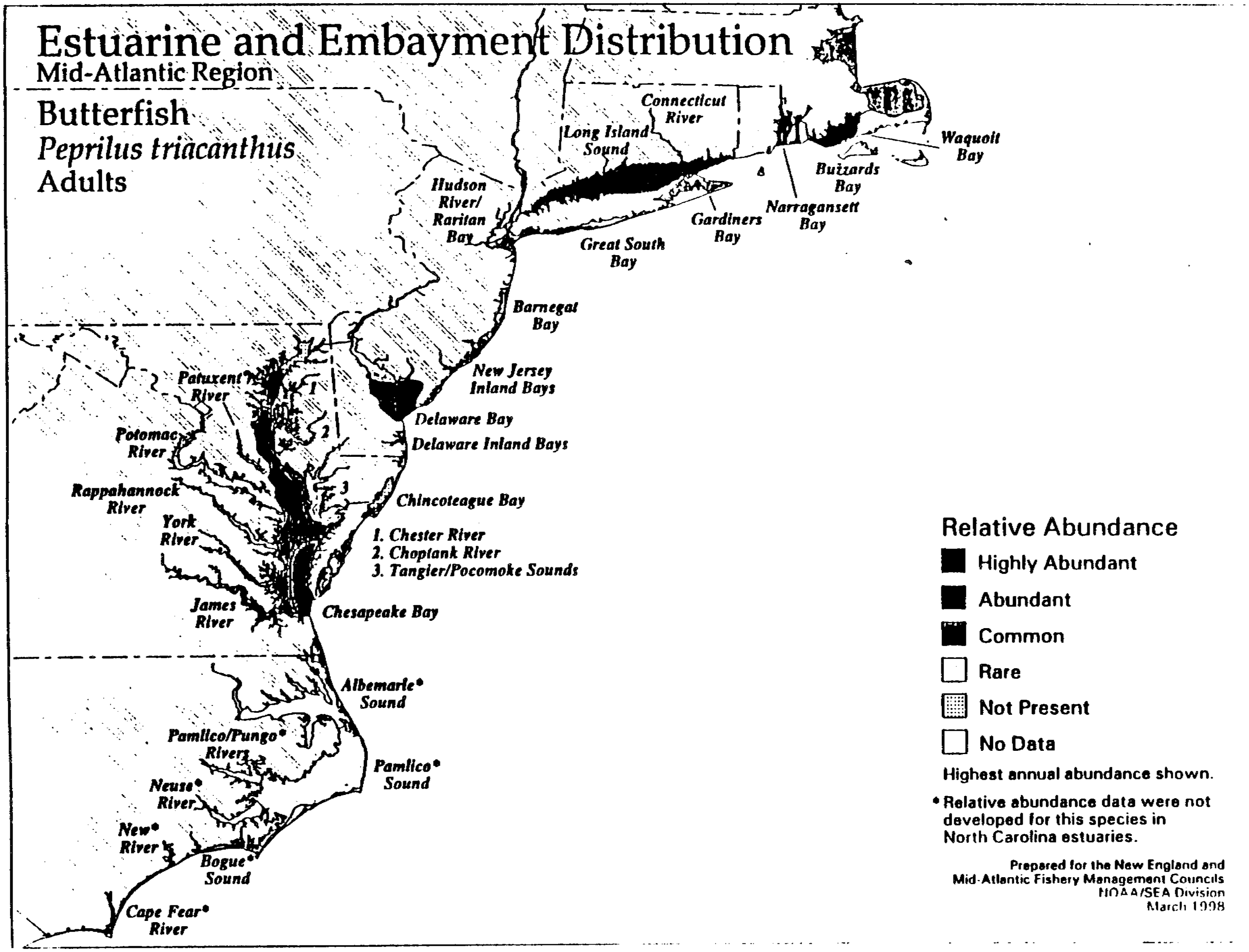


Figure 4.3d(continued). Relative of abundance and distribution of adult butterfish in North and Mid-Atlantic estuaries. Those estuaries in which adults are classified as highly abundant, abundant, or common are designated as essential fish habitat.
Source: ELMR data.

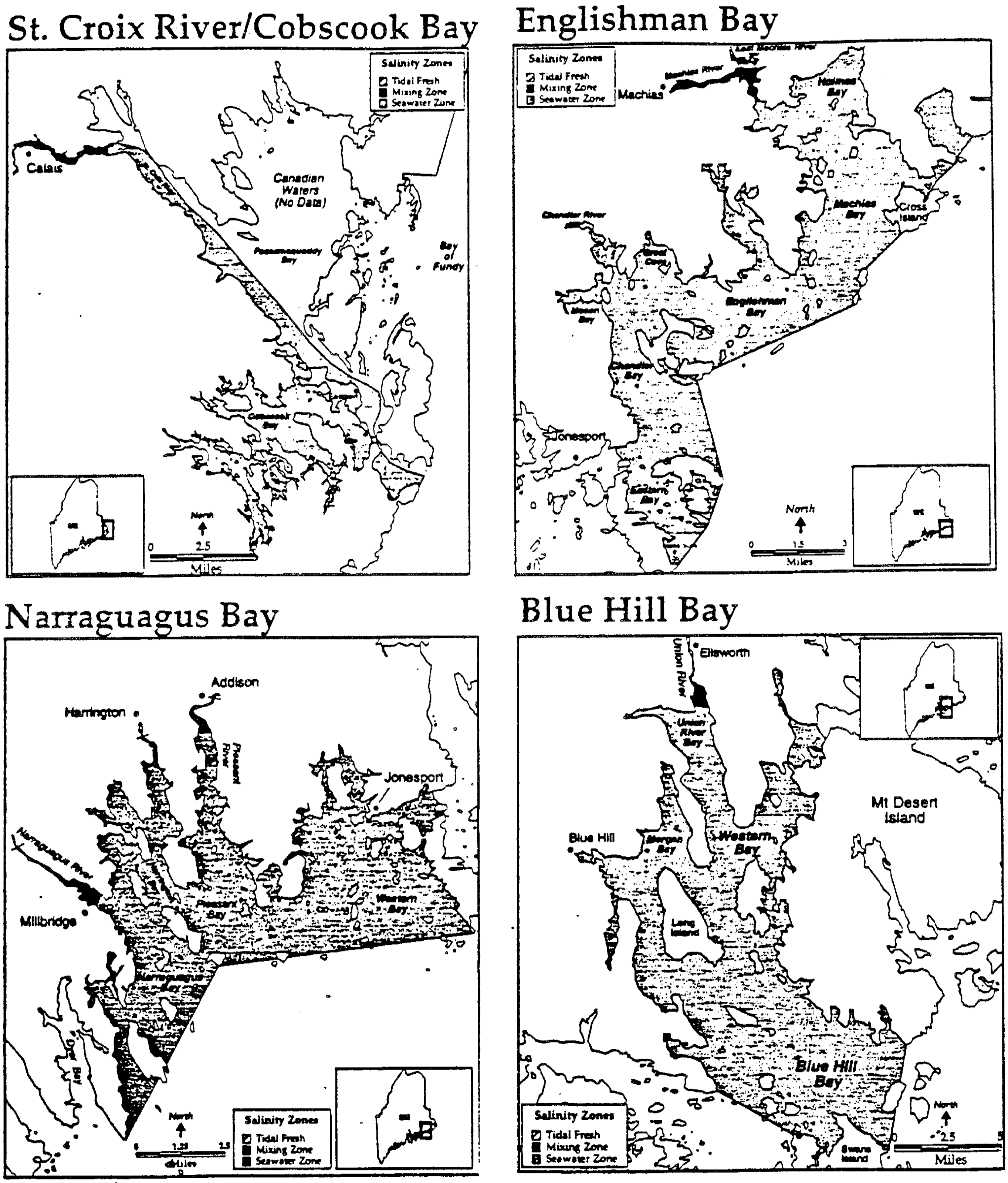


Figure 44a. Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data). Source: NOAA 1997a.

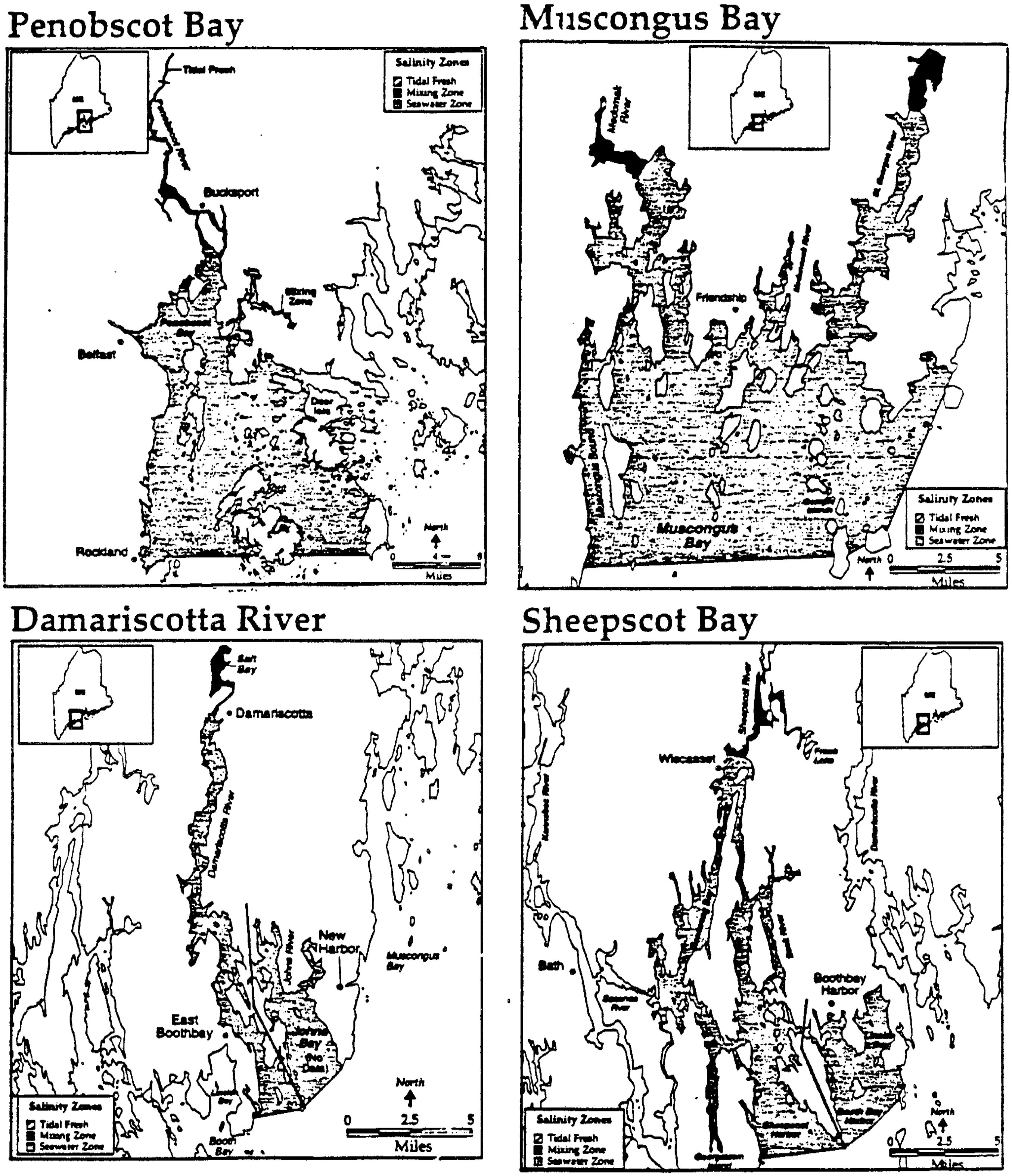


Figure 44a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

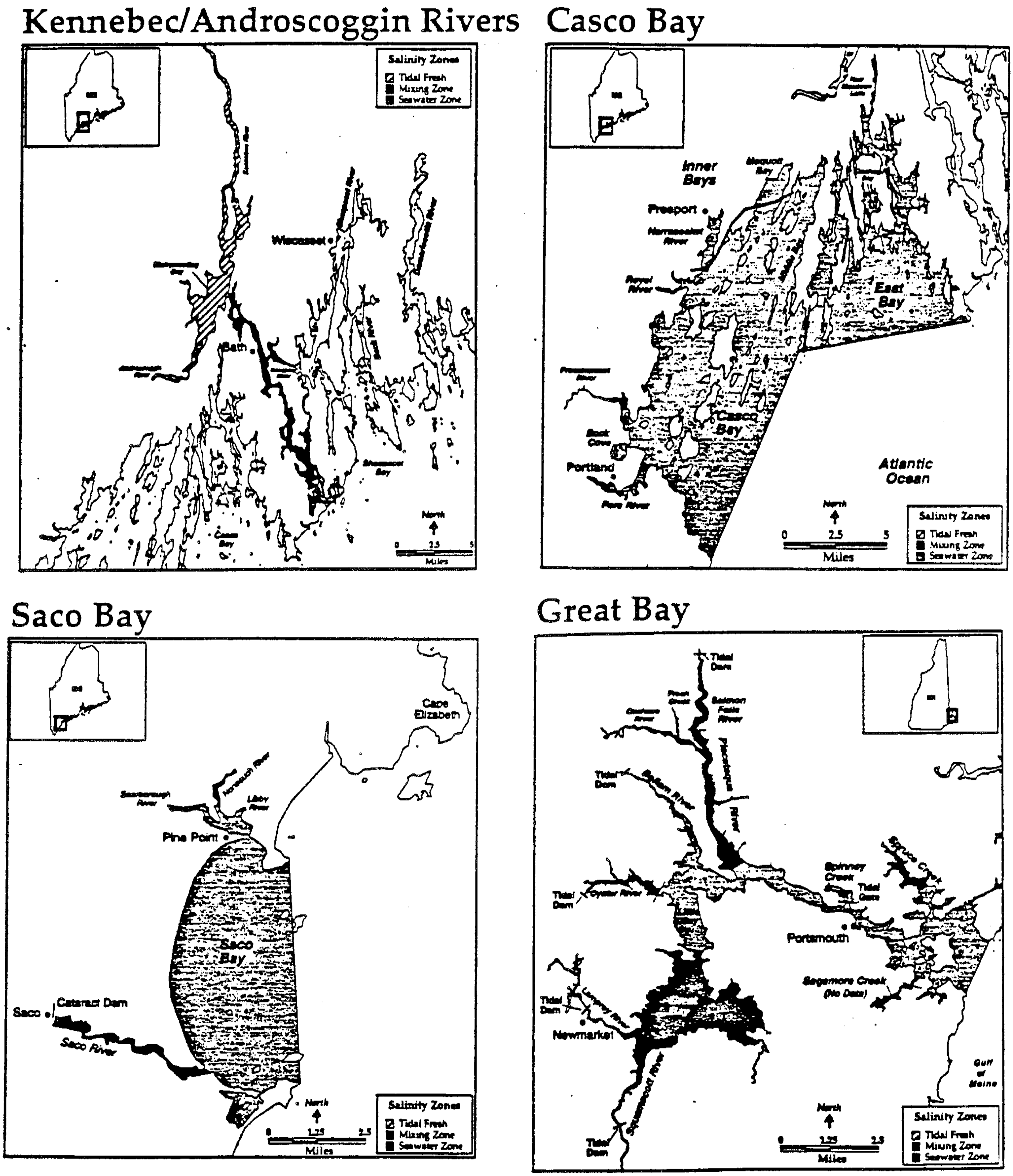
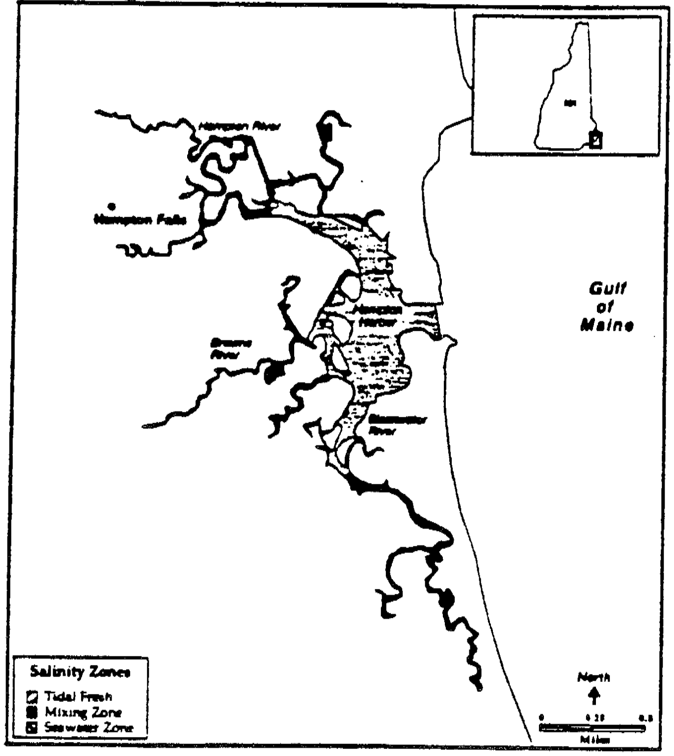
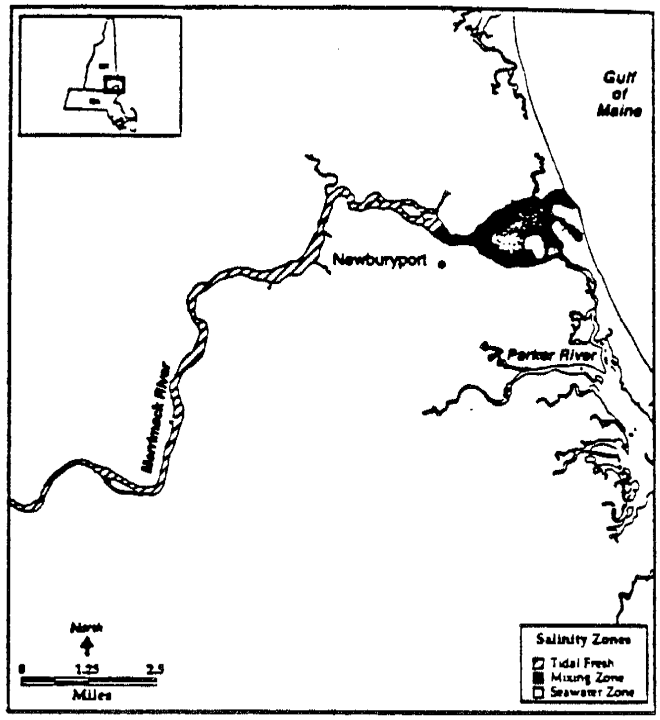


Figure 44a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

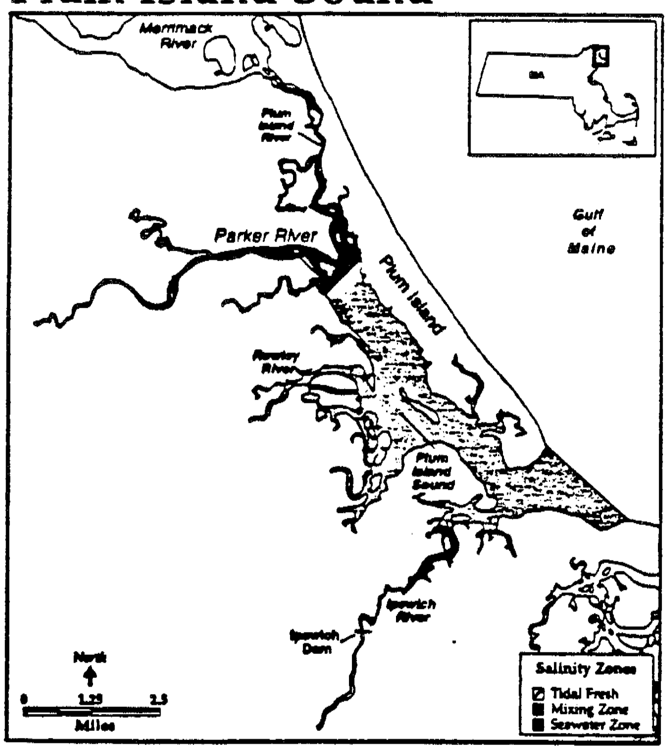
Hampton Harbor



Merrimack River



Plum Island Sound



Massachusetts Bay

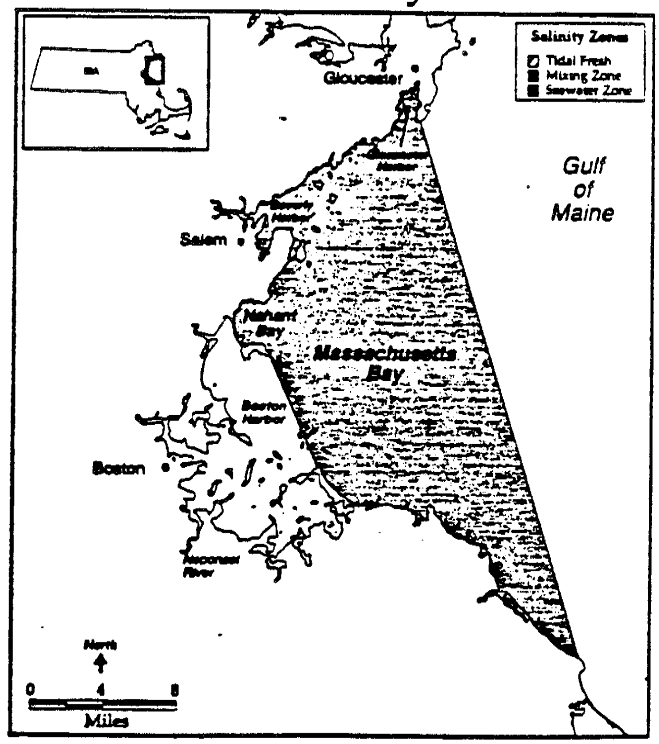
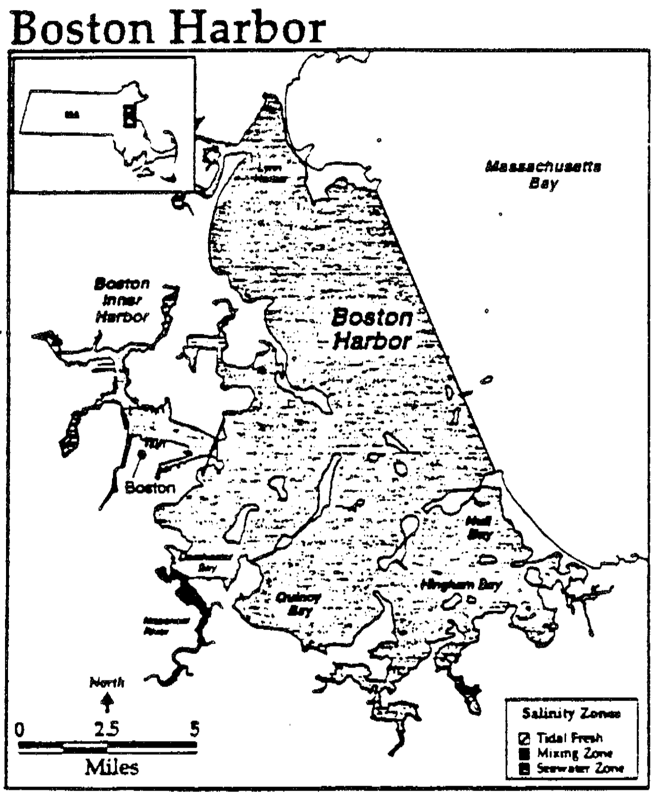


Figure 44a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.



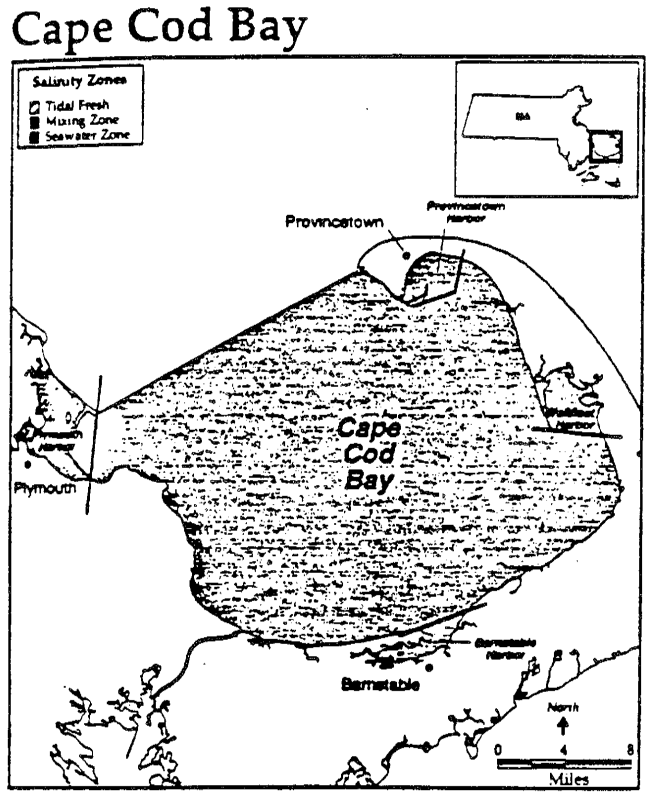


Figure 44a (continued). Salinity zone maps for the North Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997a.

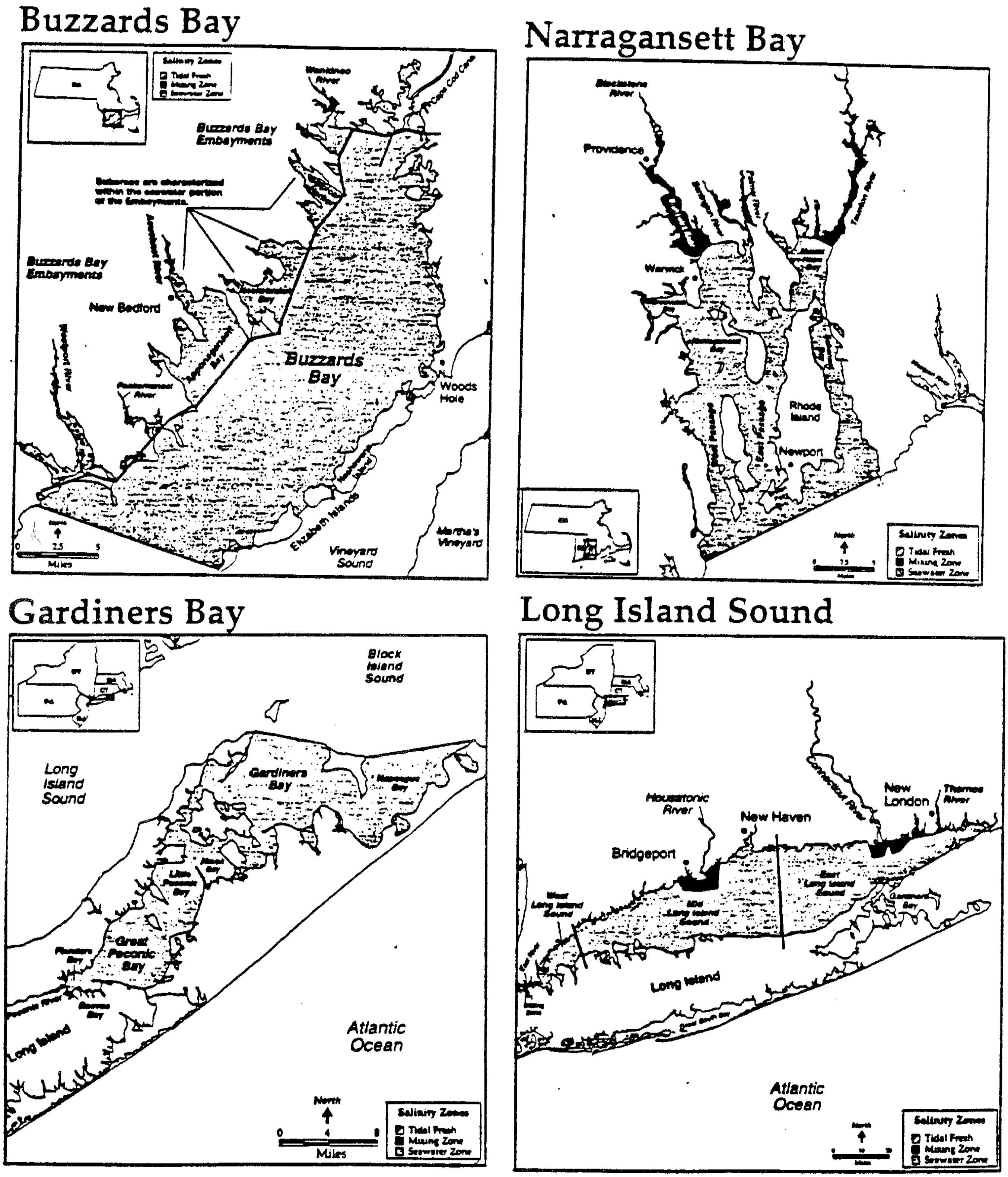
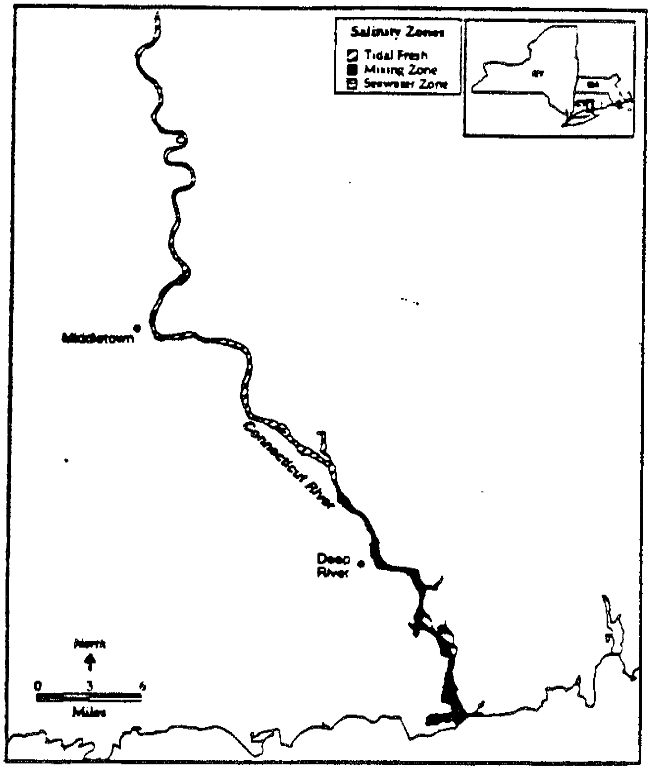
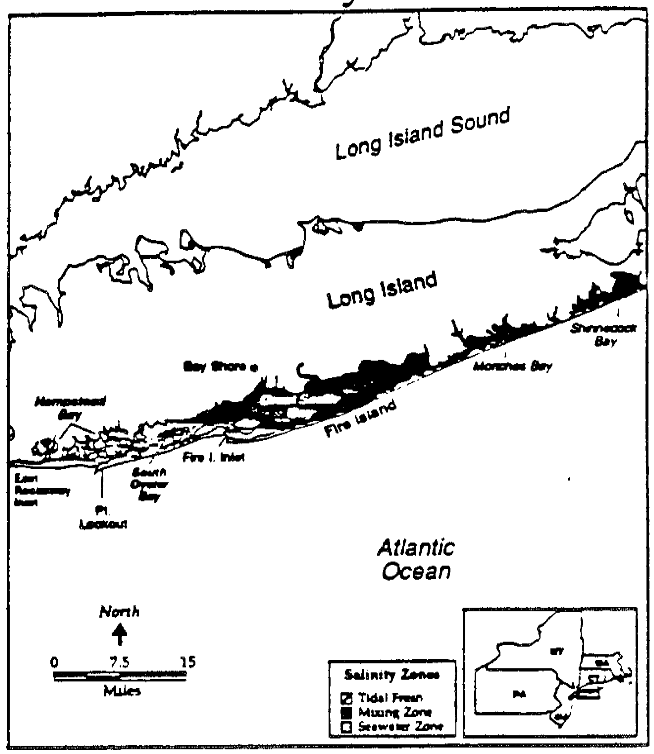


Figure 44b. Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data). Source: NOAA 1997b.

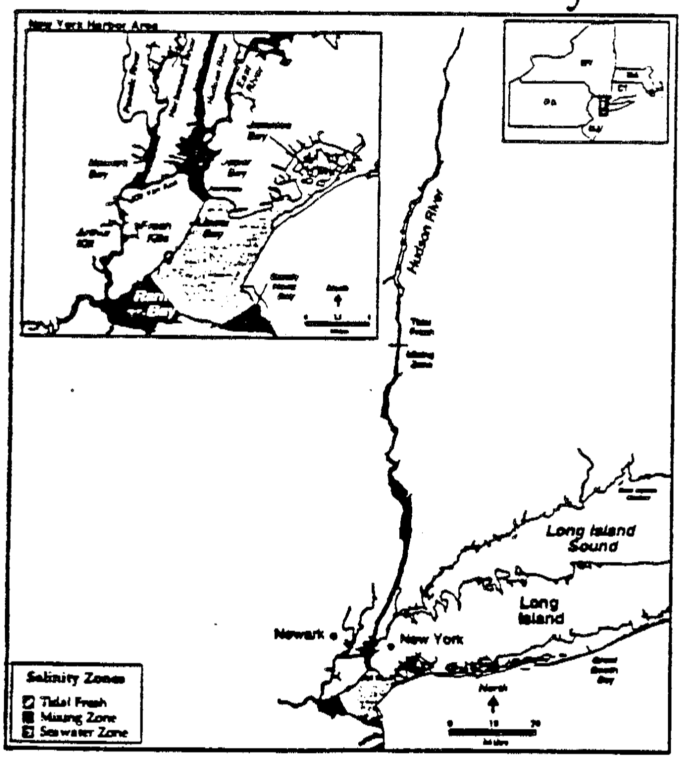
Connecticut River



Great South Bay



Hudson River/Raritan Bay



Barnegat Bay

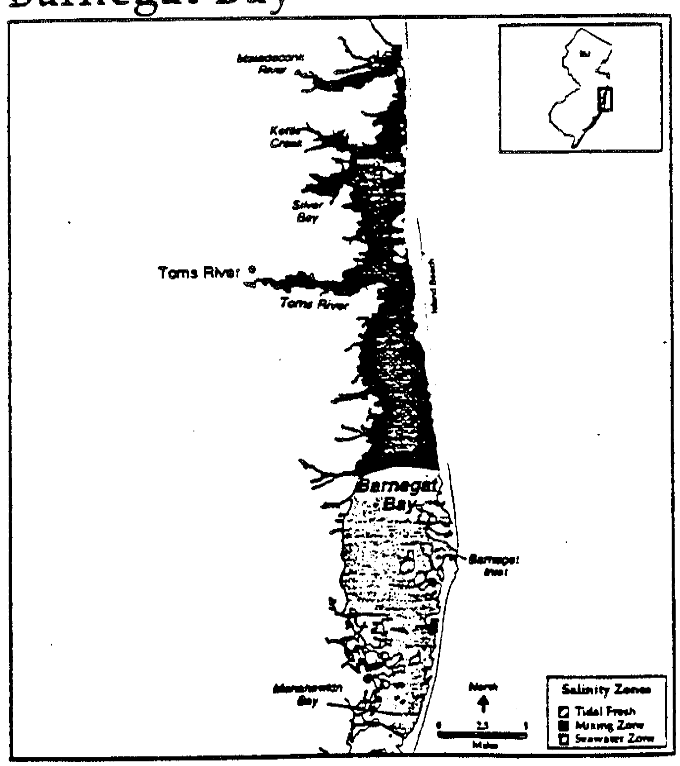


Figure 44b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

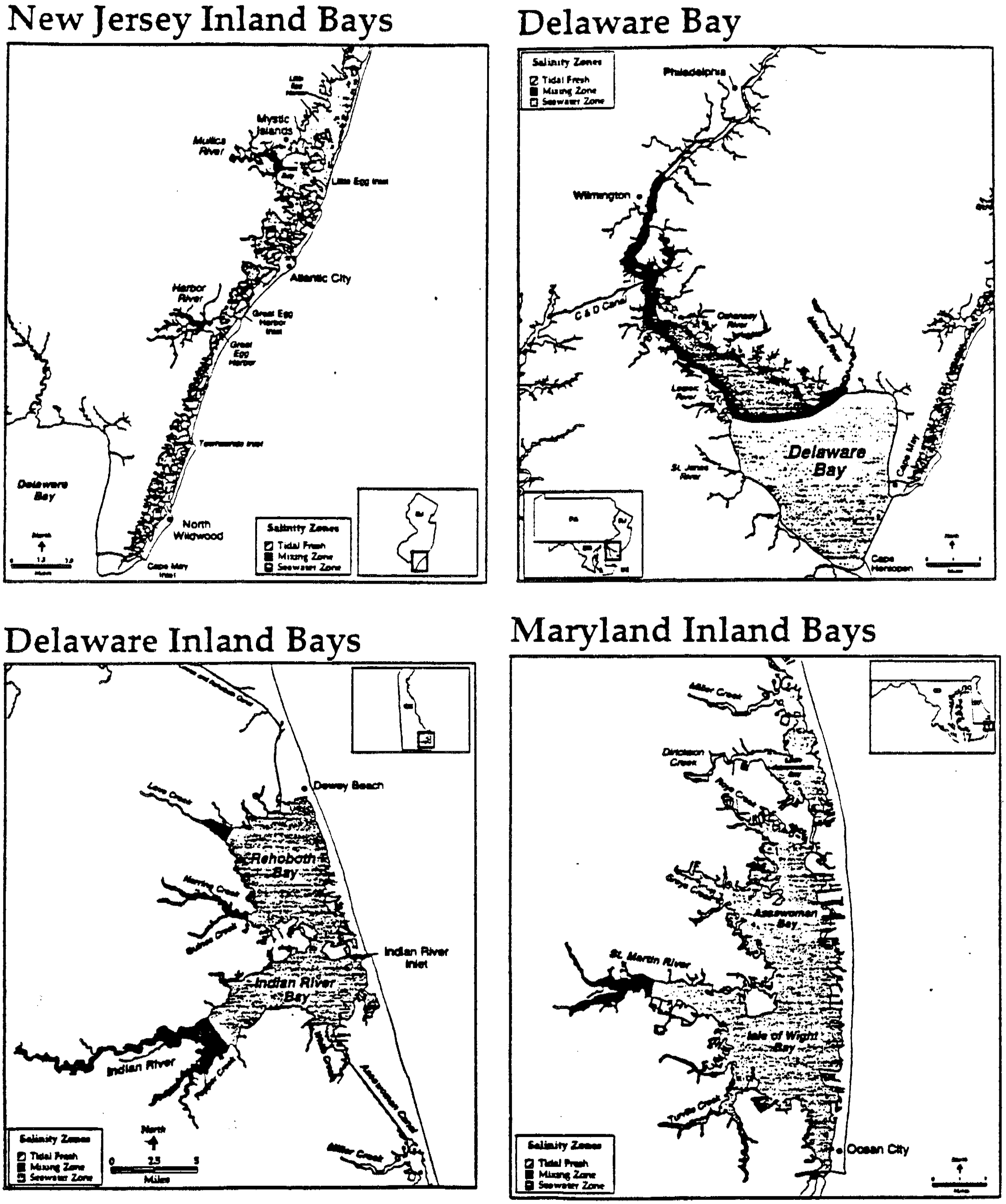


Figure 44b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

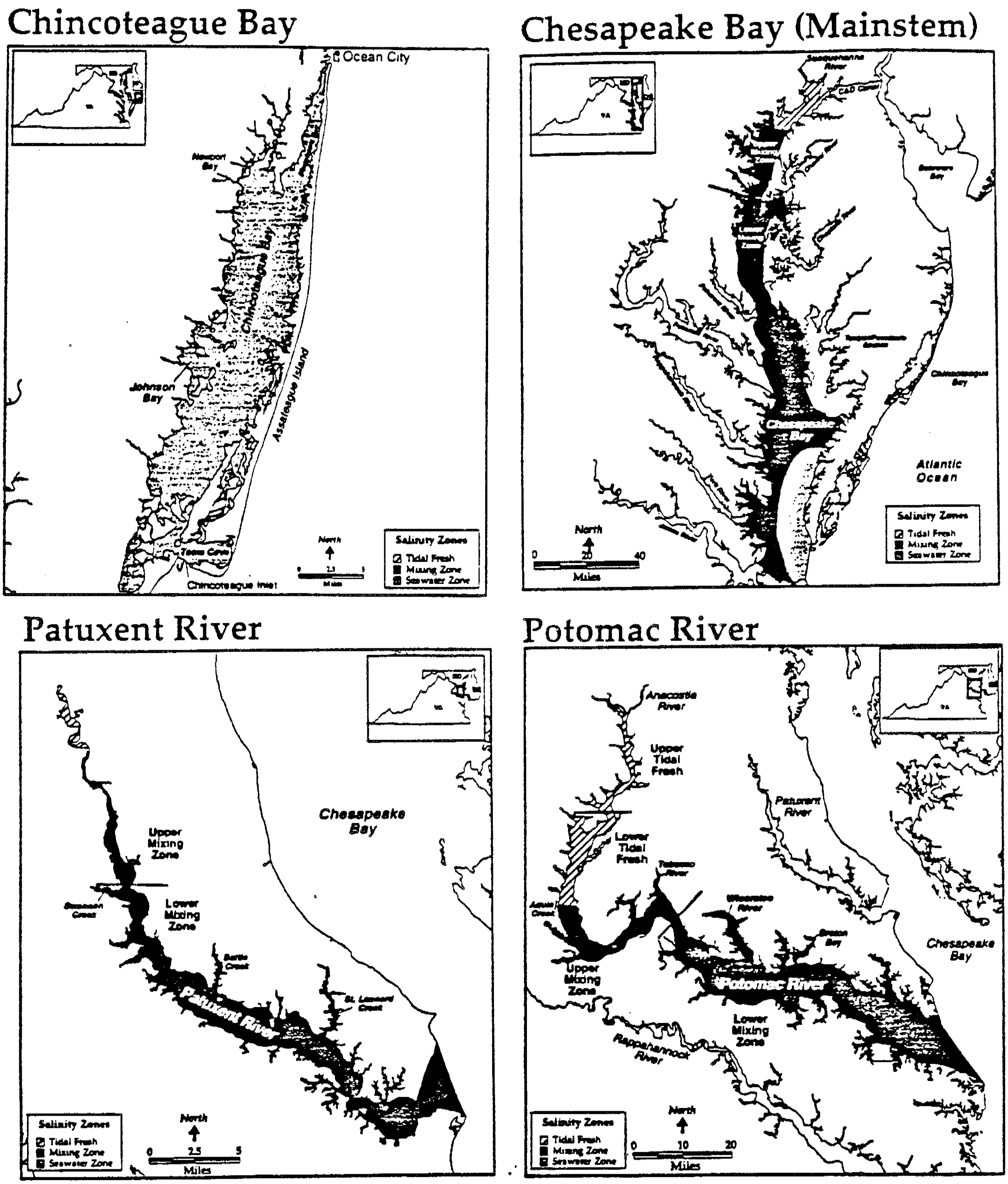
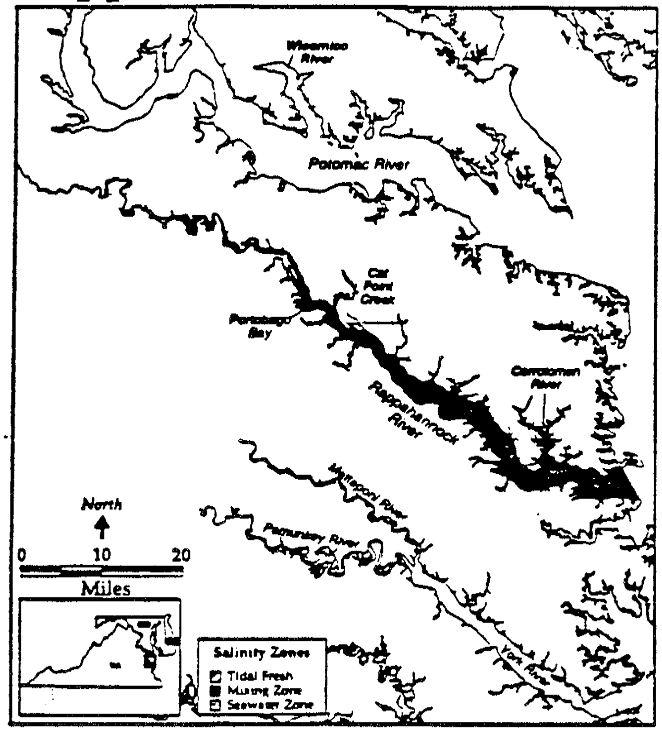
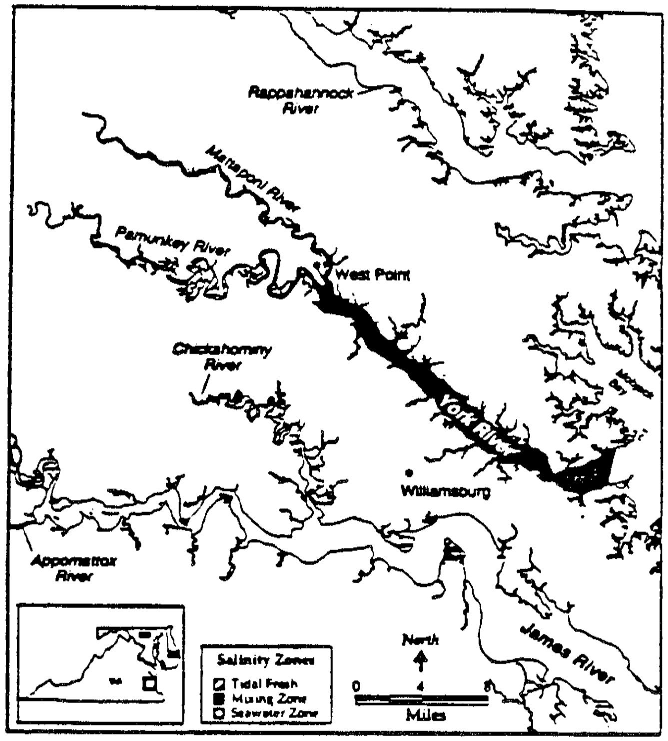


Figure 44b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

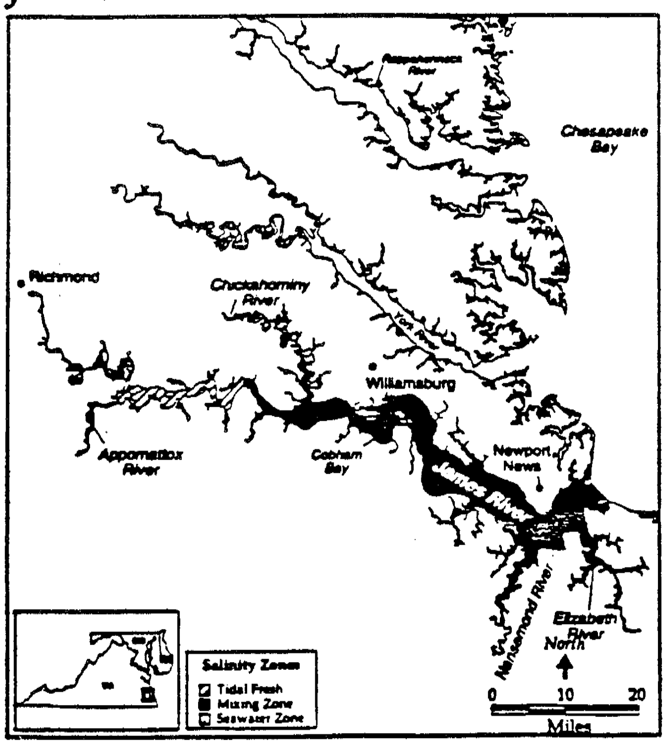
Rappahannock River



York River



James River



Chester River

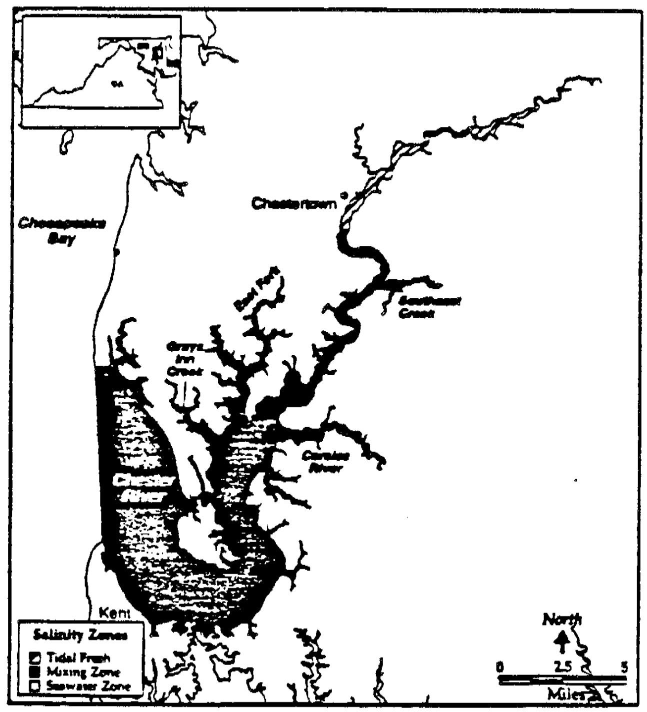


Figure 44b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

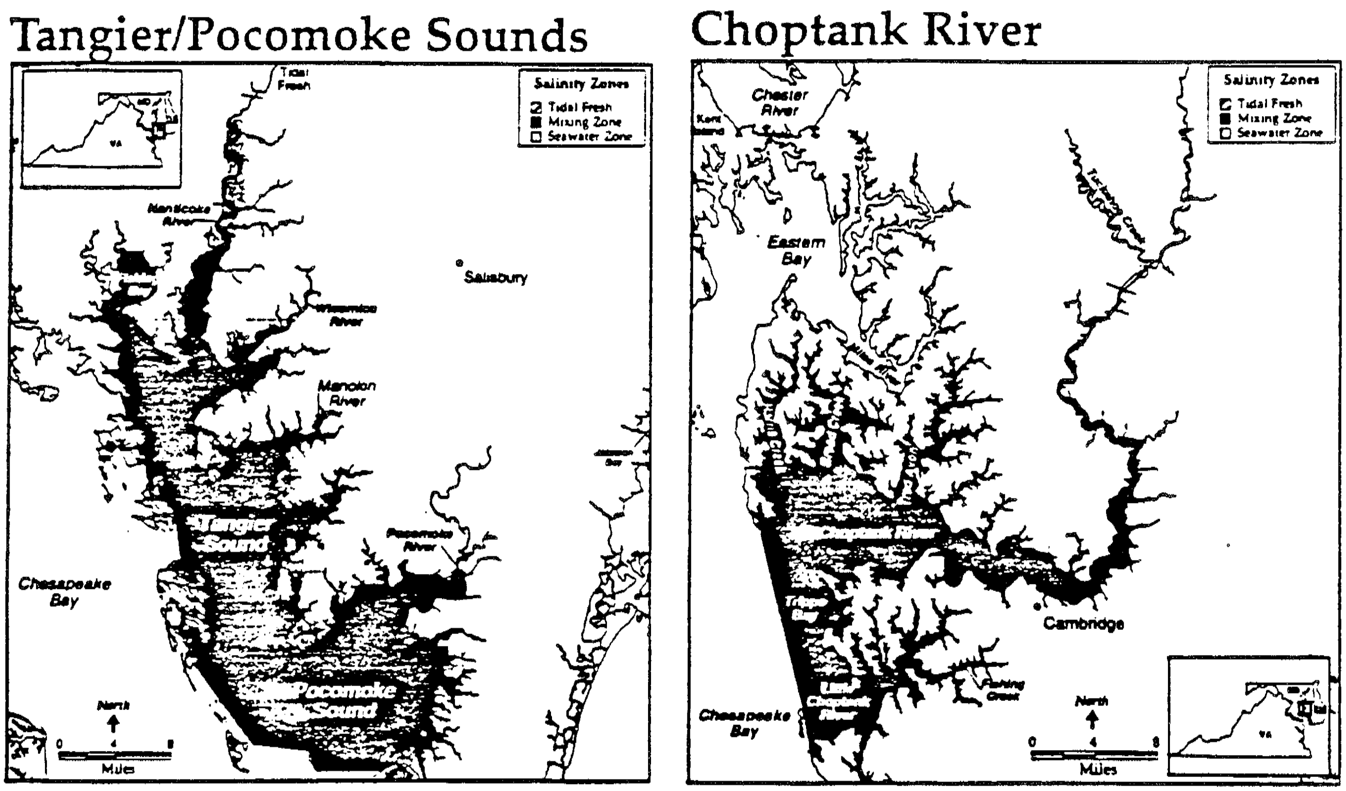


Figure 44b (continued). Salinity zone maps for the Mid-Atlantic estuaries (to be used with ELMR data).
Source: NOAA 1997b.

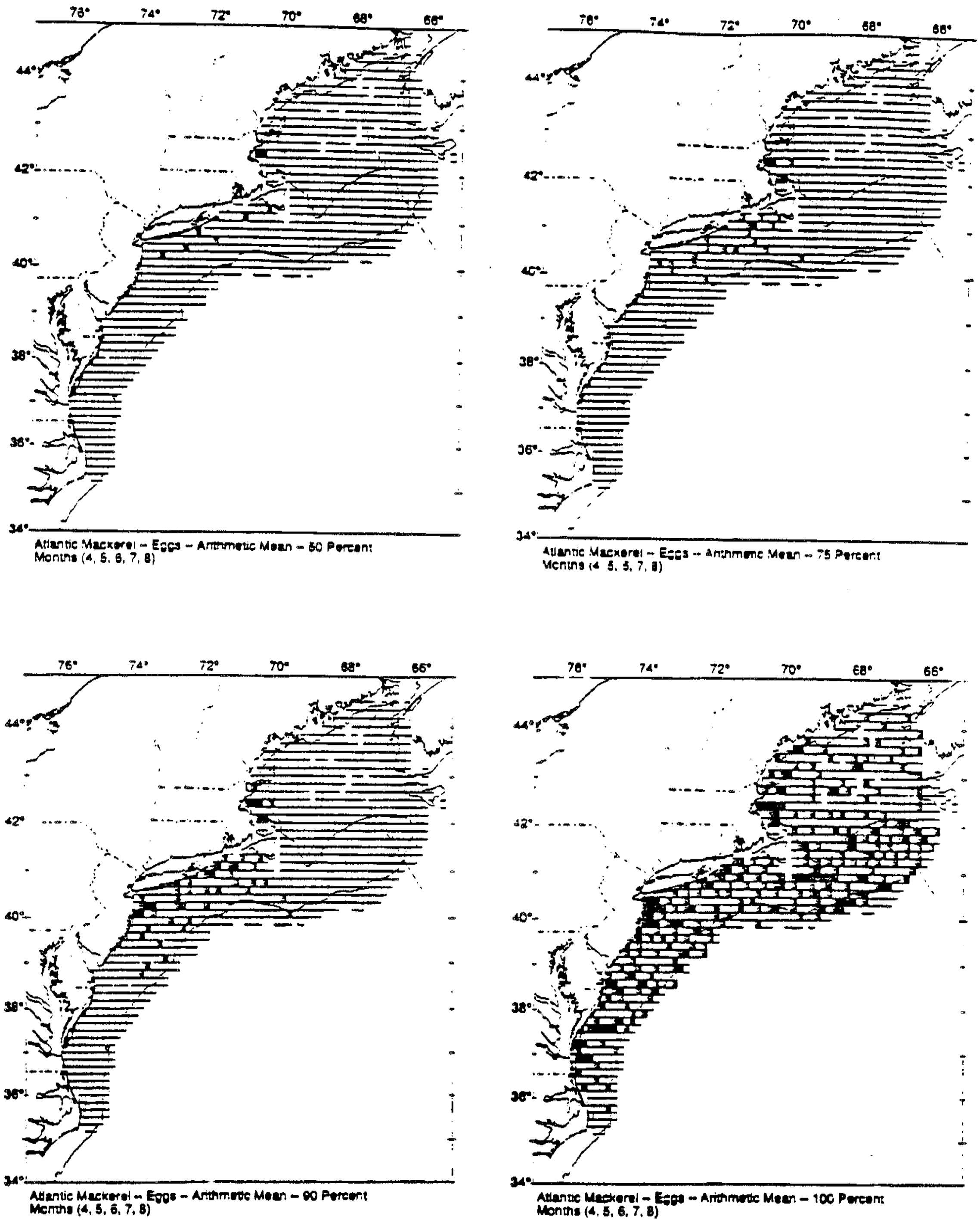


Figure 45a. Four options for designating EFH for Atlantic mackerel eggs under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the MARMAP survey.
Source: Cross pers. comm.

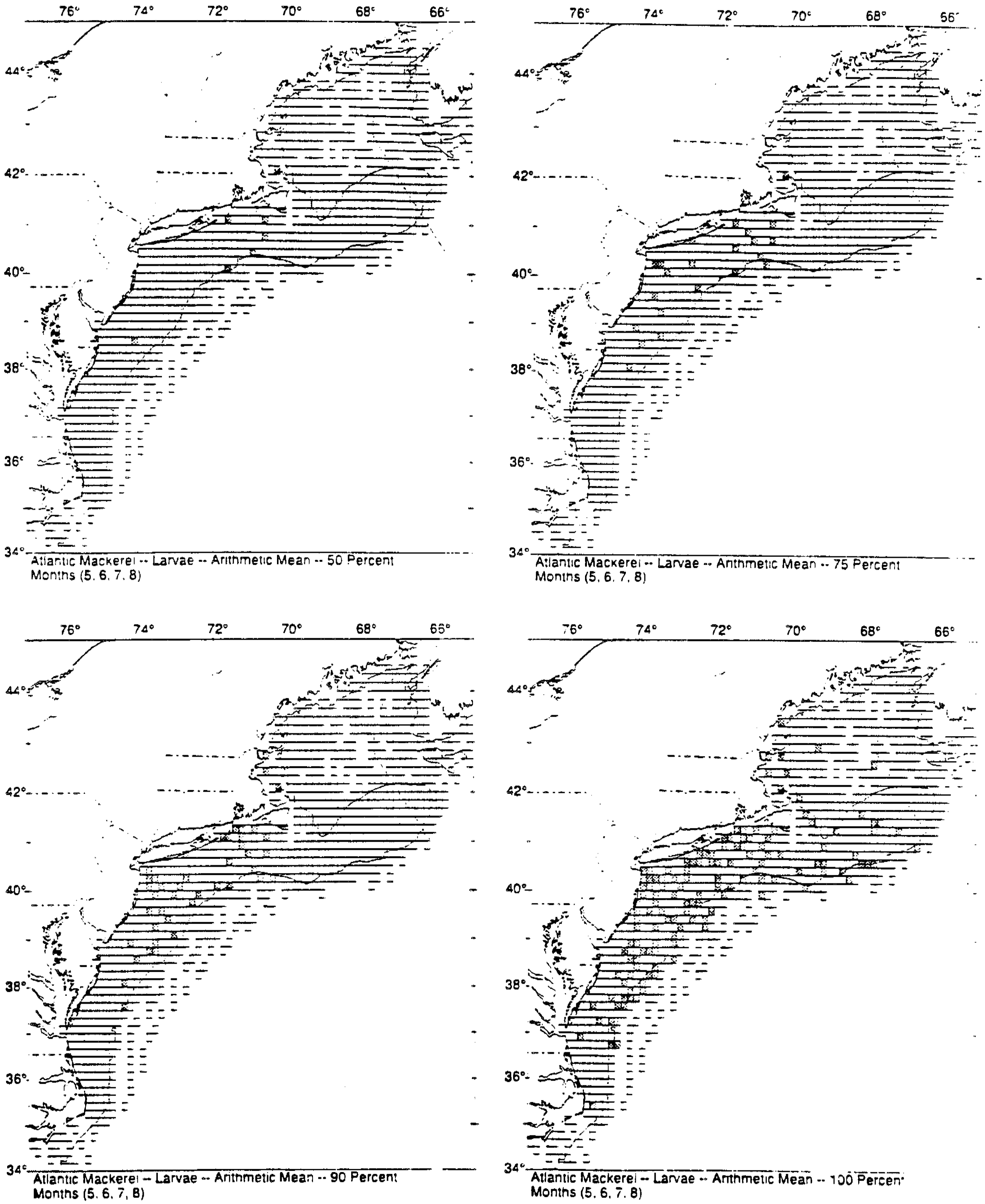


Figure 45b. Four options for designating EFH for Atlantic mackerel larvae under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the MARMAP survey.
Source: Cross pers. comm.

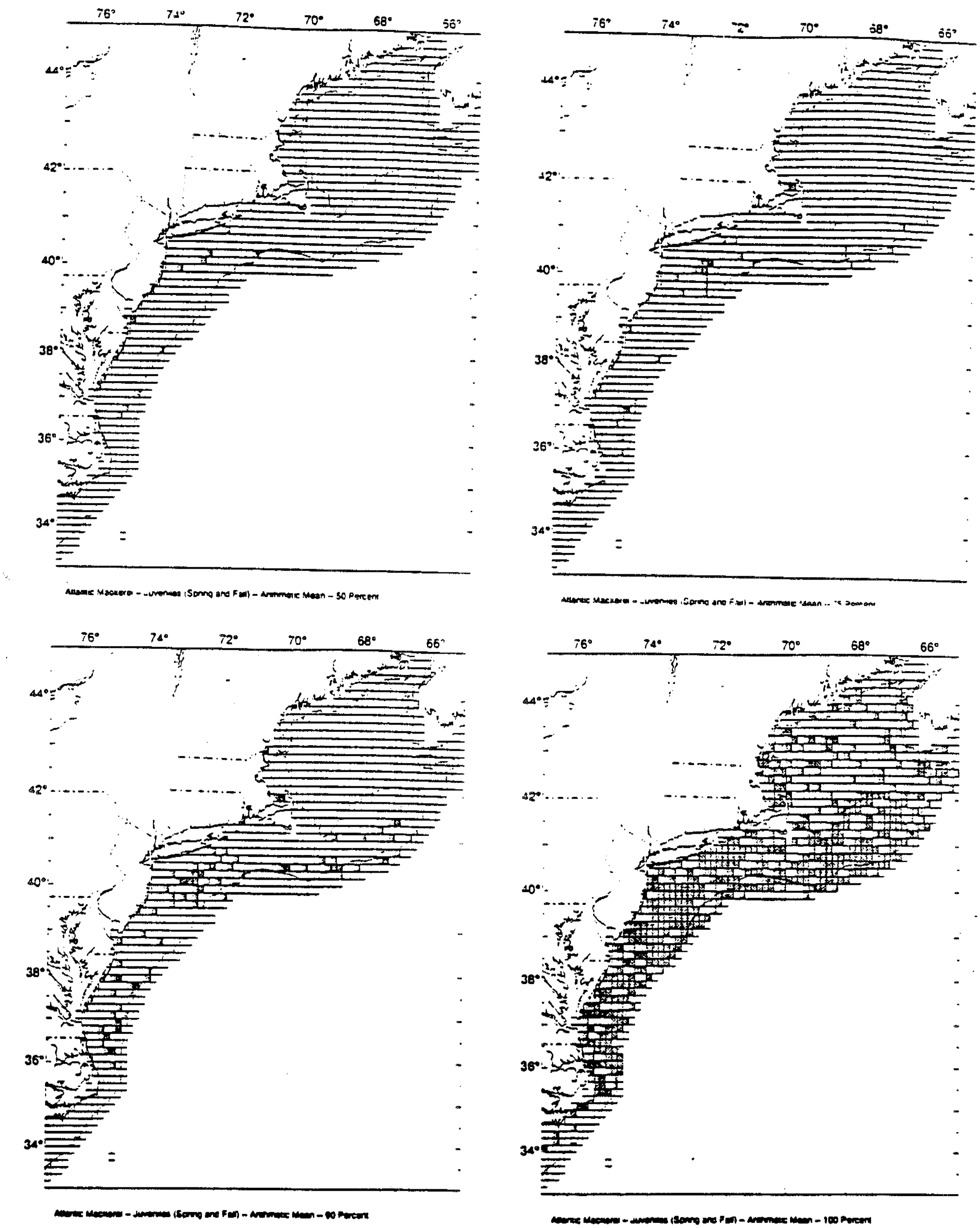


Figure 45c. Four options for designating EFH for juvenile Atlantic mackerel under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

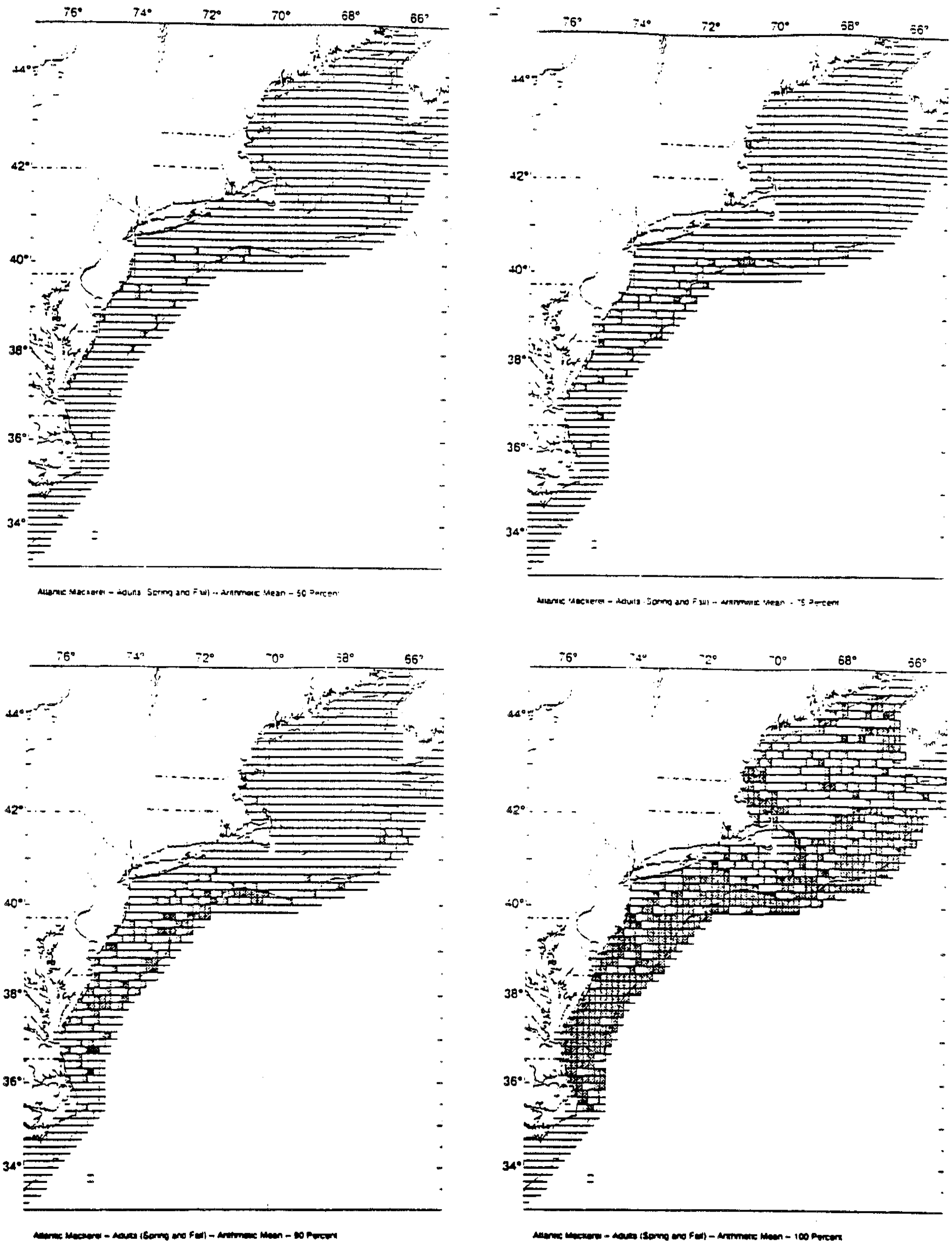


Figure 45d. Four options for designating EFH for adult Atlantic mackerel under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

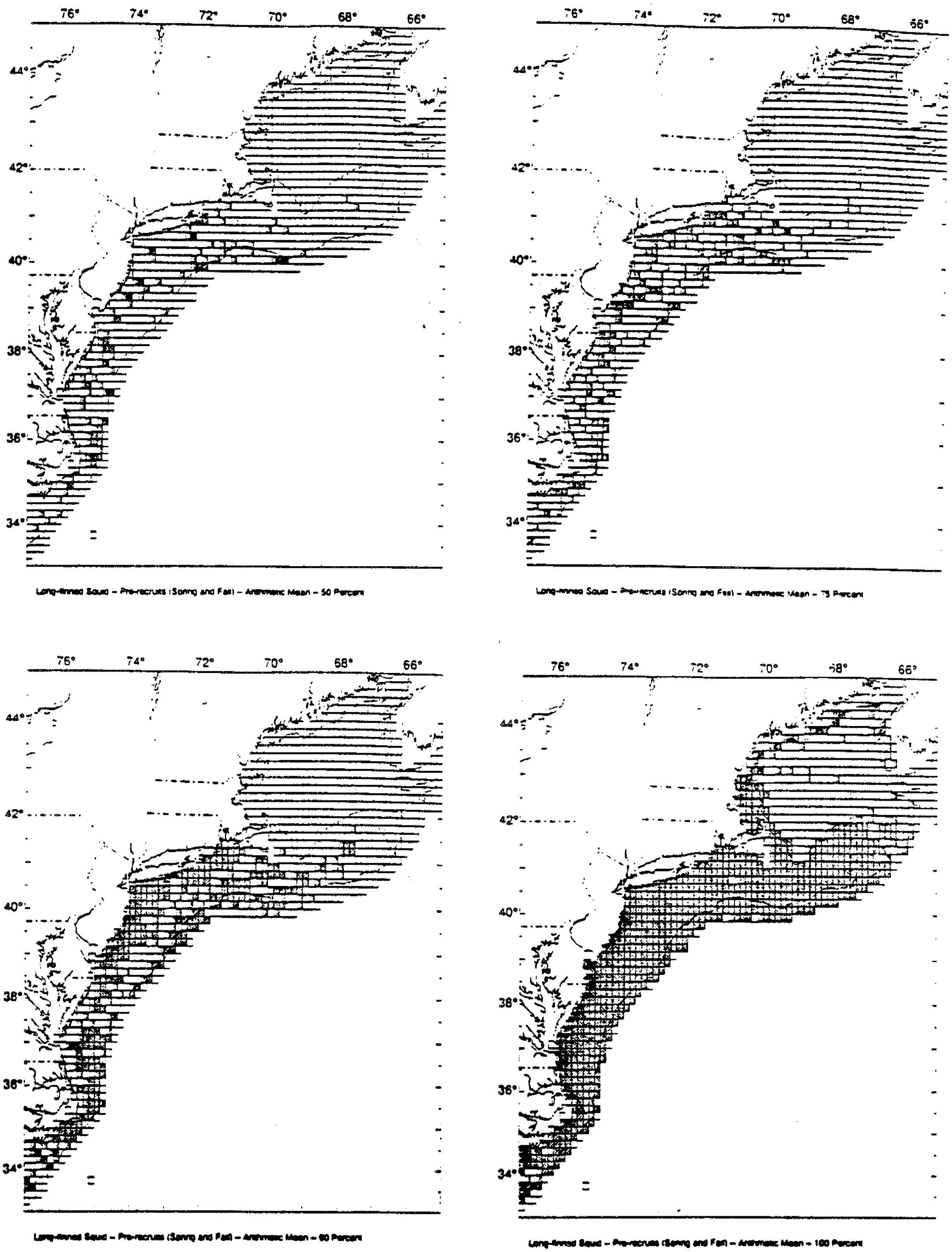


Figure 46a. Four options for designating EFH for *Loligo* pre-recruits under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

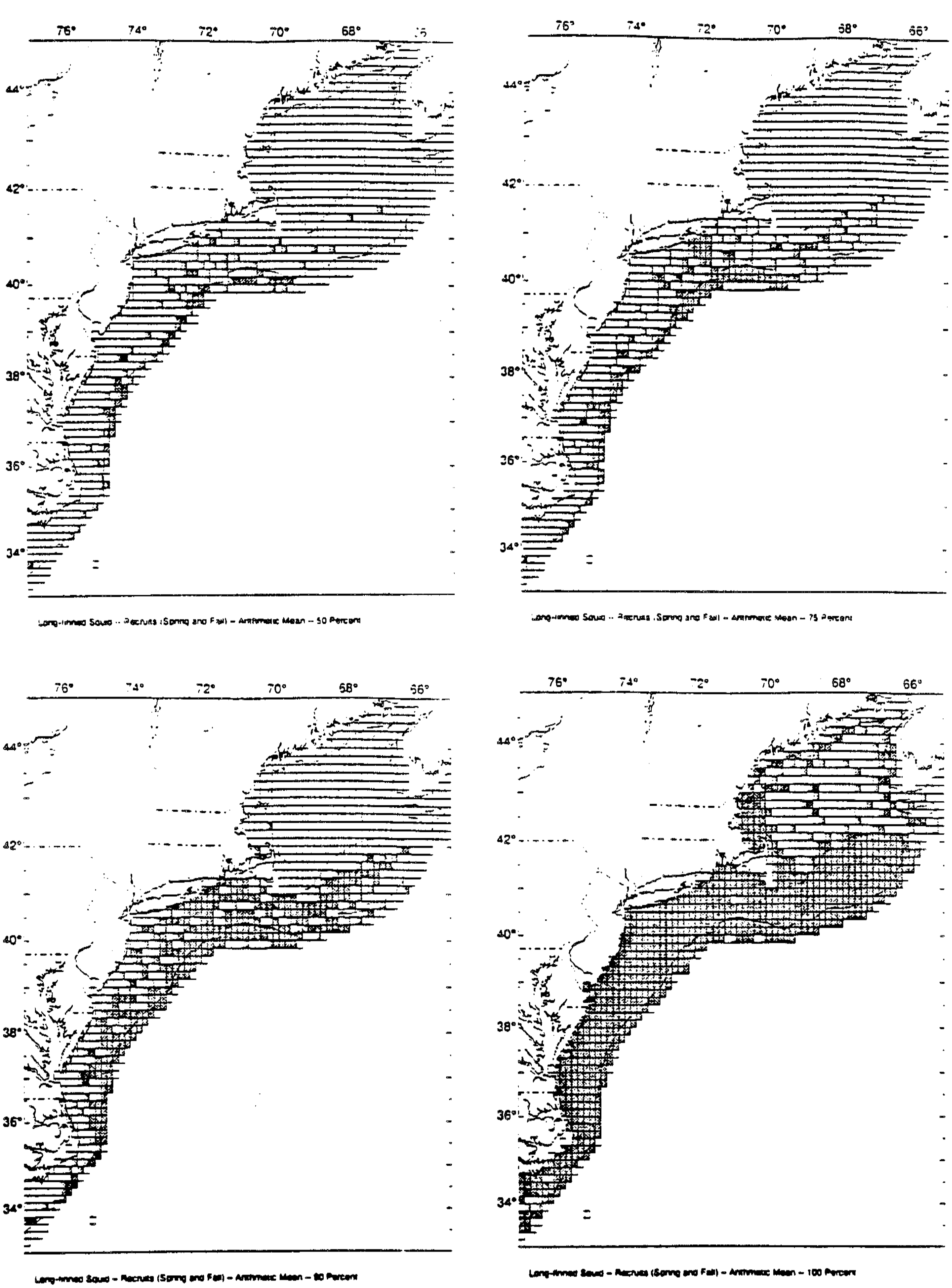


Figure 46b. Four options for designating EFH for *Loligo* recruits under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

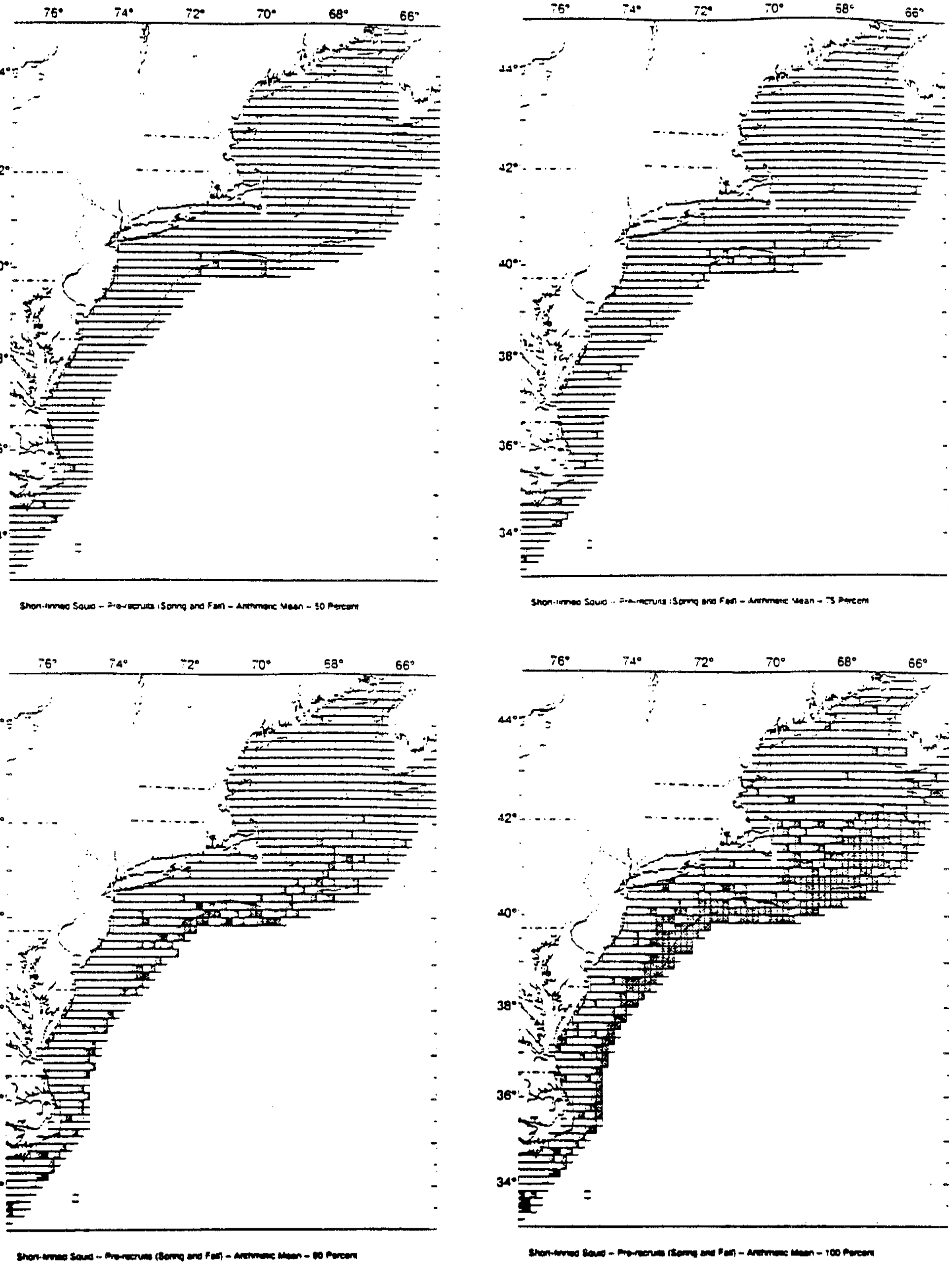


Figure 47a. Four options for designating EFH for *Illex* pre-recruits under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

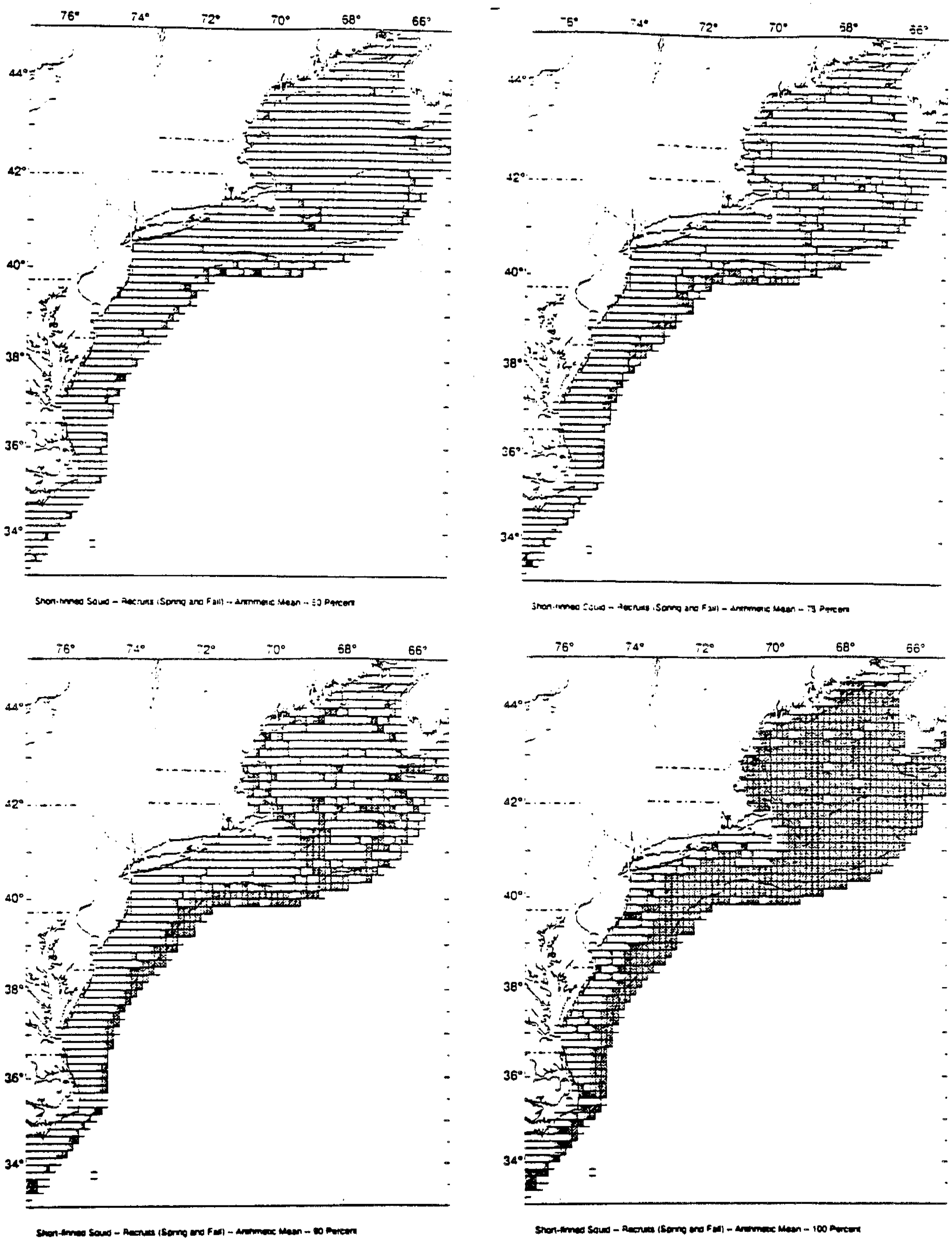


Figure 47b. Four options for designating EFH for *Illex* recruits under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

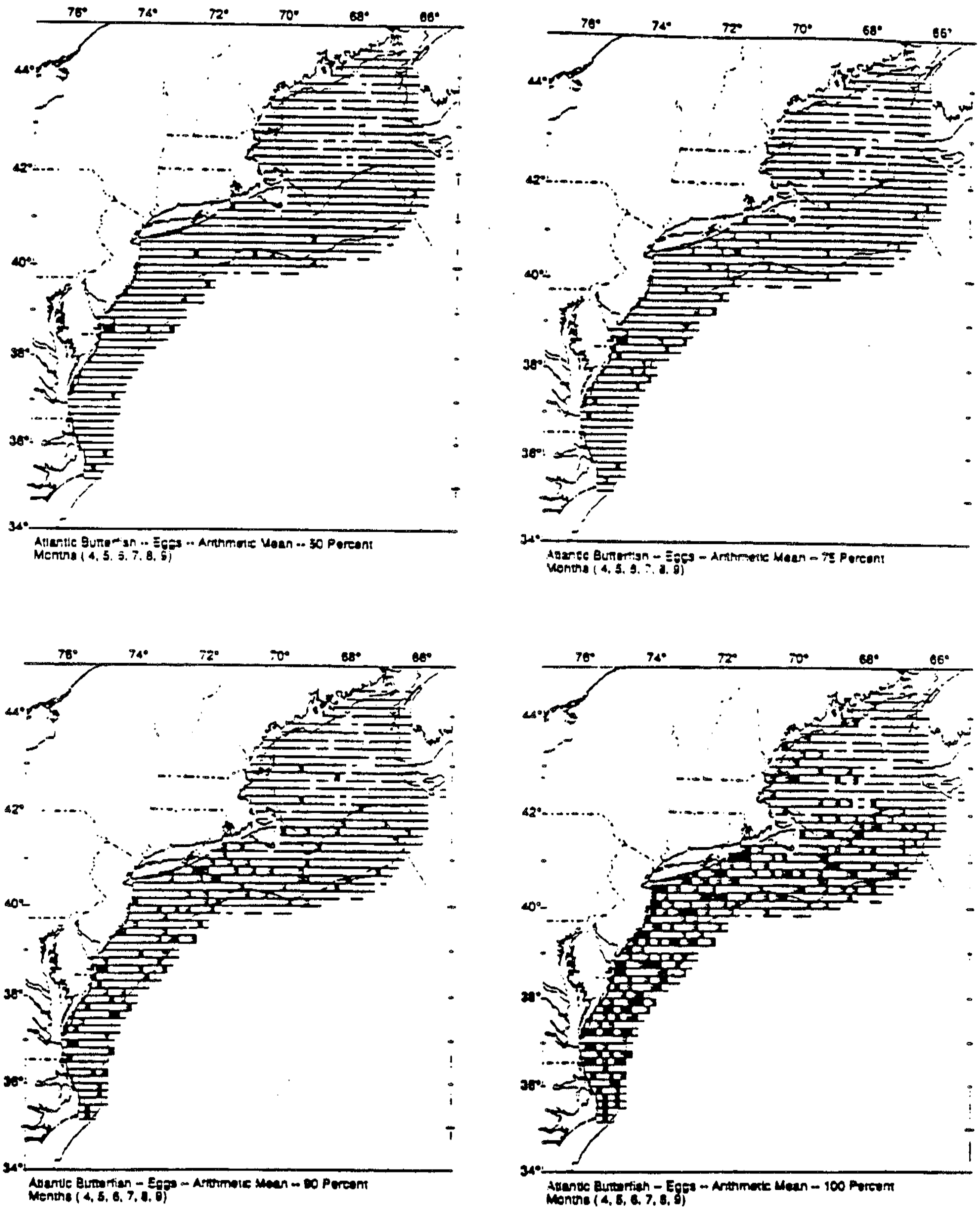


Figure 48a. Four options for designating EFH for butterfish eggs under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the MARMAP survey.
Source: Cross pers. comm.

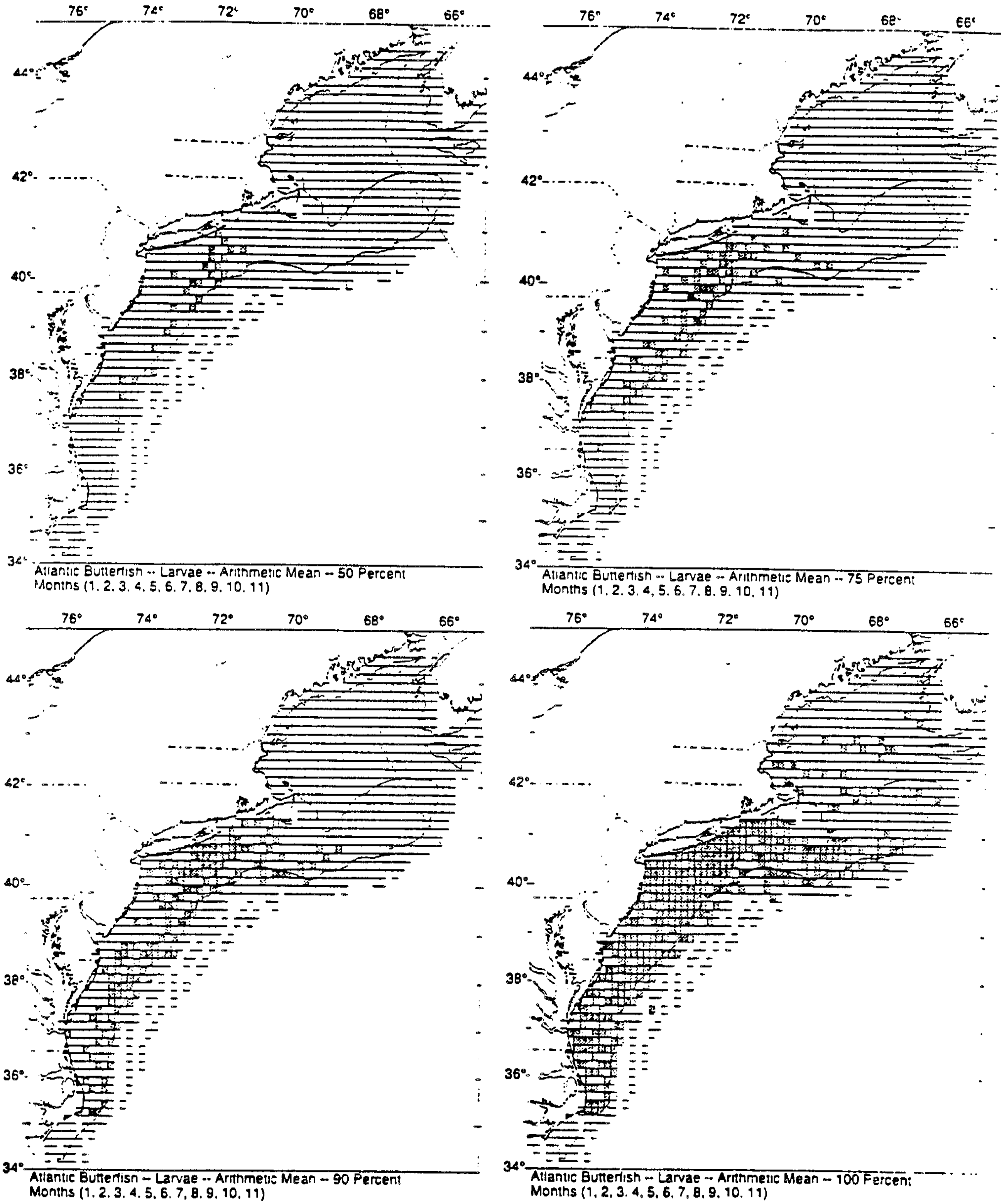


Figure 48b. Four options for designating EFH for butterfish larvae under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the MARMAP survey.
Source: Cross pers. comm.

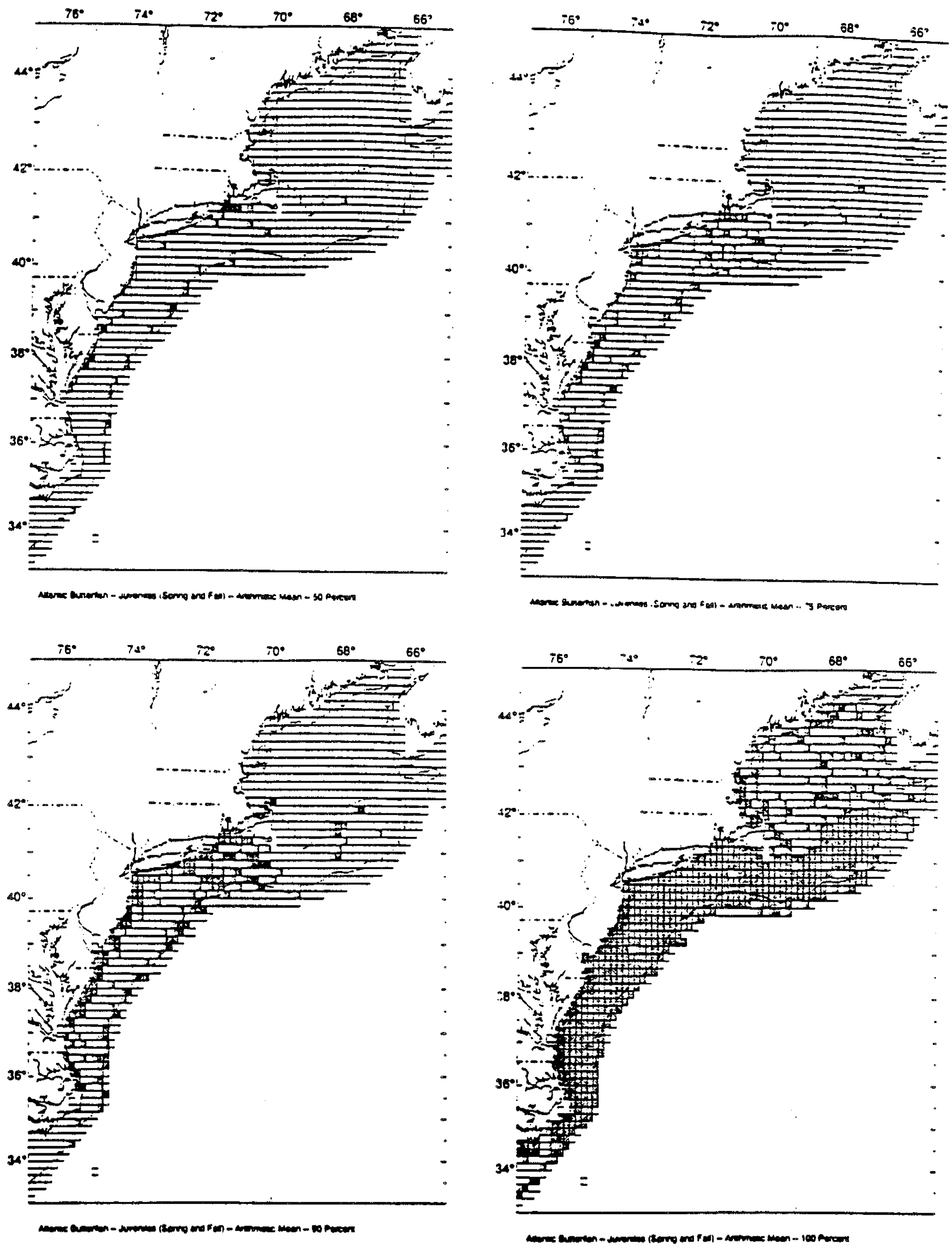


Figure 48c. Four options for designating EFH for juvenile butterfish under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

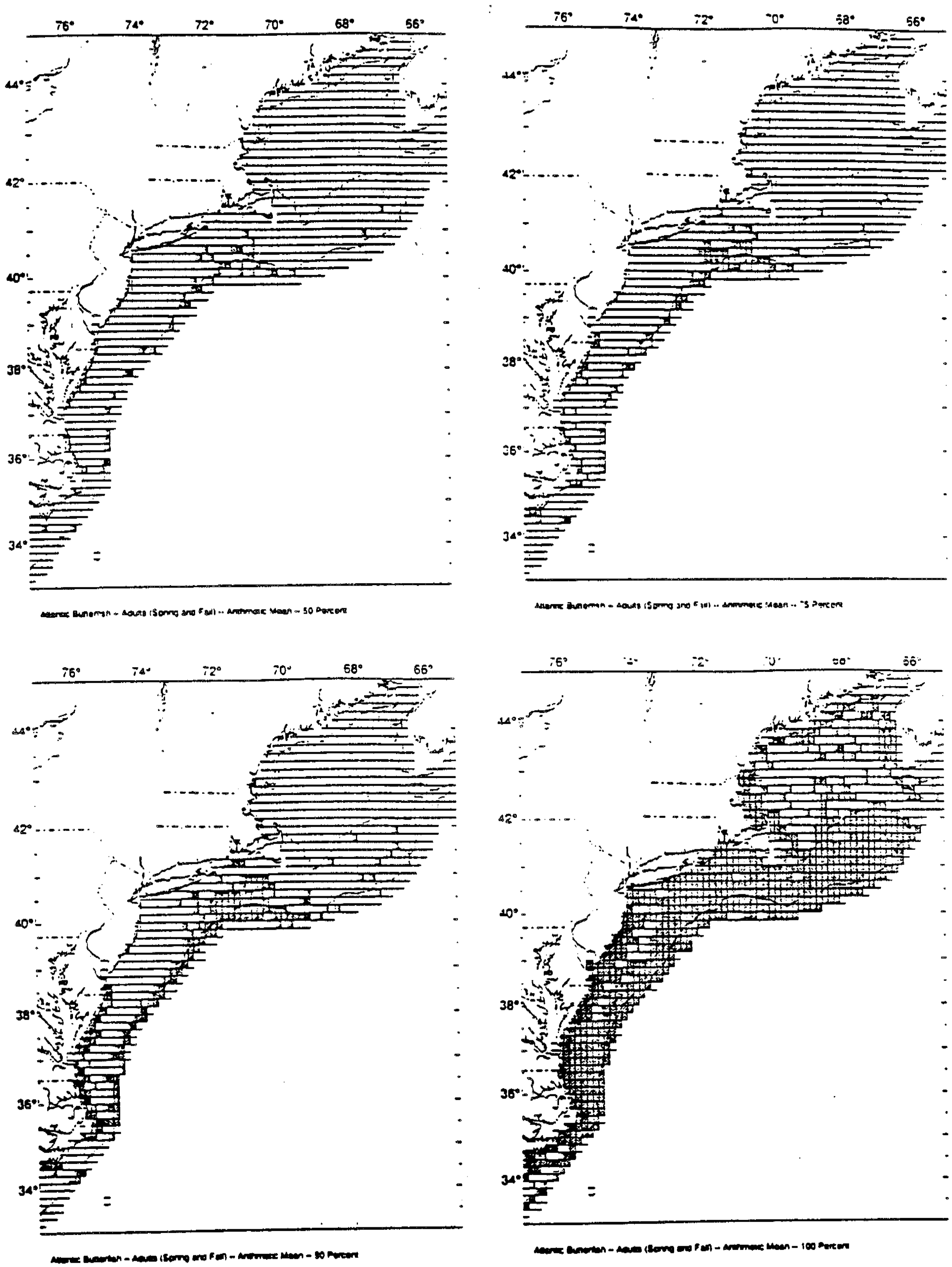


Figure 48d. Four options for designating EFH for adult butterfish under Alternative 5, the preferred alternative: 1) the top 50% of the catch; 2) the top 75% of the catch; 3) the top 90% of the catch; 4) and the top100% of the catch, in the NEFSC trawl survey.
Source: Cross pers. comm.

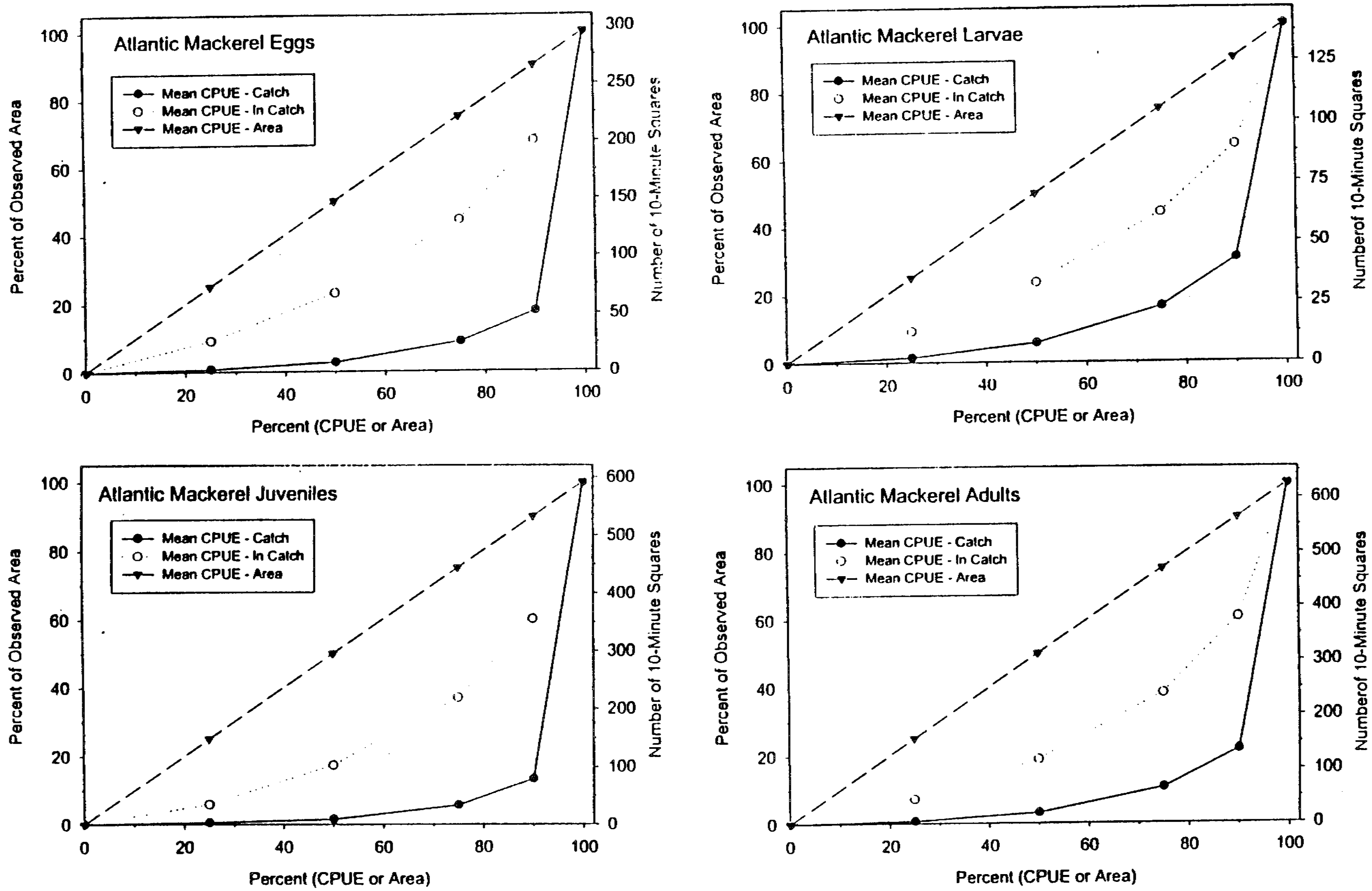
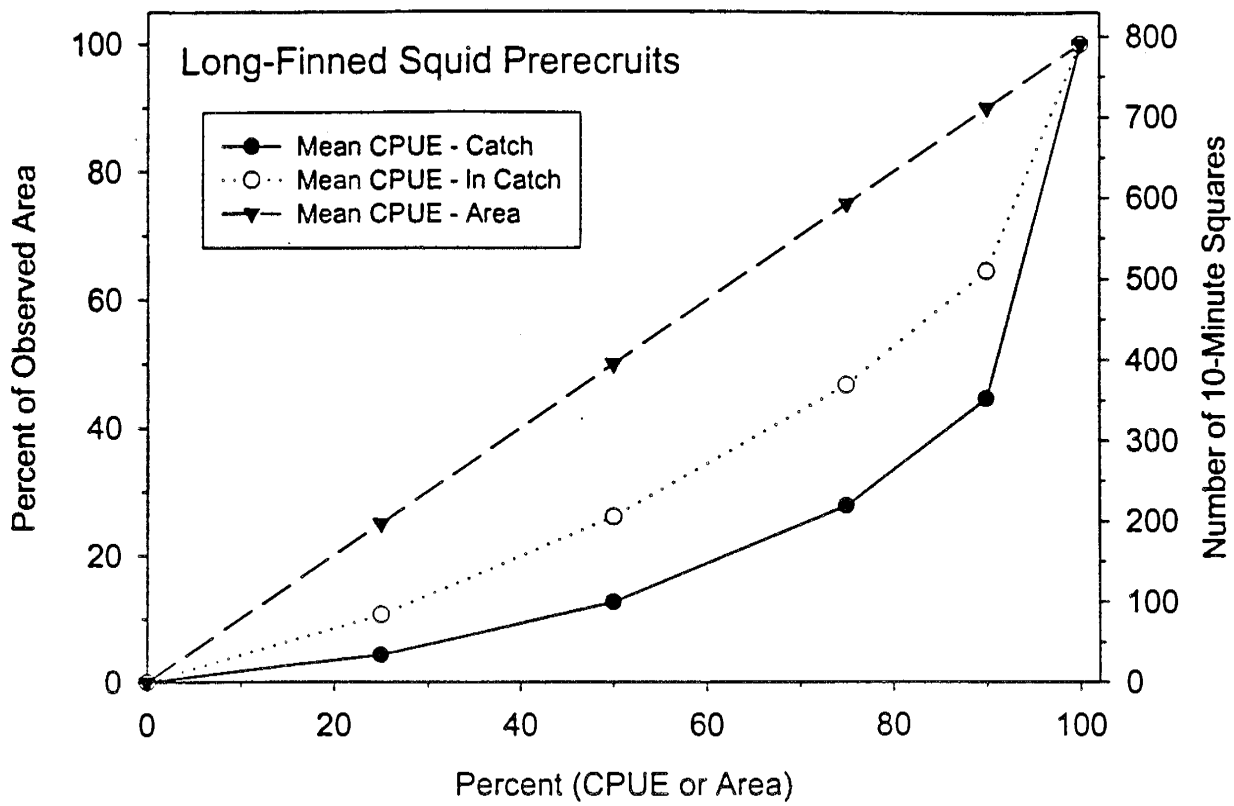


Figure 49a-d. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for Atlantic mackerel - a) eggs, b) larvae, c) juveniles, and d) adults.
Source: Cross pers. comm.



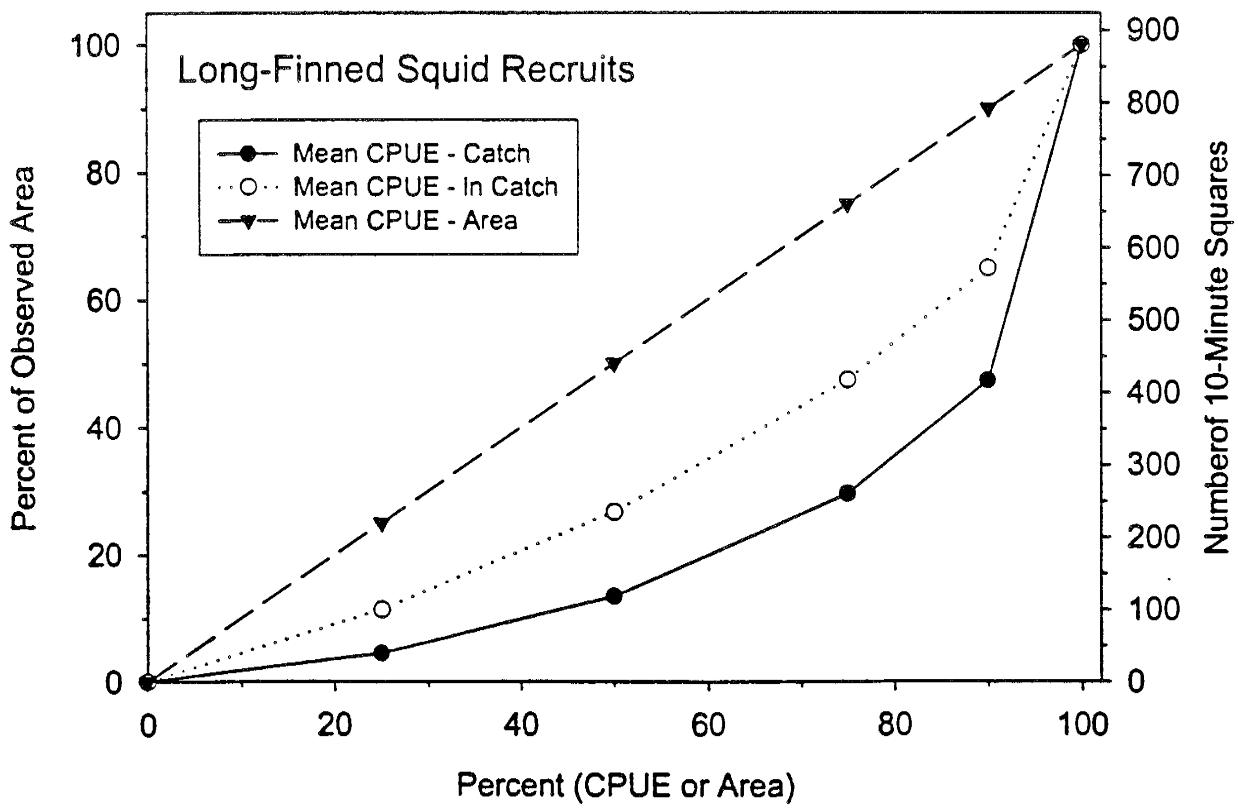
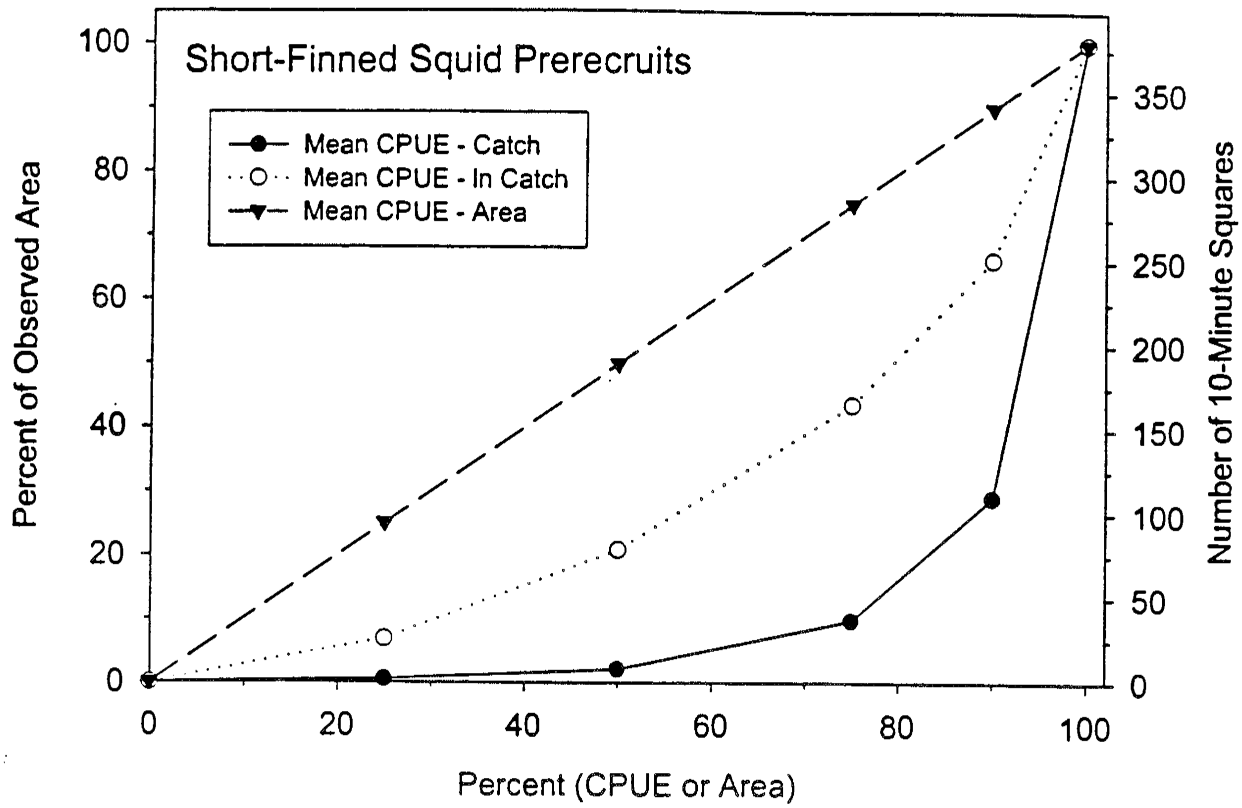


Figure 50a-b. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for *Loligo* - a) recruits and b) pre-recruits.
Source: Cross pers. comm.



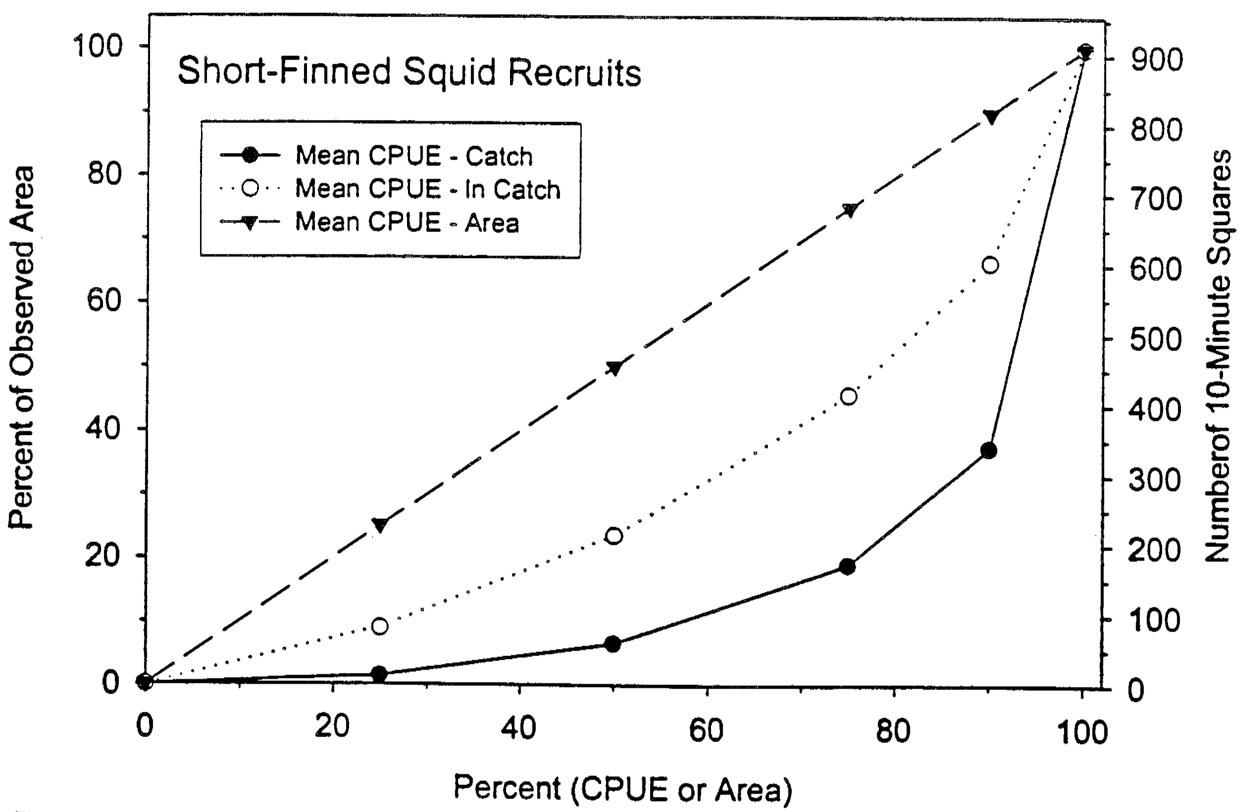


Figure 51a-b. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for *Illex* - a) recruits and b) pre-recruits. Source: Cross pers. comm.

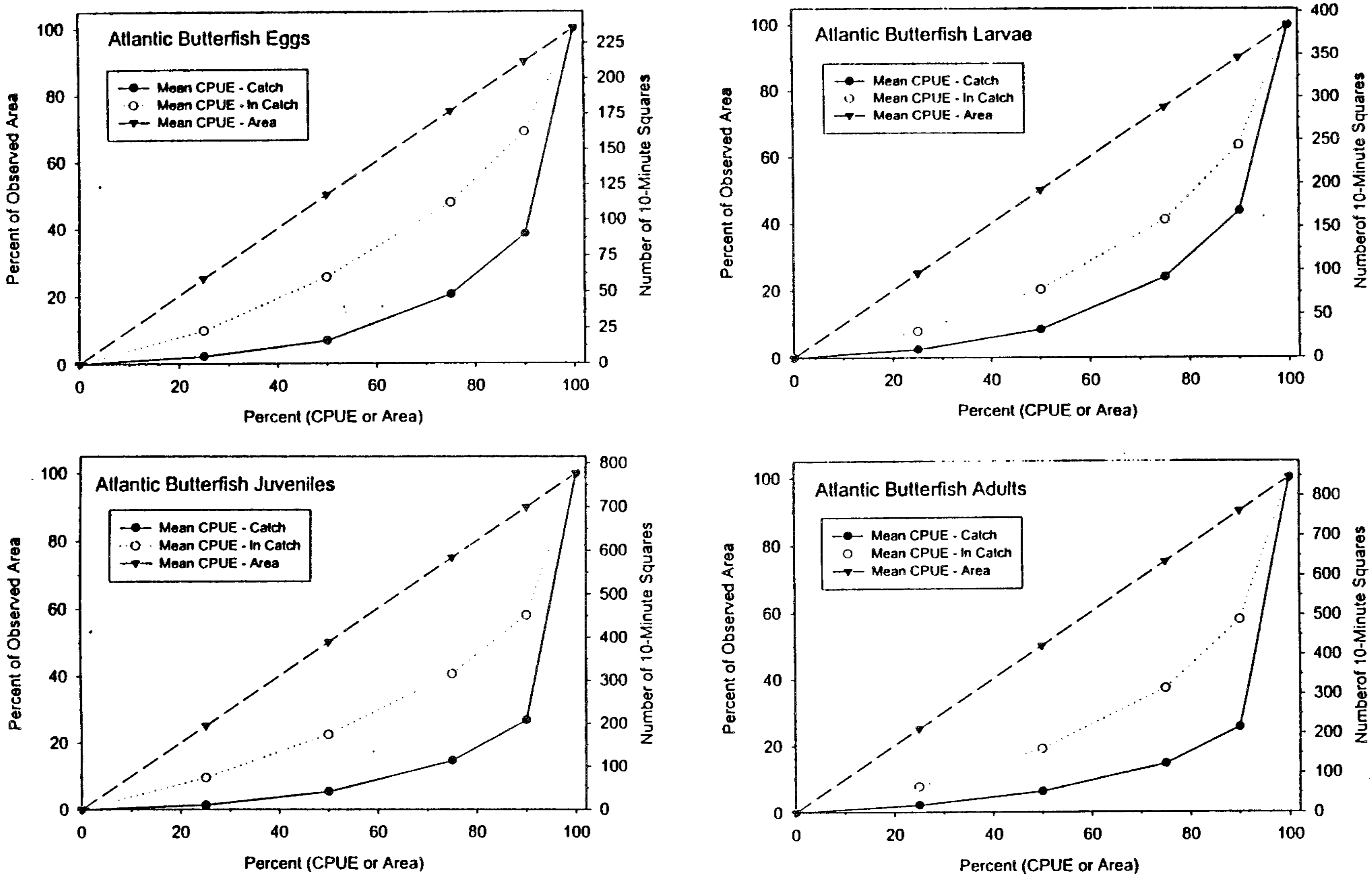


Figure 52a-d. Graphical representation of percent area and numbers of 10 minute squares encompassed in the area analysis, logged CPUE, and CPUE for butterfish - a) eggs, b) larvae, c) juveniles, and d) adults.
Source: Cross pers. comm.

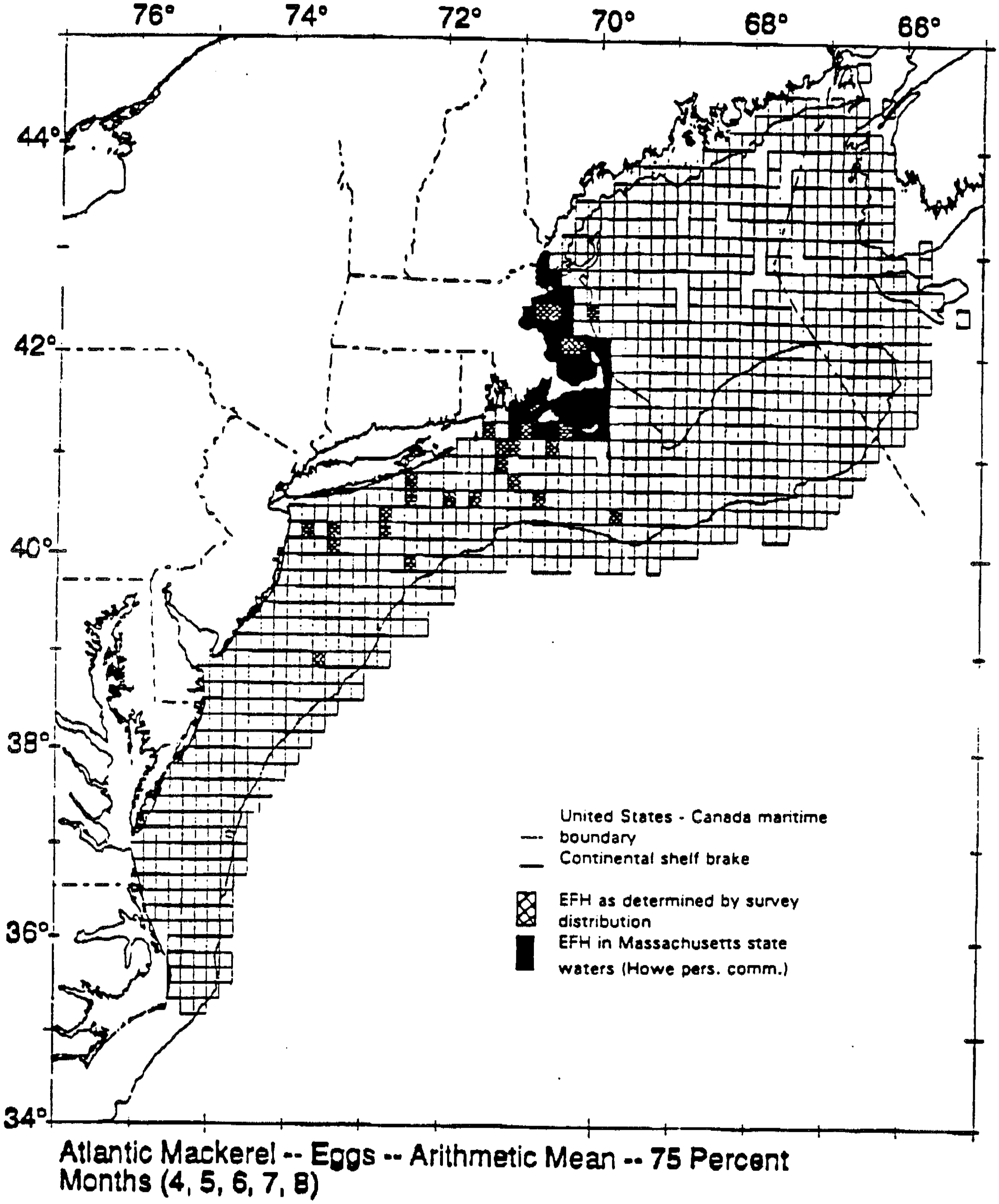


Figure 53a. EFH for Atlantic mackerel eggs, the area which encompasses the top 75% of the catch of Atlantic mackerel in the MARMAP and NEFSC trawl surveys.

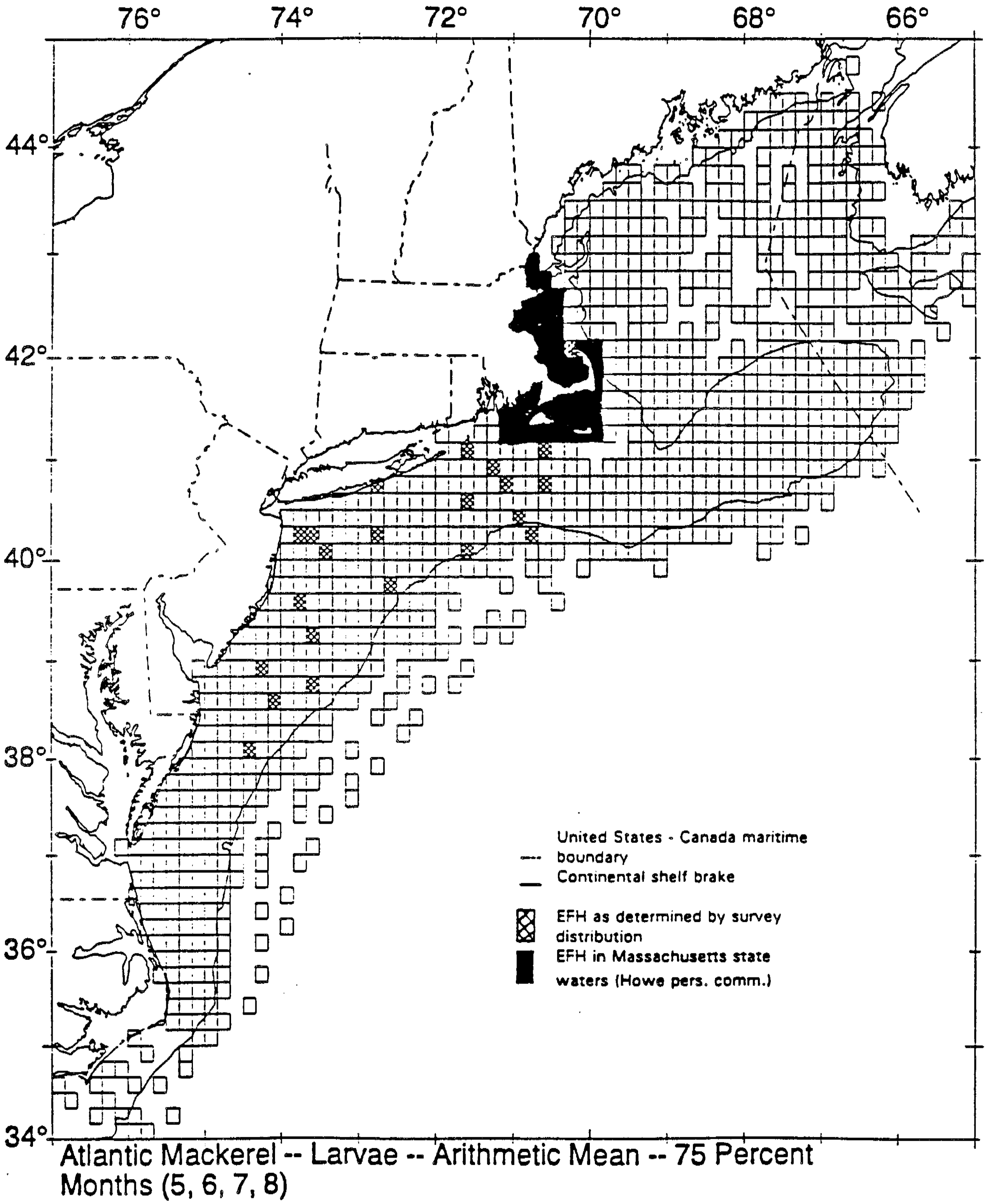
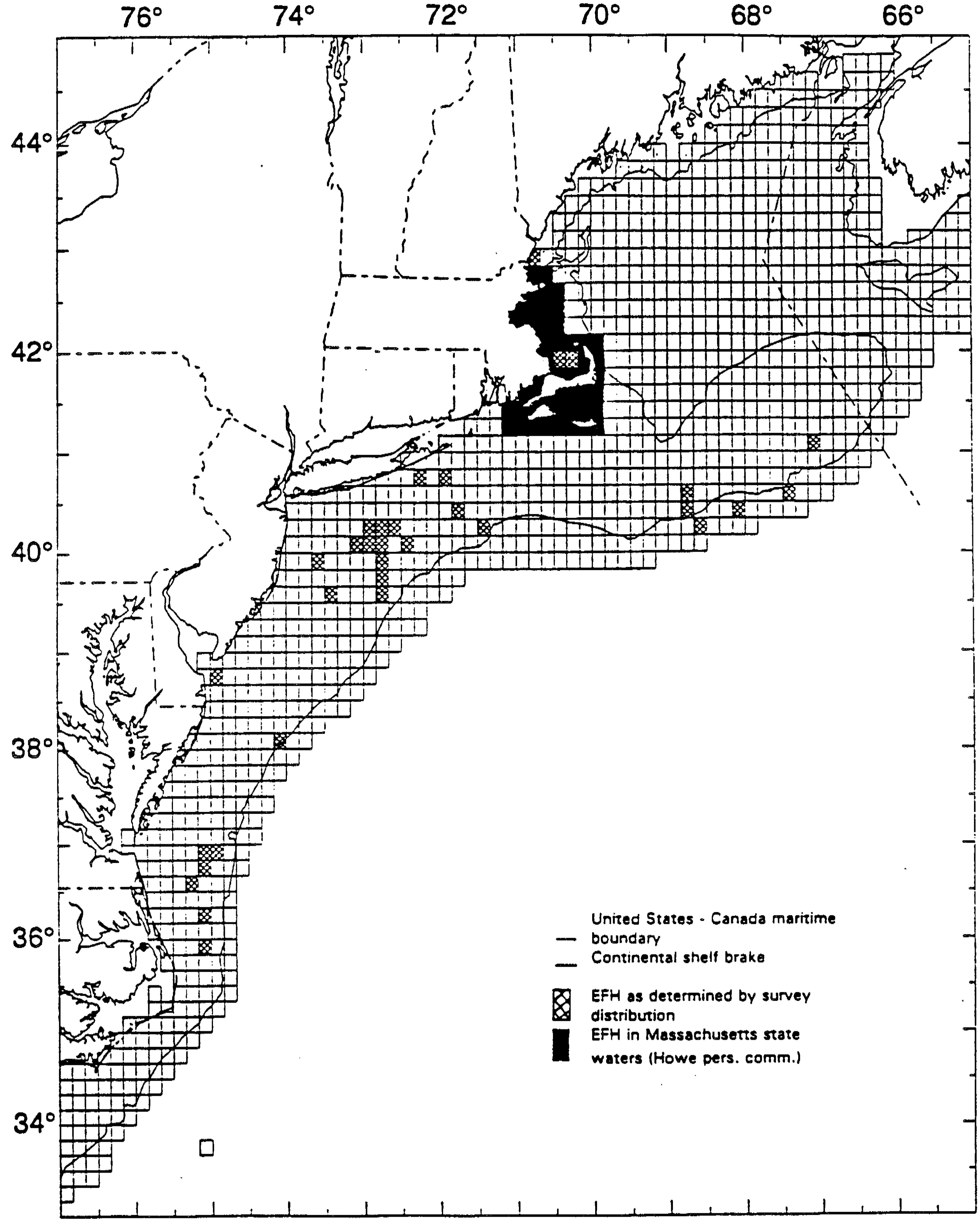
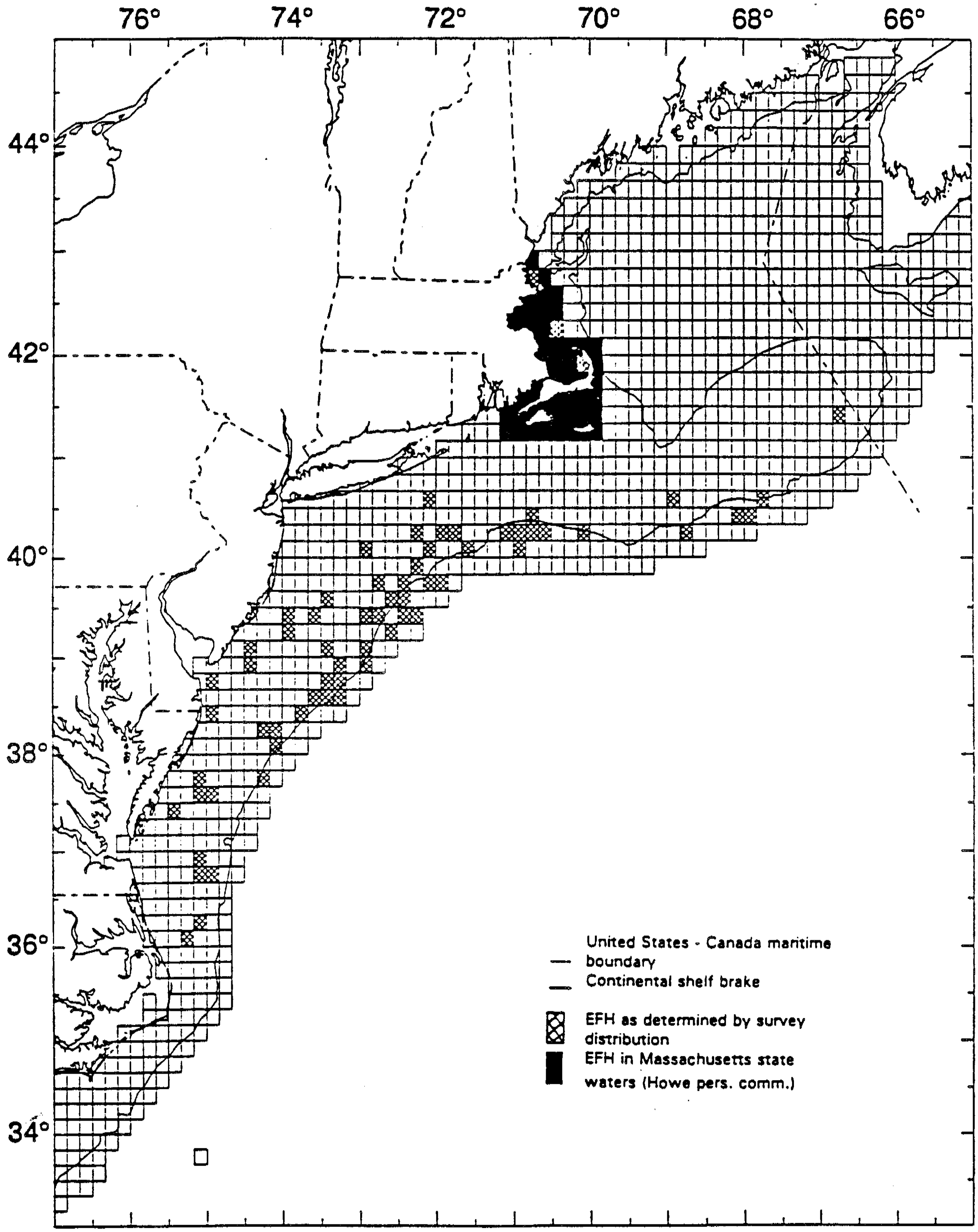


Figure 53b. EFH for Atlantic mackerel larvae, the area which encompasses the top 75% of the catch of Atlantic mackerel in the MARMAP and NEFSC trawl surveys.



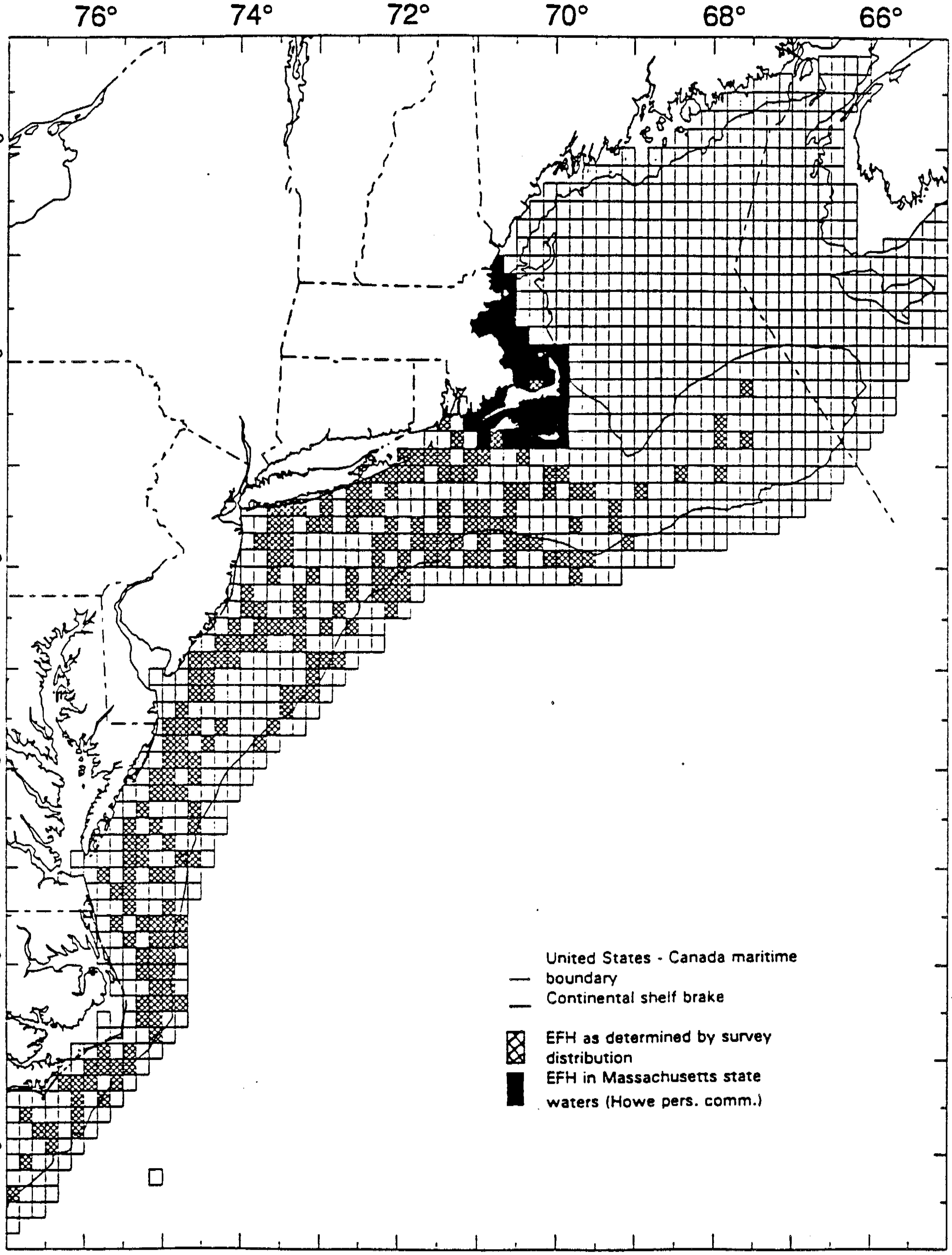
Atlantic Mackerel -- Juveniles (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 53c. EFH for Atlantic mackerel juveniles, the area which encompasses the top 75% of the catch of Atlantic mackerel in the MARMAP and NEFSC trawl surveys.



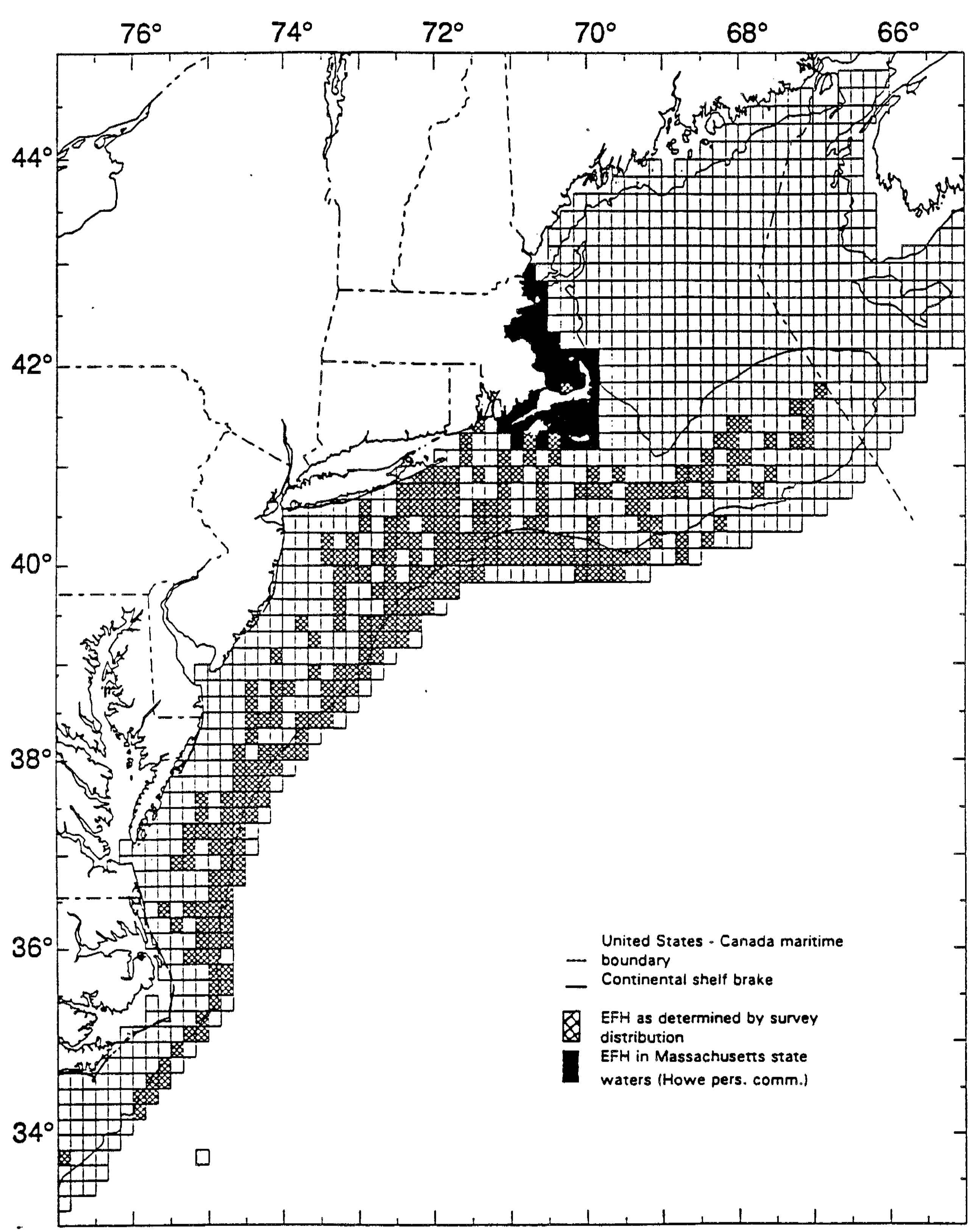
Atlantic Mackerel – Adults (Spring and Fall) -- Arithmetic Mean – 75 Percent

Figure 53d. EFH for Atlantic mackerel adults, the area which encompasses the top 75% of the catch of Atlantic mackerel in the MARMAP and NEFSC trawl surveys.



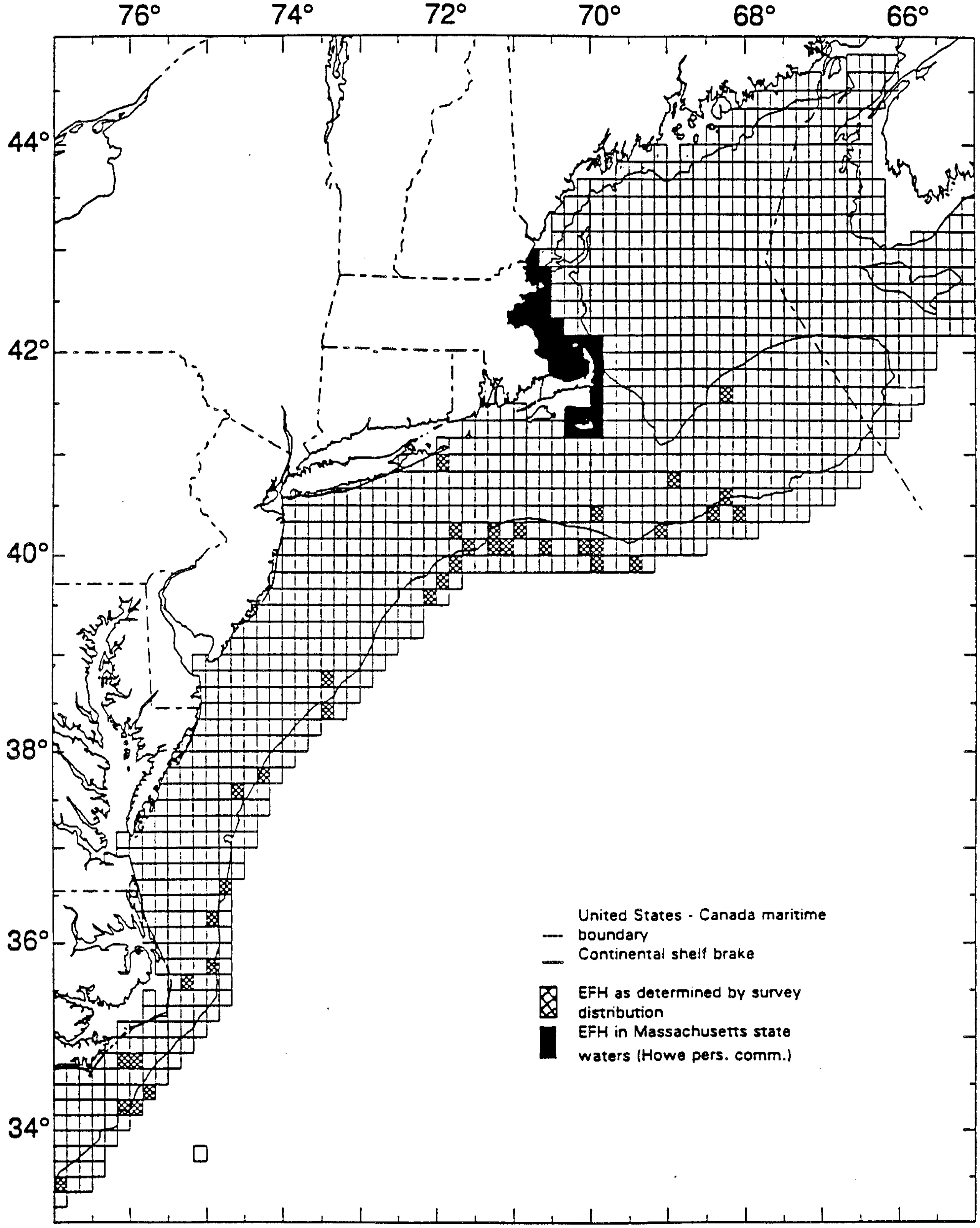
Long-finned Squid -- Pre-recruits (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 54a. EFH for *Loligo* pre-recruits, the area which encompasses the top 75% of the catch of *Loligo* in the NEFSC trawl surveys.



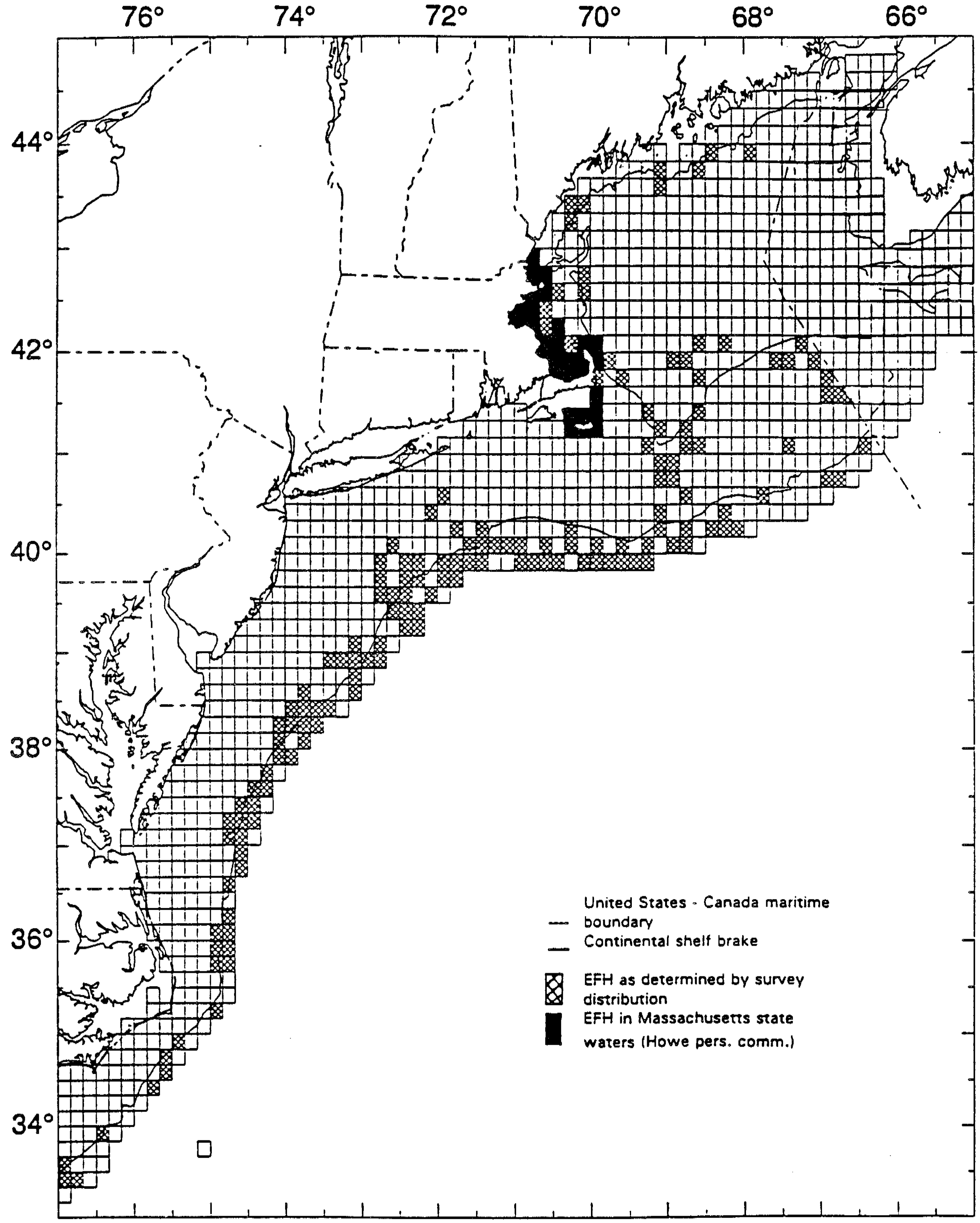
Long-finned Squid -- Recruits (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 54b. EFH for *Loligo* recruits, the area which encompasses the top 75% of the catch of *Loligo* in the NEFSC trawl surveys.



Short-finned Squid -- Pre-recruits (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 55a. EFH for *Illex* pre-recruits, the area which encompasses the top 75% of the catch of *Illex* in the NEFSC trawl surveys.



Short-finned Squid -- Recruits (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 55b. EFH for *Illex* recruits, the area which encompasses the top 75% of the catch of *Illex* in the NEFSC trawl surveys.

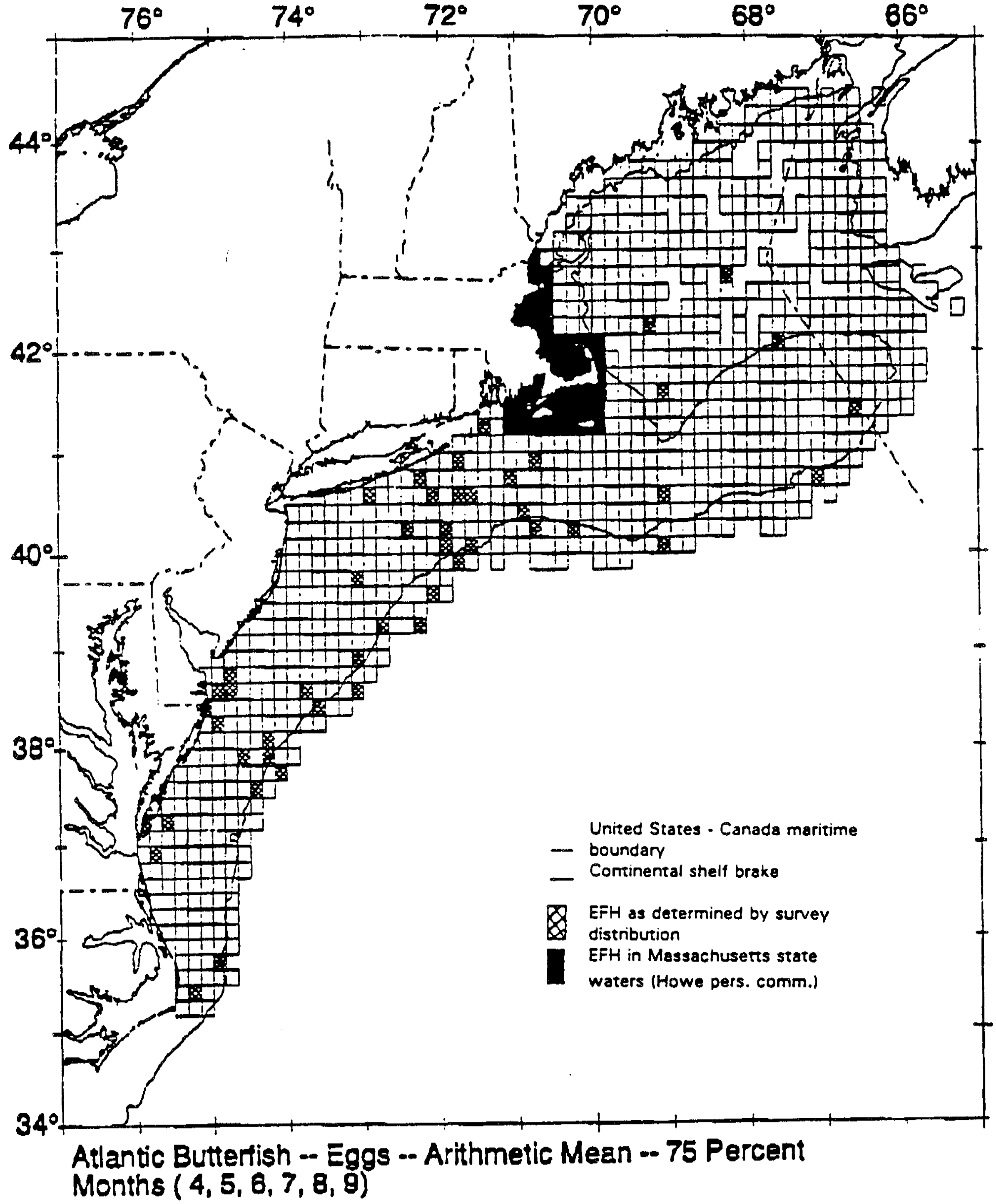


Figure 56a. EFH for butterfish eggs, the area which encompasses the top 75% of the catch of butterfish in the MARMAP and NEFSC trawl surveys.

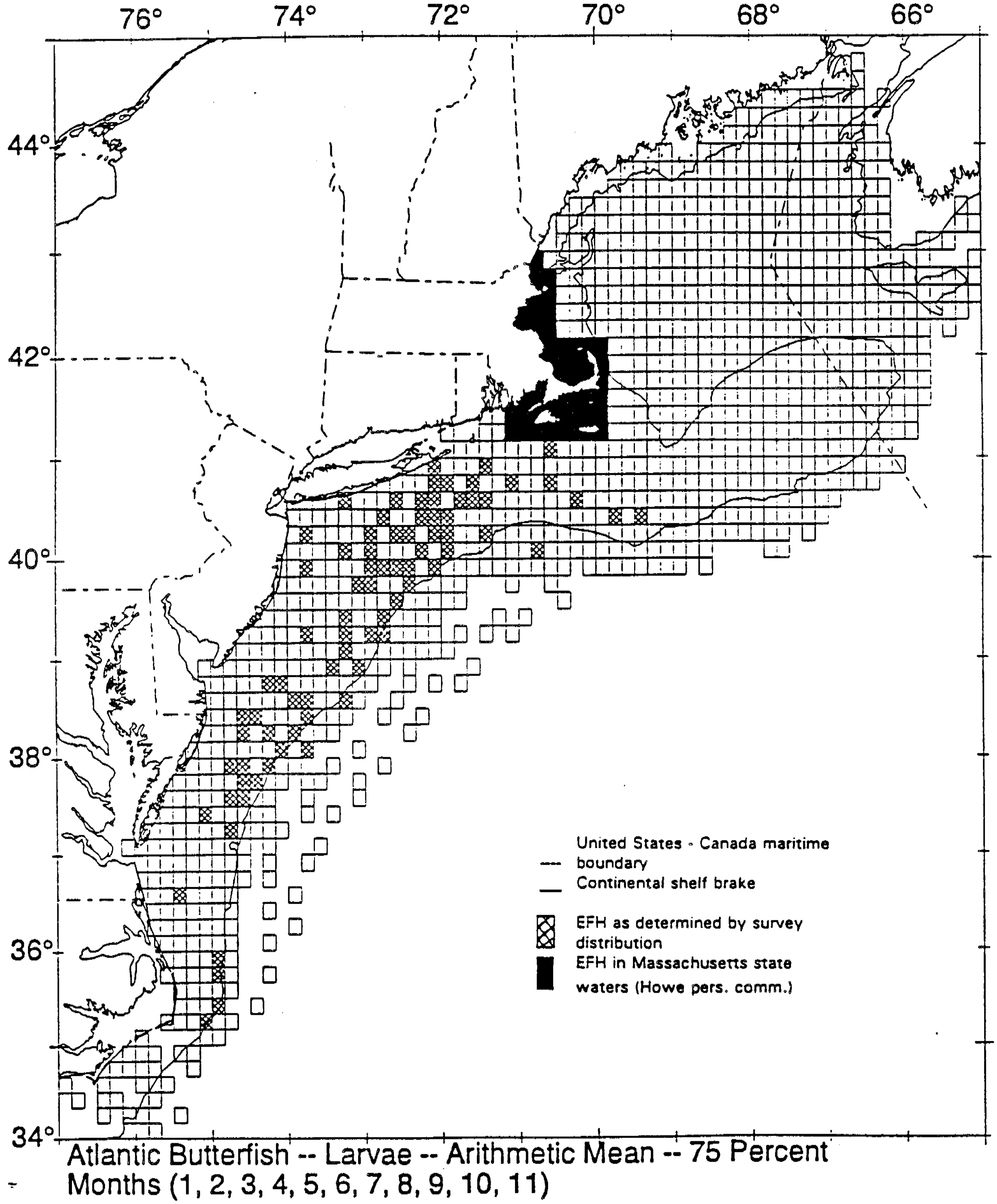
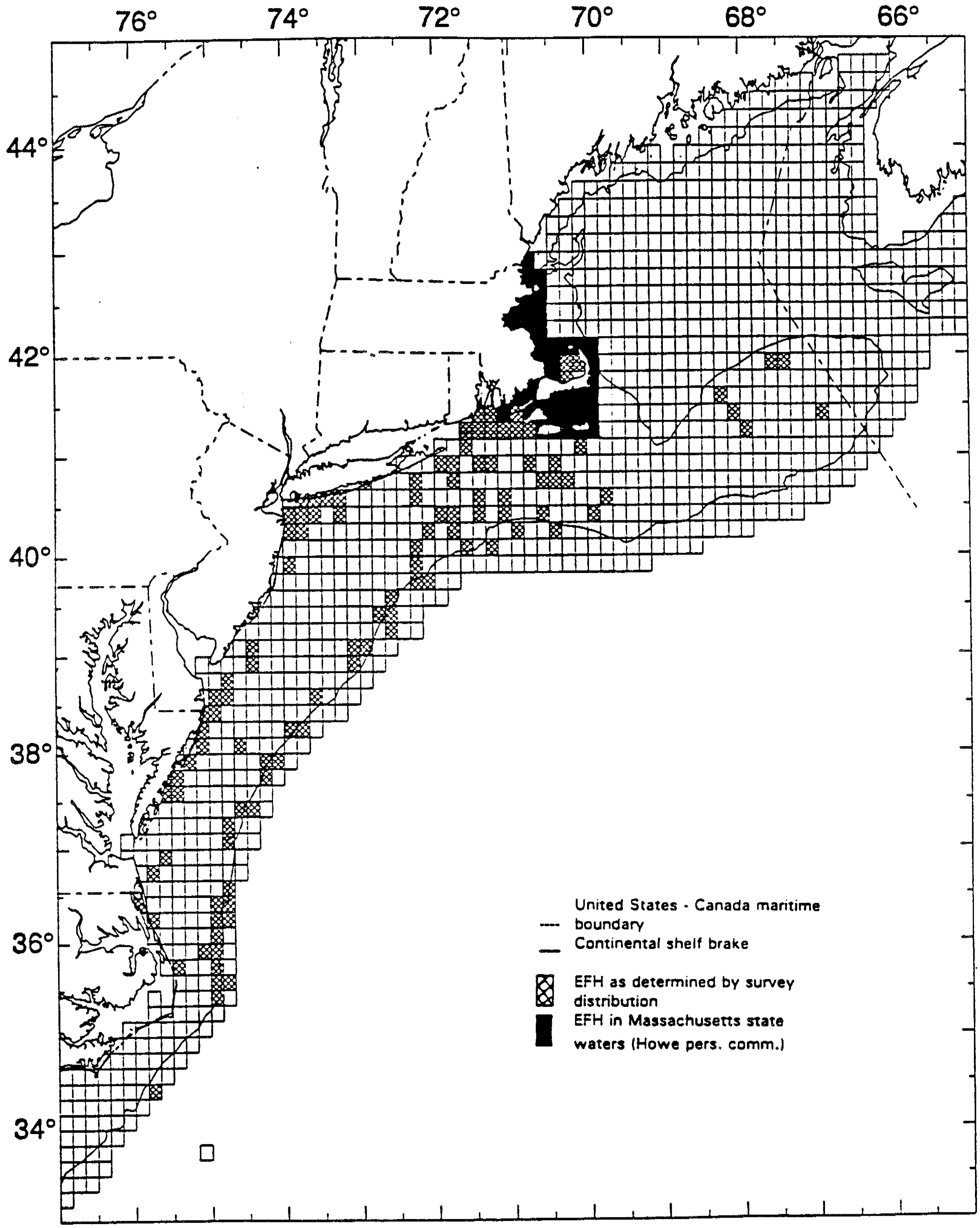
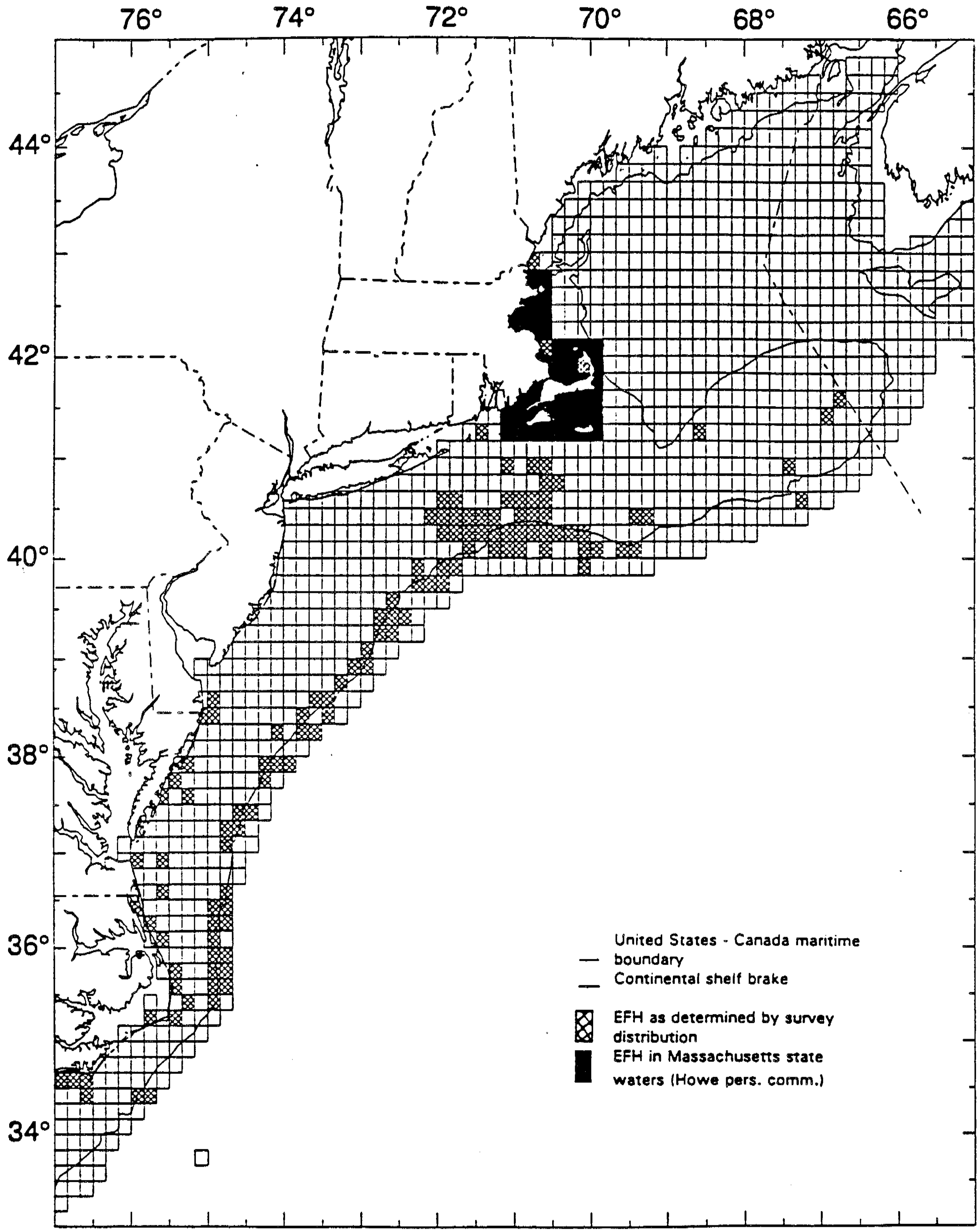


Figure 56b. EFH for butterfish larvae, the area which encompasses the top 75% of the catch of butterfish in the MARMAP and NEFSC trawl surveys.



Atlantic Butterfish -- Juveniles (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 56c. EFH for butterfish juveniles, the area which encompasses the top 75% of the catch of butterfish in the MARMAP and NEFSC trawl surveys.



Atlantic Butterfish -- Adults (Spring and Fall) -- Arithmetic Mean -- 75 Percent

Figure 56d. EFH for butterfish adults, the area which encompasses the top 75% of the catch of butterfish in the MARMAP and NEFSC trawl surveys.

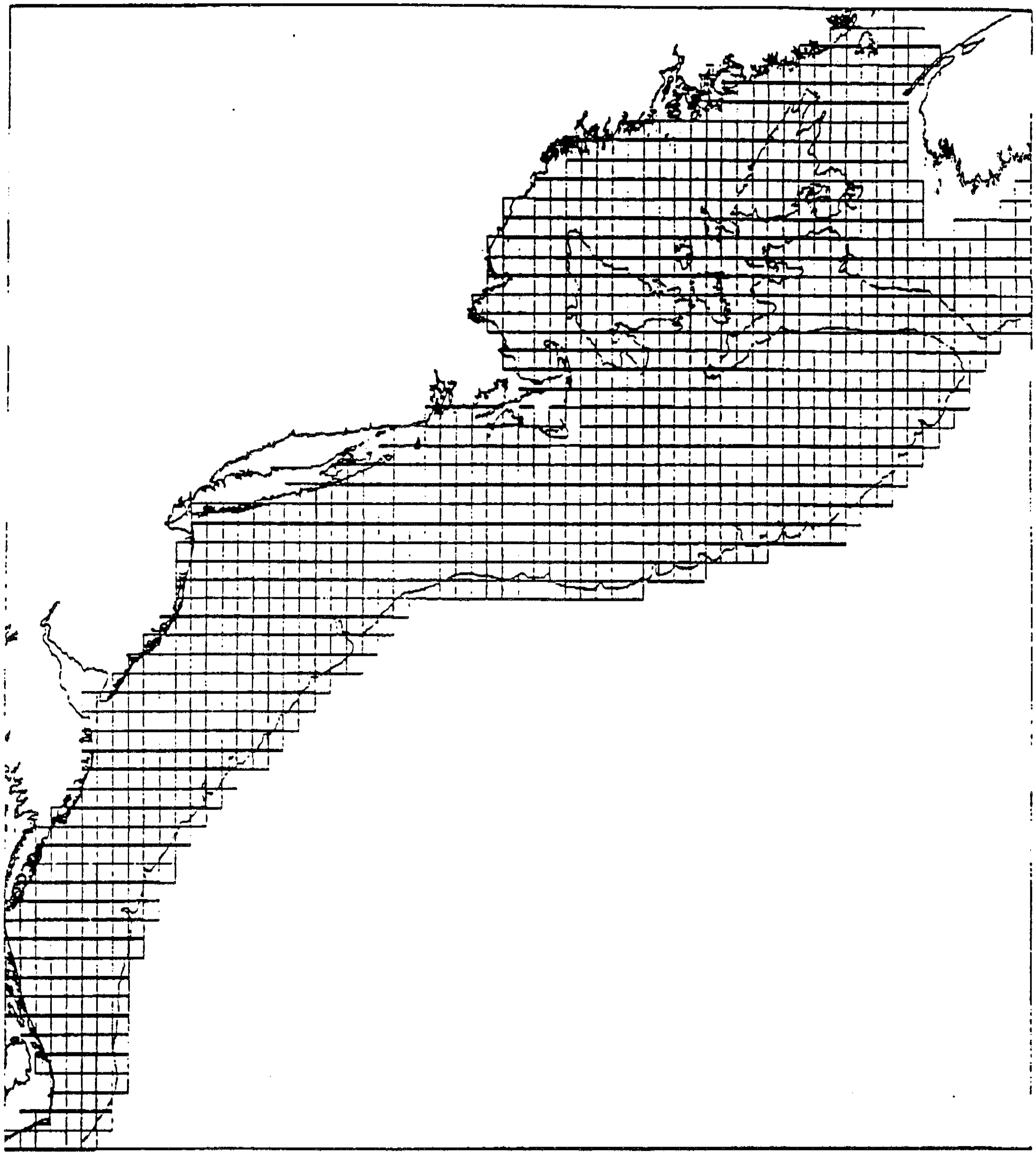


Figure 57. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

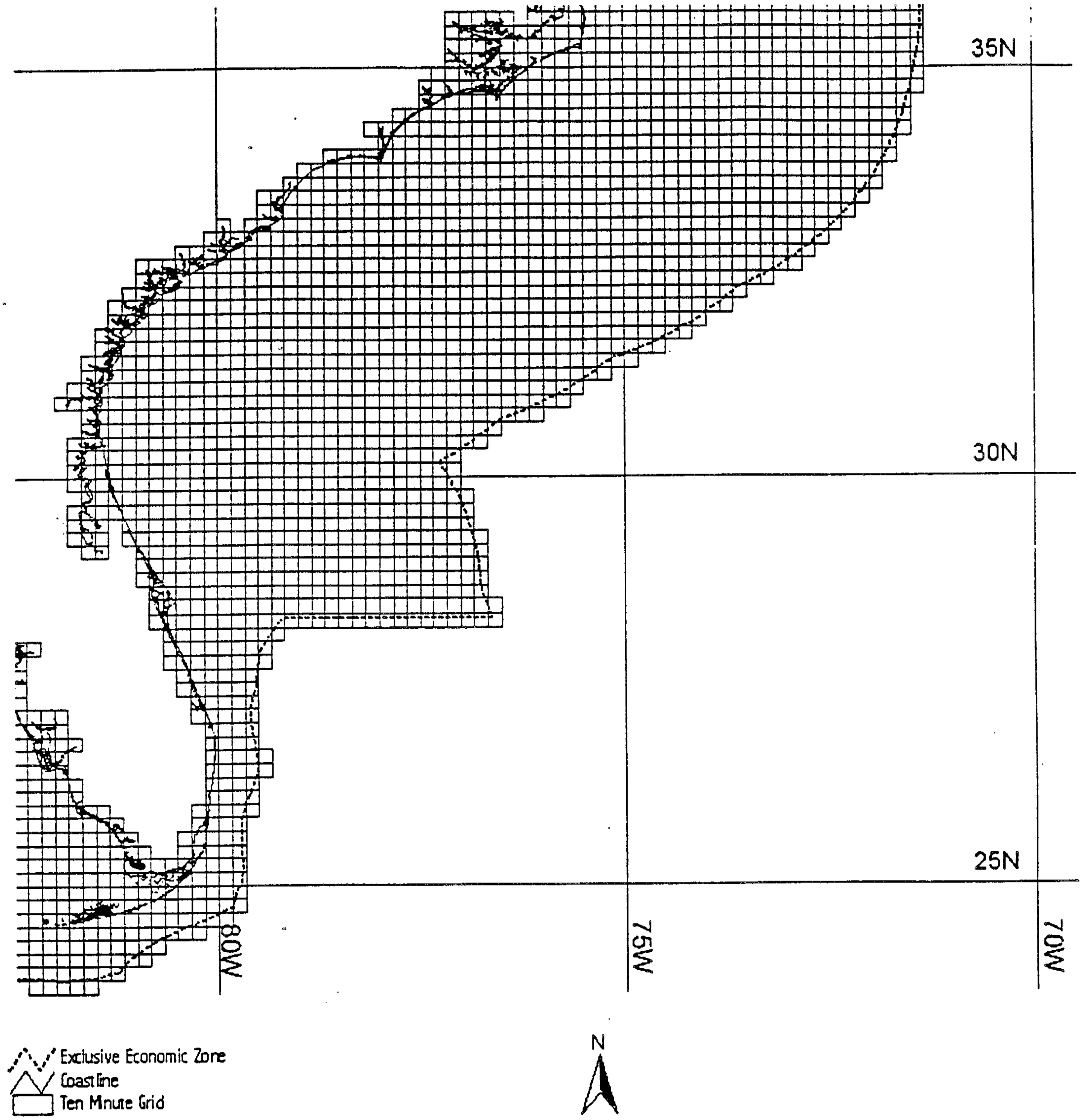


Figure 58. Blank 10 minute grid, south of Cape Hatteras, NC for input by the public of EFH.

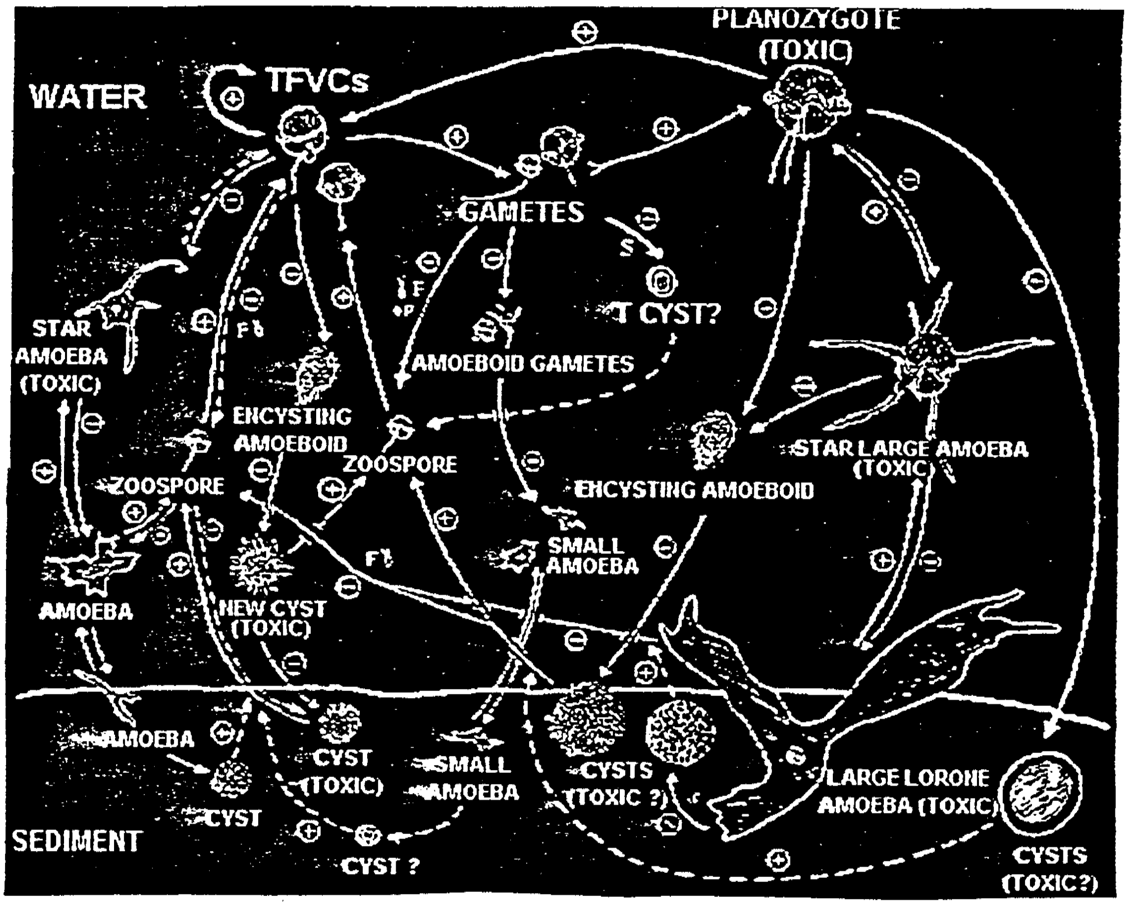


Figure 59. Diagrammatic life history of *Pfiesteria piscicida*.
Source: NCSU 1998.

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.

Comments on Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP

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).

Comments on Amendment 12 to the Atlantic Surf clam and Ocean Quahog FMP

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.

Comments on Amendment 12 to the Summer Flounder, Scup and Black Sea Bass FMP

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.

<u>Comments on Amendment 12 to Surf Clam and Ocean Quahog FMP</u>

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?

<u>Comments on Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP</u>

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.

<u>Comments on Amendment 12 to the Summer flounder, Scup and Black sea bass FMP</u>

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.

Dear Senators Stevens, Chafee, Snowe, Kerry and the Atlantic Fisheries Council;

My name is Don Cameron and I've been a fisherman for the past 30 years. Fishing out of Gloucester, Boston, Virginia and Alaska. I've been everything from cook to captain. During the past 30 years I've endured storms on Georges Banks that I have been lucky enough to return to port; but many others haven't.

I can recall pulling along side the Capt. Cosmo and calling over to the crew that we were going in and that I would see them in a couple days. No one has ever seen them again! I lost a dozen friends on three different boats that fall. One night last year we had a crew of 7 friends over for supper on the Katie Ann in Seattle. They left to head for Alaska on their big safe boat and the next day the F/T Explorer found one body.

Please take the time to read the books the Perfect Storm, Working on the Edge or Nights of Ice...

Now let me get to the point. I'm a crew member on the Atlantic Star. In the 30 years of fishing I have never felt so totally safe on a vessel. I have made many trips on giant factory trawlers and many times with huge bags of fish on deck. Our stability left a lot to be desired and left a taste of fear in this old sea dogs mouth. I have no problem with the Stevens bill and the exclusion of factory trawlers from our waters. The Atlantic Star is not a factory trawler! We are a little big boat. There are many boats in the mackerel and herring industry that catch and hold more fish than we possibly could. We are a safe working platform. What has horsepower and length got to do with anything in regards to the Atlantic Star. The power pushes a large safe vessel that can only catch and process 250 tons of food quality fish a day.

You limit the size and horsepower to exclude the Atlantic Star and then people will invest in the conversion of round bottom mud boats that catch mackerel and herring offshore. You watch and see boats being lost because greedy skippers will overload their boats and get caught in unpredicted winter storms on Georges Banks. It's going to happen mark my words! And I hope every life that is lost on a boat that would be forced to work under a law like that remains on the conscience of lawmakers and people that support that law the rest of their lives.

I sincerely hope that I have a job along with 50 or more American fishermen and women on the East Coast.

Thank you,
Don Cameron
Atlantic Star

Don Cameron

9/8/98

ATTACHMENT 2

WE THE UNDERSIGNED ASK FOR THE IMMEDIATE RESIGNATION OR FIRING OF JIM O'MALLEY AS RHODE ISLAND'S REPRESENTATIVE TO THE MID ATLANTIC COUNCIL.

MICHAEL TARASEVICH F/V BLACK SHEEP
Brian Loftes F/V Elizabeth Anne
[illegible] F/V [illegible] Rose
Jon [illegible] O/D Mystic
W[illegible] E [illegible] F/V Capt B [illegible]
[illegible] [illegible]
Danny [illegible] F/V [illegible]

ATTACHMENT 3

WE ARE PROUD OF
FISHERMEN
UNITED NATIONAL FISHERMEN'S ASSOC.
919-473-3287
123 APPLE RD. MANNS HARBOR, N.C. 27953

Comments on Amendment 12 Summer Flounder Scup & Black Sea Bass

This Document Is not Based on best Scientific Information, it is based on flaws that started in the 1981 Fishery Management Plan for Summer Flounders Prepared by Paul G. Scarlett.

At the time Chang & Pecheco information was the best Science but was rejected due to the desire of the plan writers to implement stringent regulations on one sector of the fishery (commercial) this bias is reflected in the interpretation of the available information. If the corrected age (1996 information was inserted into the plan then the original plan would have started fishing on age 3 fish.
Faulty science is part of the 1987-88 Council fishery Management plan This plan also set Separate standards in 1993 quota vs. landing limits for Commercial & Recreational fishing a violation of the new Magnuson act. Amendment 12 does not Address recreational by - catch and hook and release mortality. (National Standard 9)A simple keep the first X fish and no releases in the recreational fishery would address the problem. Regulatory Waste due to quota management is not addressed in this plan the so called 15% by catch reduction is penalty to the commercial sector. No mention is made to address the increase in number of recreational fishermen that has lead to increased harvest and hook and release mortality. Amendment 12 does not reflect that declines in landing in scup and Black Sea bass were due to the 5 1/2 web size imposed in 1989 by N.C. and 1990 in the EEZ

1.1.2.1 the current overfishing definition is incorrect, nothing in the plan mentions natural cycles or explains the changes in landings that have occurred in recorded landing. (examples 18.6 tide cycles 10-12 year changes in sea temperature, Russell cycle, solar cycles, lunar tide occurrences.) as (msy) has varied in history then Page 8 (is expected to result in long -term average yield close to msy.) this statement can not be justified as msy has varied due to natural fluctuations.
Magnuson Steven's 101-627, 104-297 (3) to assure that the national fishery conservation and management program utilizes, and is based upon, the best scientific information available; involves, and is responsive to the needs of, interested and affected States and citizens; considers efficiency; draws upon Federal, State, and academic capabilities in carrying out research, administration, management, and enforcement; considers the effect of fishing on immature fish and encourages development of practical measures that minimize by catch and avoids unnecessary waste of fish; and is workable and effective.

Definition of overfishing of the three species can not be correct, The projected msy has never been documented in any of the fisheries. Flounder target bio mass 169 million pounds and 338 million pounds (no where in the records do these figures exist) The commercial industry Questions the science that defines over fishing without referencing natural fluctuations.

Using existing definitions optimum yield and maximum sustainable yield are exclusive of each other and the fishery will never produce to capacity. Clearly the 1981 document could have placed MSY at 44 million pounds the adverage reported commercial landings from 1980 to 1989 was 19.5 million pounds with no net restrictions thus the number of fish killed landing 19.5 million # would have been greater than landing 19.5 million using 5 1/2 web through out. Science never explains why the fish are in numbers and the quota is in pounds.
F .24 can not be justified as the stock has recovered with the industry fishing a much higher than proposed F. Council has not justified how in 1993 a separate system of allocation was put in place Quota for commercial with mandatory pay back and a harvest limit and no pay back, clearly this does not meet Magnuson requirements. The continued change in regulations on a yearly basis has not allowed for information on the effects of regulations to be evident. thus since 1989 no information on net size is available (this is inexcusable)

Essential fish habitat as addressed in this document is based on incorrect information. the effects of natural occurring cycles, changes in sea water temperature, acid rain , chlorine, and the affects of land development are far greater than the effects of fishing. This portion could be interpreted to prevent the further development or any recreational use of the marine environment. Again the interpretation of Essential fish habitat like over fishing should not be in the hands of those who will benefit from increased employment in application of the rules.

Commercial fishing sector of the industry has lost all faith in the management process and the ability of science to predict or management to increase production.

4.6.3 this action in combination with prior plans has had a > 5 % losss for 20% or more of the fishermen . thus an economic statement needs to be completed. the proposed EFH section will close all areas to fishing commercially with time.

APPENDIX 2. COMMENT LETTERS AND COUNCIL RESPONSE

A total of 26 comment letters were received by the Council on the hearing draft of Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP. Seventeen letters came from fishermen; three letters represented miscellaneous interested parties; two letters were from national agencies; one letter came from a federal agency, and one letter represented a state agency. Two letters were also received from state agencies, which the Council requested. Two petitions, regarding the effects of the vessel size restrictions on the *Atlantic Star*, were also submitted; one version contained 108 signatures, and the other had 33.

Comment 1: One commenter said that the damage done to the habitat by dredges is more than the damage done by pots.

Council Response: The Council is not proposing any management measures for fishing gear because of essential fish habitat at this time. The Council believes that fish pots would have less of an impact on essential fish habitat than dredges.

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.

Council Response: The Council is proposing a framework adjustment procedure which will allow 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 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 Atlantic Mackerel, Squid and Butterfish 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 meeting and prior to and at the second Council meeting. After reviewing the Council's recommendation and supporting information, the Regional Administrator can determine either 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 the Regional Administrator may determine 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. Hence, the public will be given adequate opportunity to comment on any framework adjustment actions proposed by the Council.

Comment 3: Two respondents felt that the problems of discard mortality and bycatch were understated by the Amendment and advocated the addition of strong measures to offset them, as well as measures to establish accurate reporting of bycatch.

Council Response: The Council addressed the new requirements of SFA concerning bycatch in section 3.4.9 of the Amendment. 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.

In addition, this amendment includes framework provisions described in Section 3.1.1 to deal with discard problems in the future should they arise. Specifically, if a discard problem is identified, gear restrictions could be implemented to reduce discard mortality.

Comment 4: One respondent felt that the data used to establish F_{msy} and biomass threshold are not supportable, and therefore, the Amendment should be tabled until more thorough data become available.

Council Response: 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.

To address the new SFA requirements relative to National Standard 1, an Overfishing Definition Review Panel was convened to review the definitions of overfishing in NEFMC and MAFMC management plans (Applegate *et al.* 1998). The overfishing definitions proposed in this Amendment follow the recommendations of Applegate *et al.* (1998) and are based on the best and most recent scientific data available.

Comment 5: One commenter stated that the OY and MSY estimates only support the maximum possible landings over time and should be adjusted to account for the health of the ecosystem (i.e. predator/prey relationships) and the viability of the commercial and recreational fisheries while protecting the health of the stocks.

Council response: The Council has proposed to define overfishing for each species as the fishing mortality rate which produces MSY (or a suitable proxy) for each species. The annual quota, which forms the basis for OY, is specified as the catch associated with 75% of F_{MSY}. As such, the Council has take a precautionary approach to specifying OY. The Council has taken this conservative approach to account for uncertainties in the estimation of biological reference points for each species.

Comment 6: A total of 16 commenters did not support the vessel size restrictions included in the preferred alternative as they feel this will only prohibit one vessel, the *Atlantic Star*, from participating in the Atlantic mackerel fishery. A petition, signed by 108 individuals, and a statement, sent by 33 individuals, to this affect were also submitted.

Council Response: This amendment would restrict the size of domestic harvesting vessels permitted in the Atlantic mackerel fishery. Vessels issued Atlantic mackerel permits are not to exceed 165 ft

LOA and 750 gross registered tons or have shaft horsepower exceeding 3000 shp. The purpose of this action is to control the rate of capitalization of this fishery and promote the diversification of existing fishermen and currently permitted vessels into the Atlantic mackerel fishery. During the course of development of this amendment, the Council examined a number of options relative to limiting entry into the mackerel fishery. The current proposal would allow for the orderly development and expansion of the mackerel fishery. The vessel size limit is proposed based on concerns about the rapid over-capitalization of the mackerel fleet by the entry of large vessels with significant harvest potential. The Council is concerned about this issue because analyses indicate that the current fleet of vessels in the Northeast have more than enough harvesting capacity to take the sustainable harvest of Atlantic mackerel.

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.

Council Response: 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.

Council Response: 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 supports the measures proposed by this Amendment and the addition of the EFH section.

Council Response: none required

Comment 10: 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.

Council Response: The Council disagrees with this commenter's belief 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 11: 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 Atlantic mackerel, squid, or butterfish 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.

Council Response: 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 12: 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.

Council Response: 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.

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,

for 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. Clarify the description and identification of EFH so users of this information can determine the geographic limits of EFH designations.

   (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. <u>Refine the discussion of the methodology used to designate EFH.</u>

(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. <u>The amendments should explain how they meet the requirement to minimize to the extent practicable the adverse effects of fishing on EFH.</u>

(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. The amendments should explain why the Council is not proposing to designate any areas as HAPC for most of the species. 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. The framework adjustment process should include HAPC. 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. The final version of the amendments should be edited thoroughly. 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. Refine and clarify the EFH designations for summer flounder.

   (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. <u>Refine and clarify the EFH designations for scup.</u>

(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. <u>Refine and clarify the EFH designations for black sea bass.</u>

(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

NYSDEC, BUREAU OF MARINE RESOURCES
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E. SETAUKET, NY 11733
516-444-0430
FAX: 516-444-0434

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.

Summer flounder, scup and black sea bass
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.

Atlantic mackerel, squid and butterfish
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.

Surf clams and ocean quahogs
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 not 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

FAX

Massachusetts Division of Marine Fisheries

Date September 1, 1998

TO: Tom Hoff

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Message:

21 pages

Number of pages including cover sheet

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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 Muskegut 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,

Arnold B. Howe, AQB III

SUMMER FLOUNDER
EGGS + LARVAE

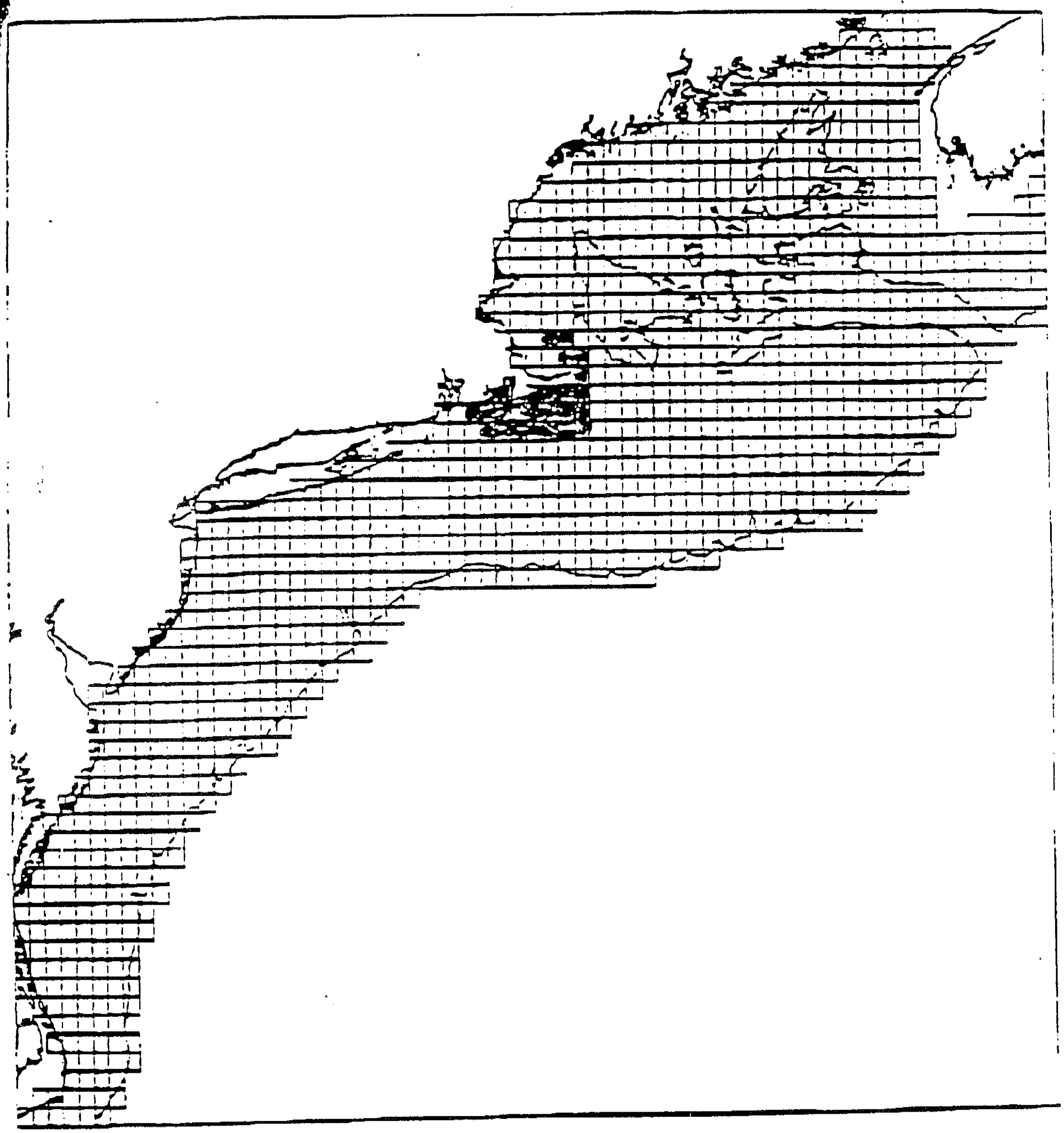

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SUMMER FLOUNDER
JUVENILES (4EEO)

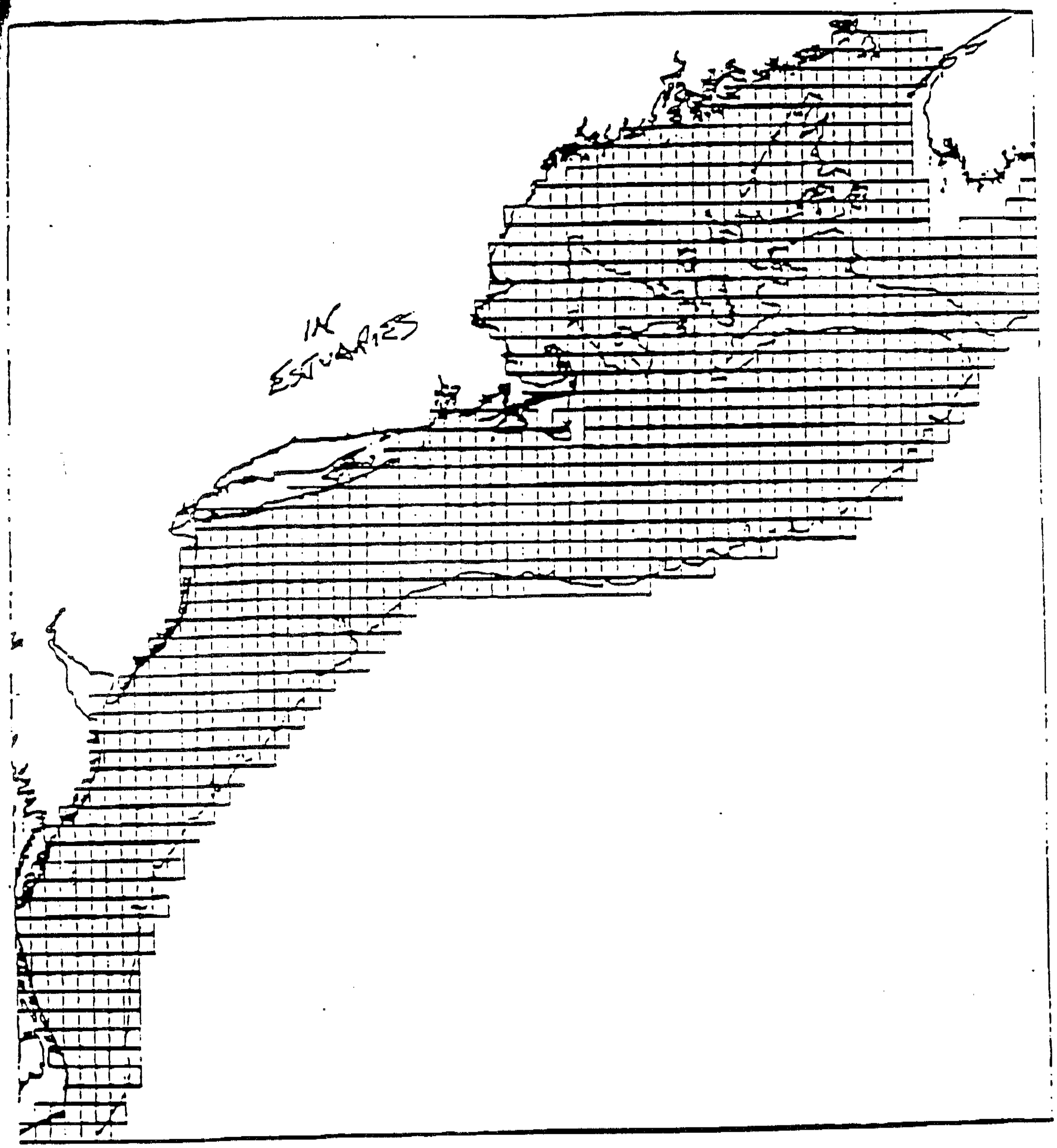

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SUMMER FLOUNDER
ADULTS

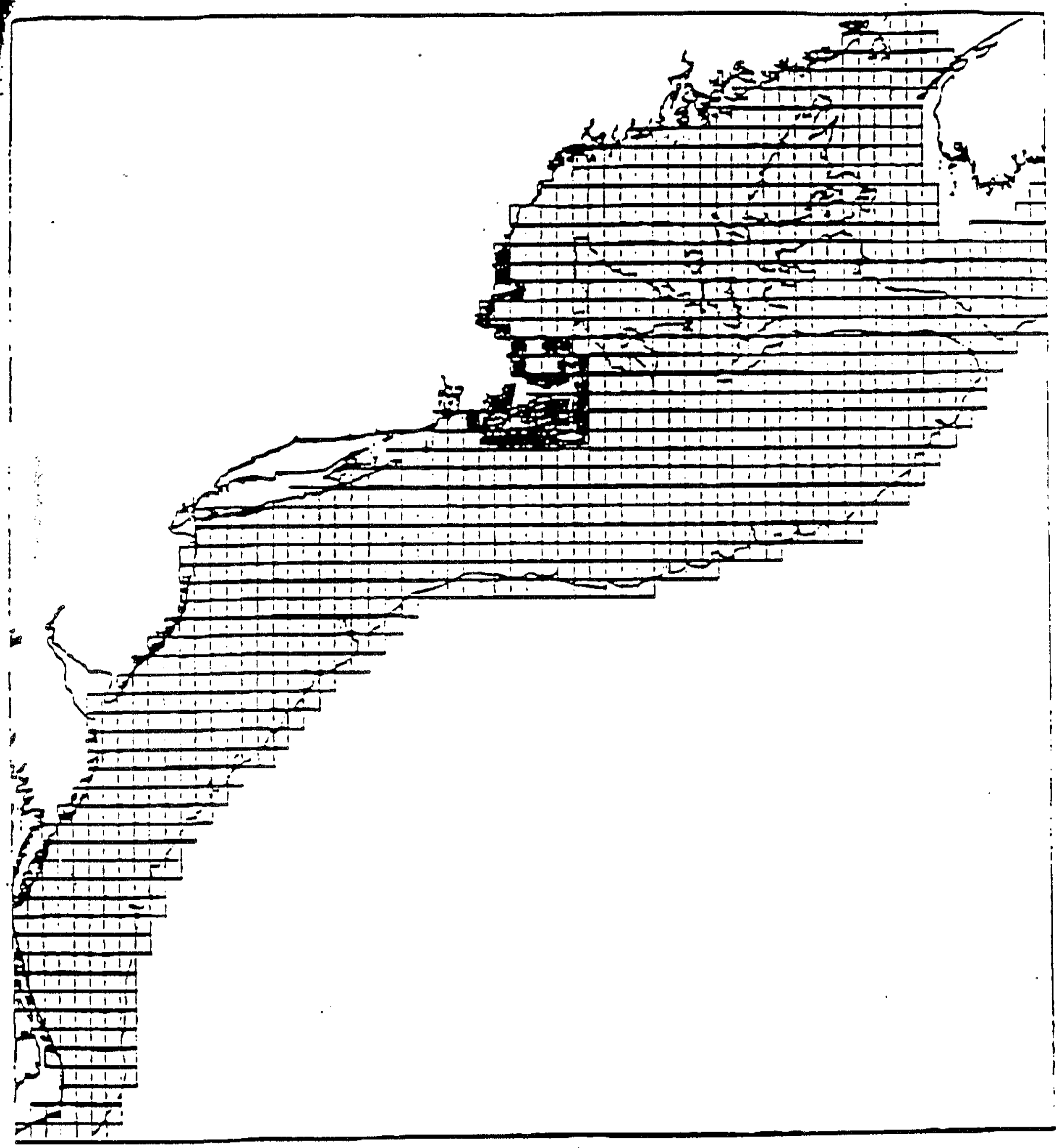

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SCUP
EGGS + LARVAE

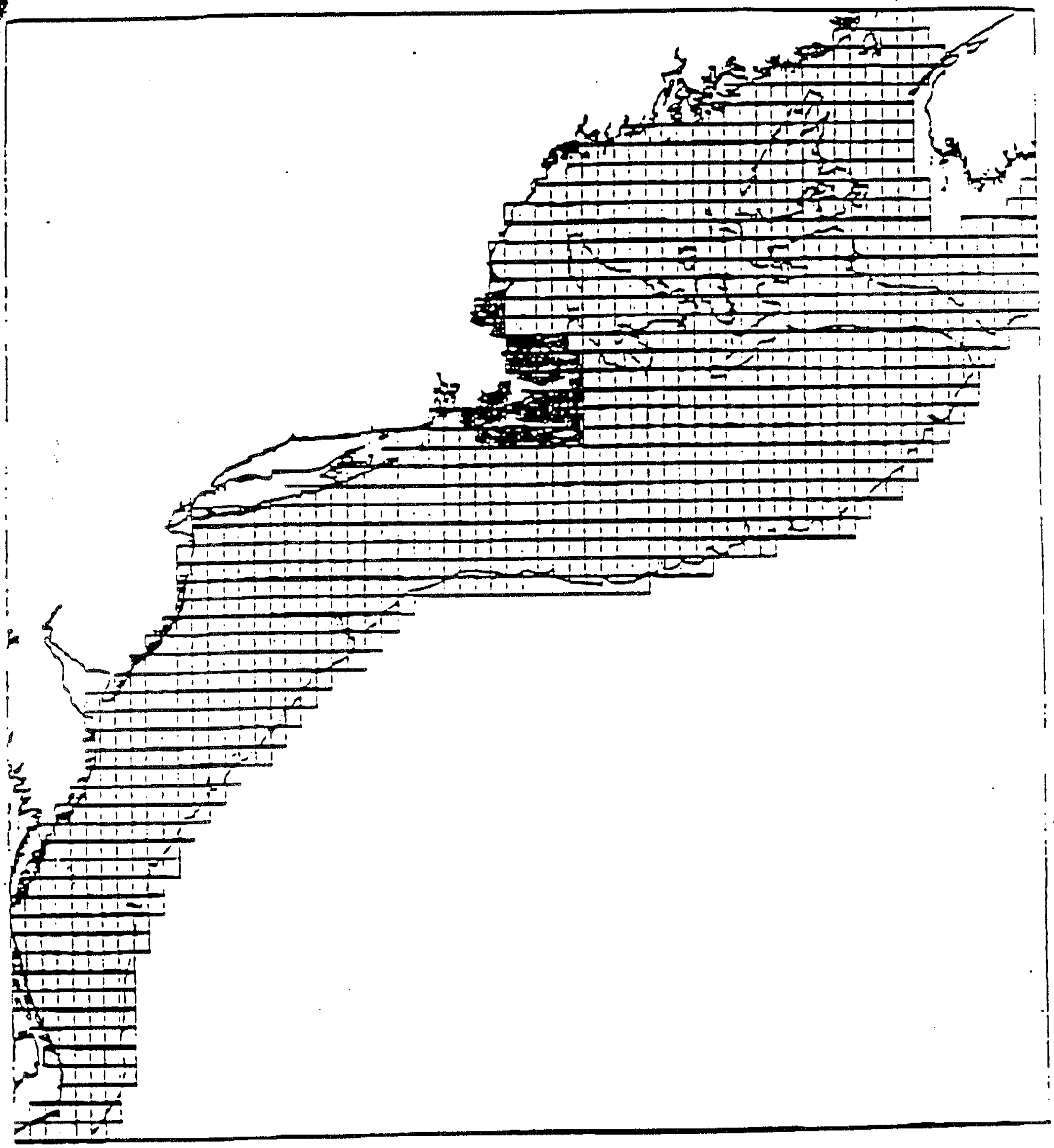

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SCUP
JUVENILES & ADULTS

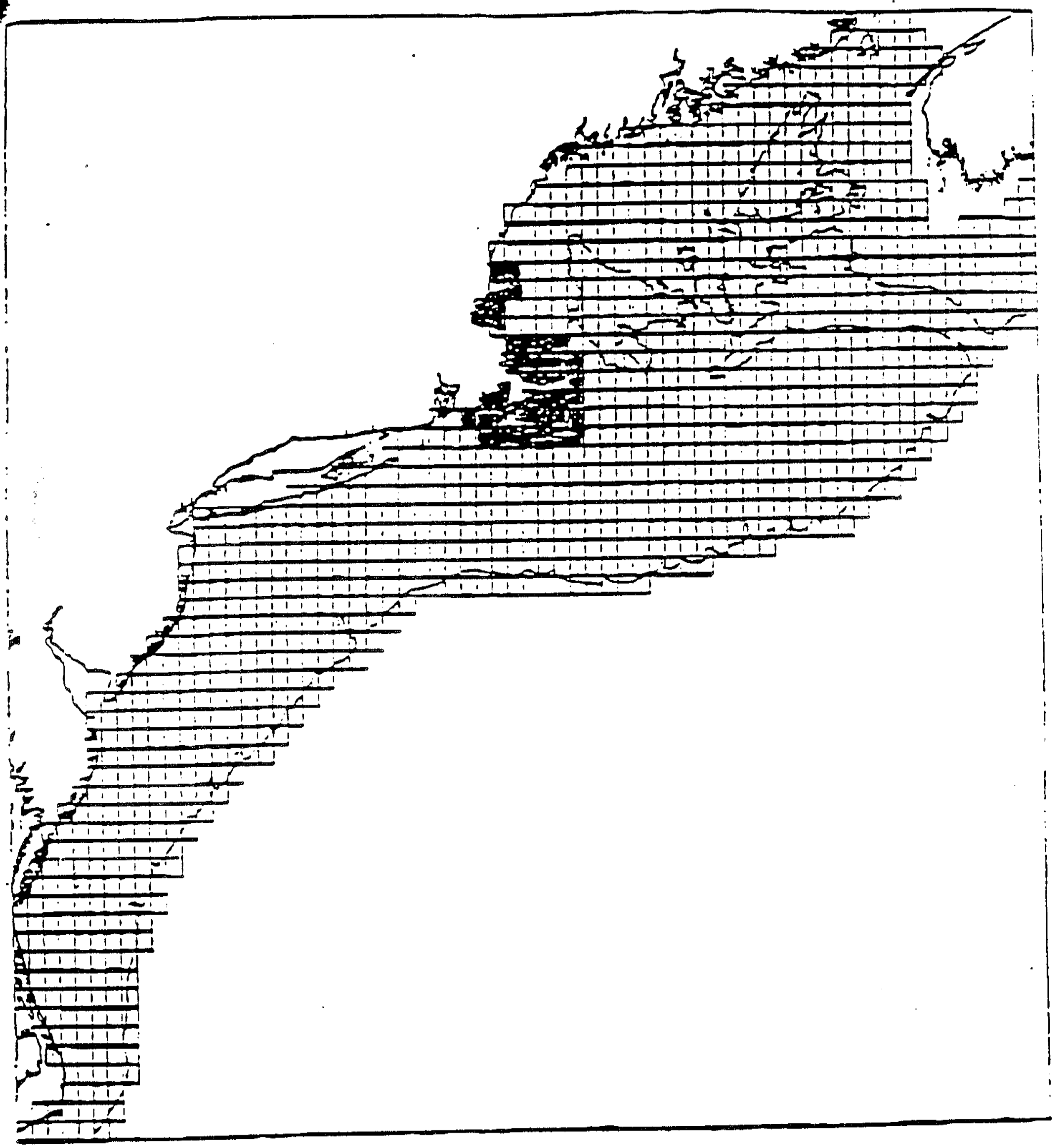

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
EGGS + LARVAE

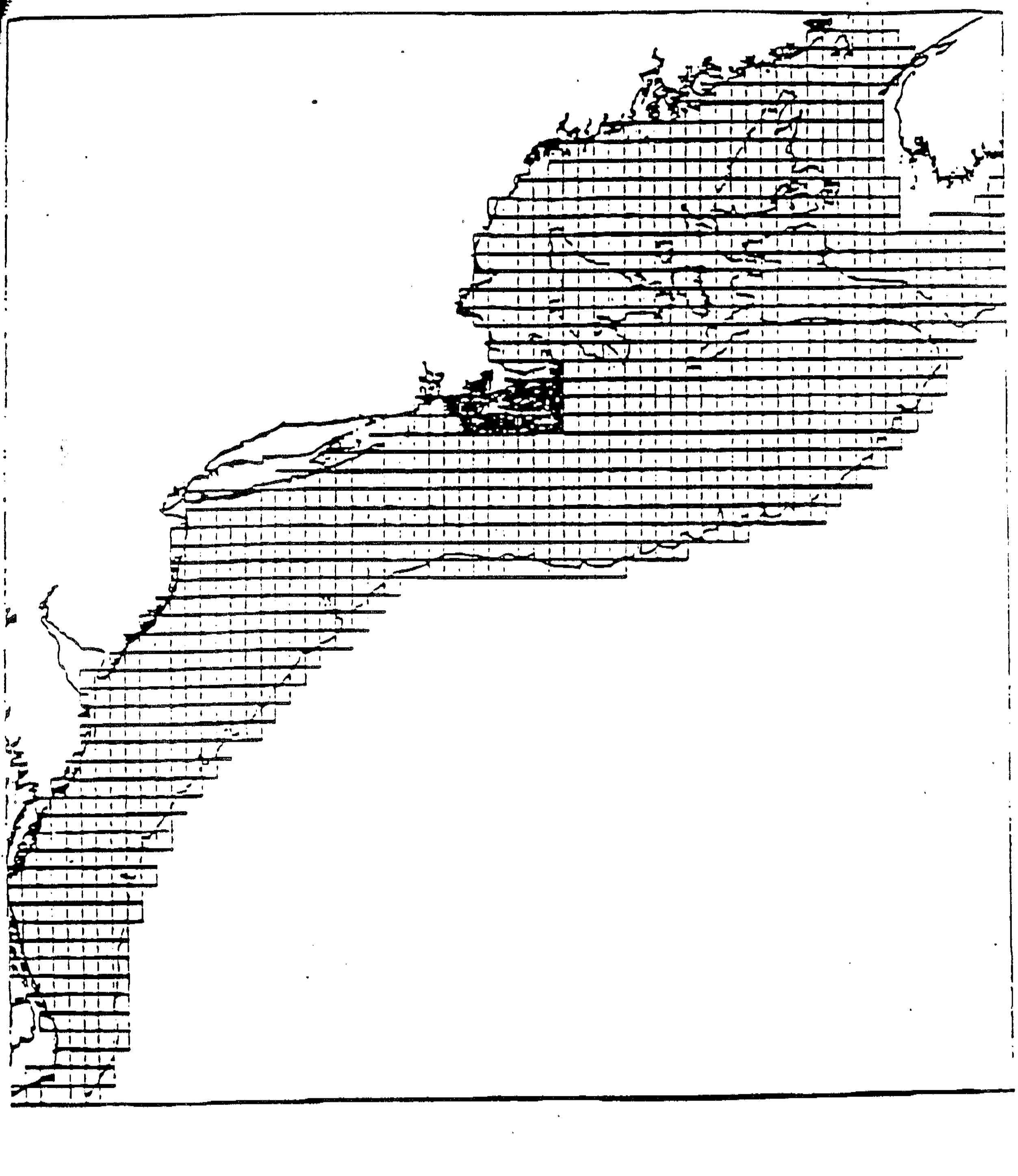

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
JUVENILES (YOY)

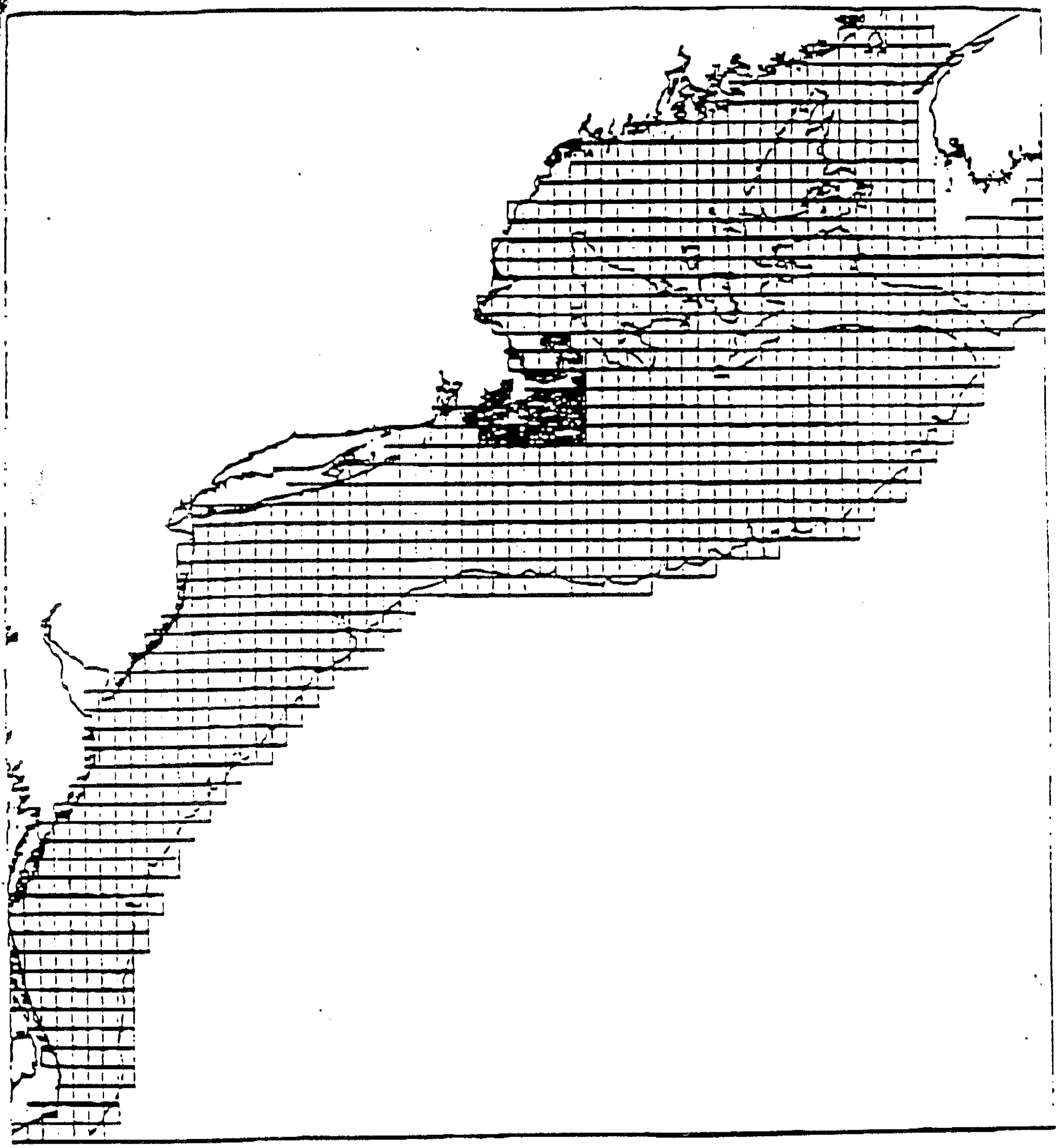

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BLACK SEA BASS
ADULTS

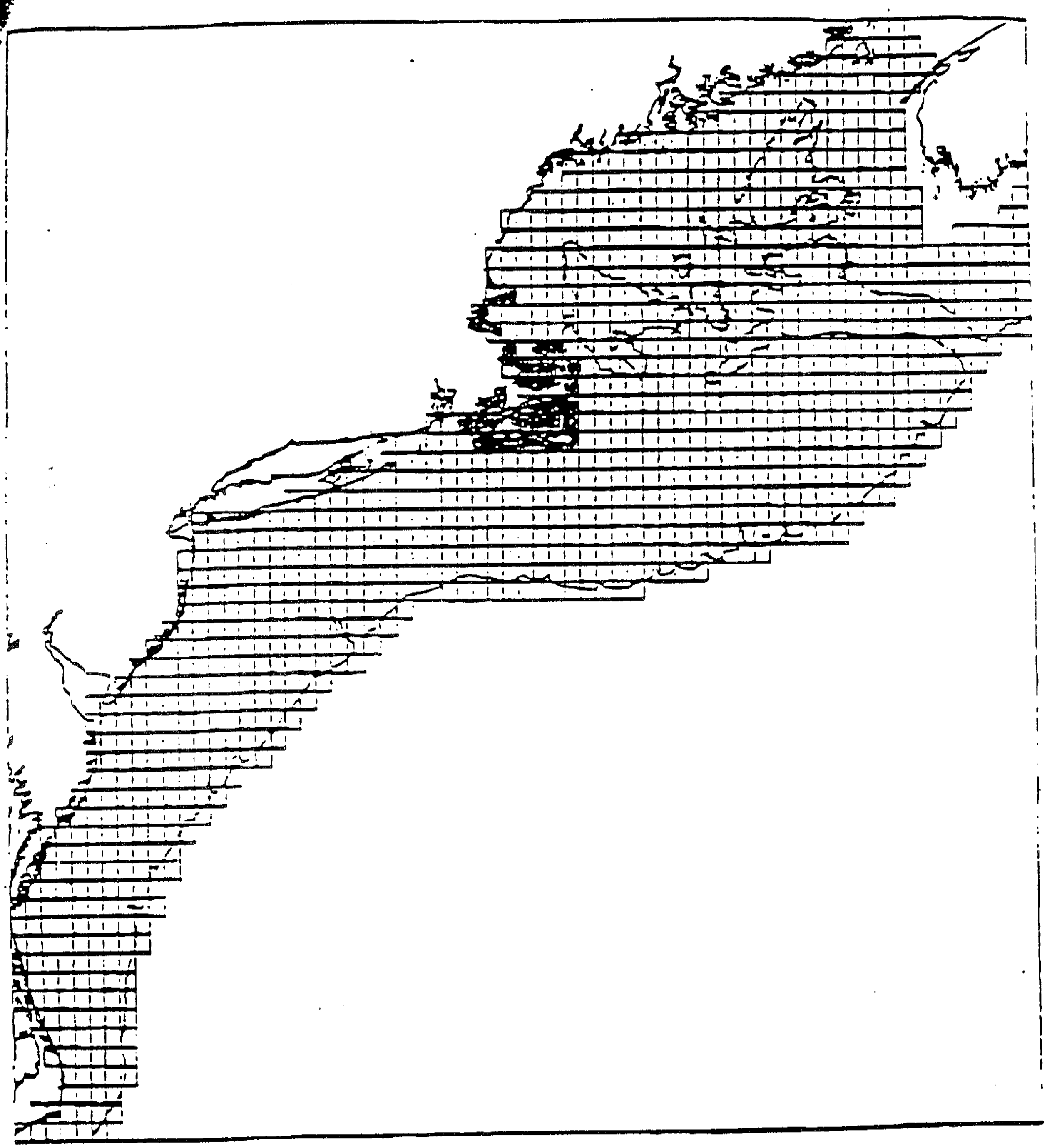

Figure 58. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

AT. MACKERAL
EGGS, LARVAE,
JUVENILES, ADULTS

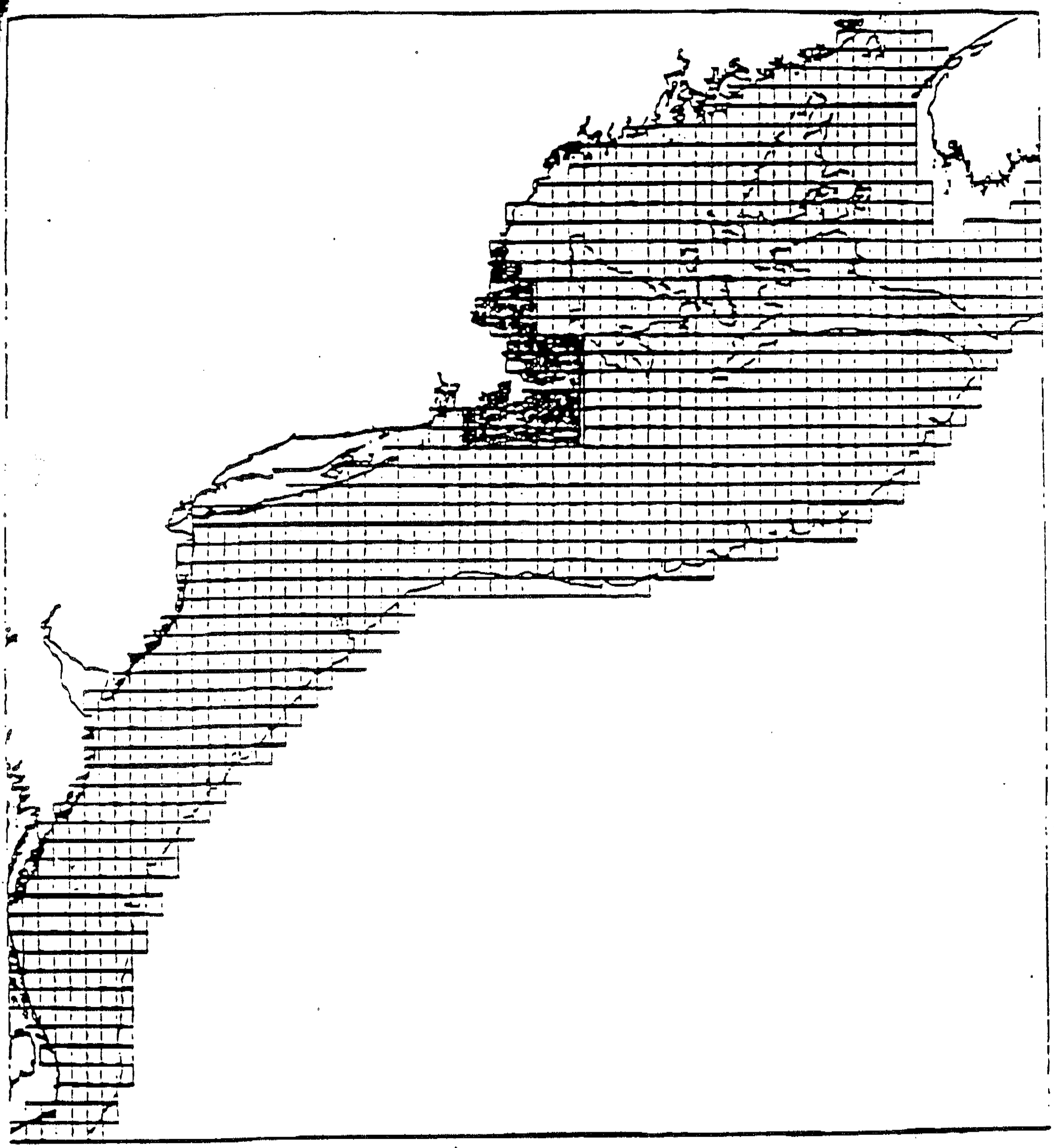

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

LOLIGO
EGGS & LARVAE

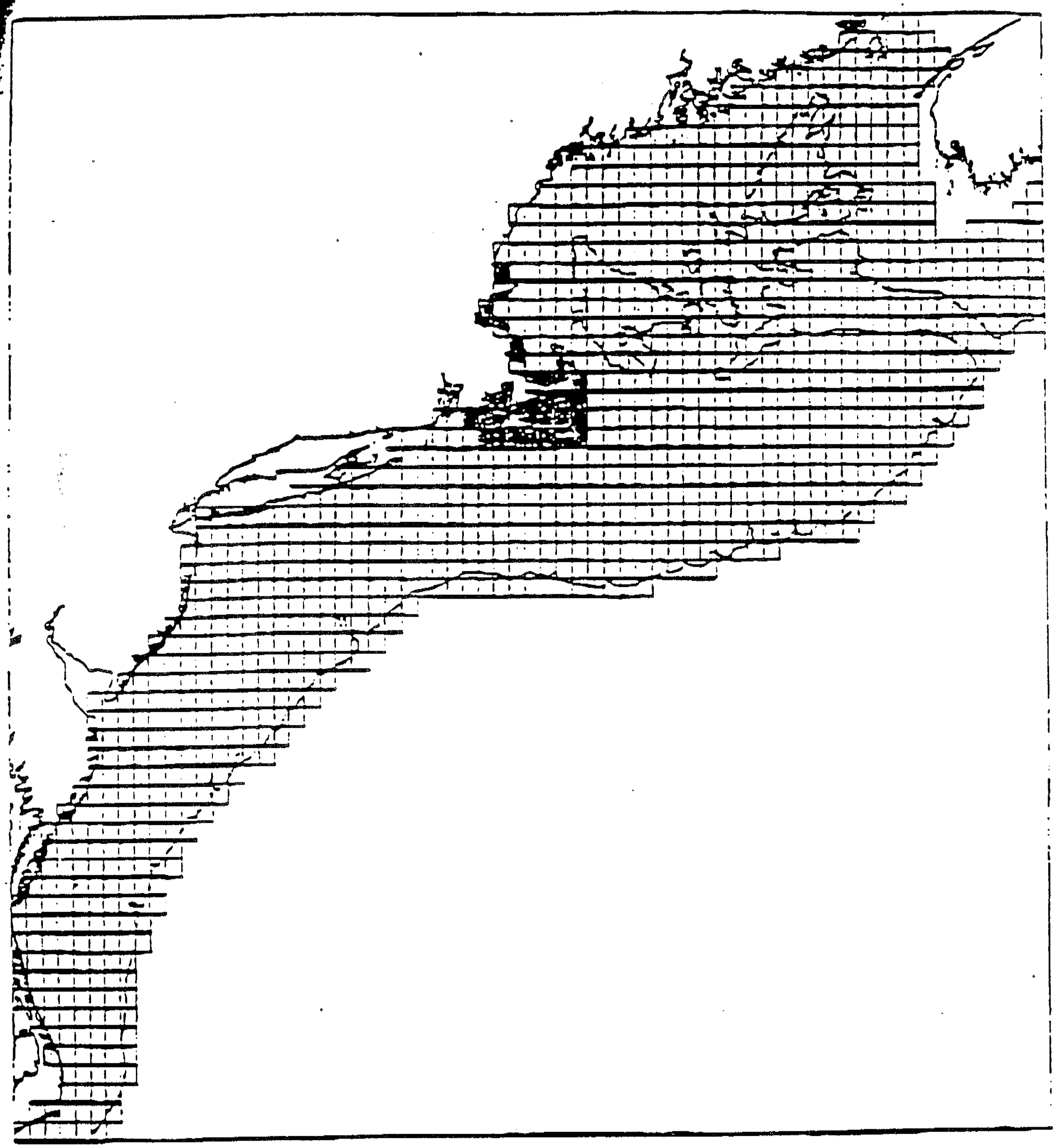

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

LOLIGO
PRE-RECRUITS & RECRUITS

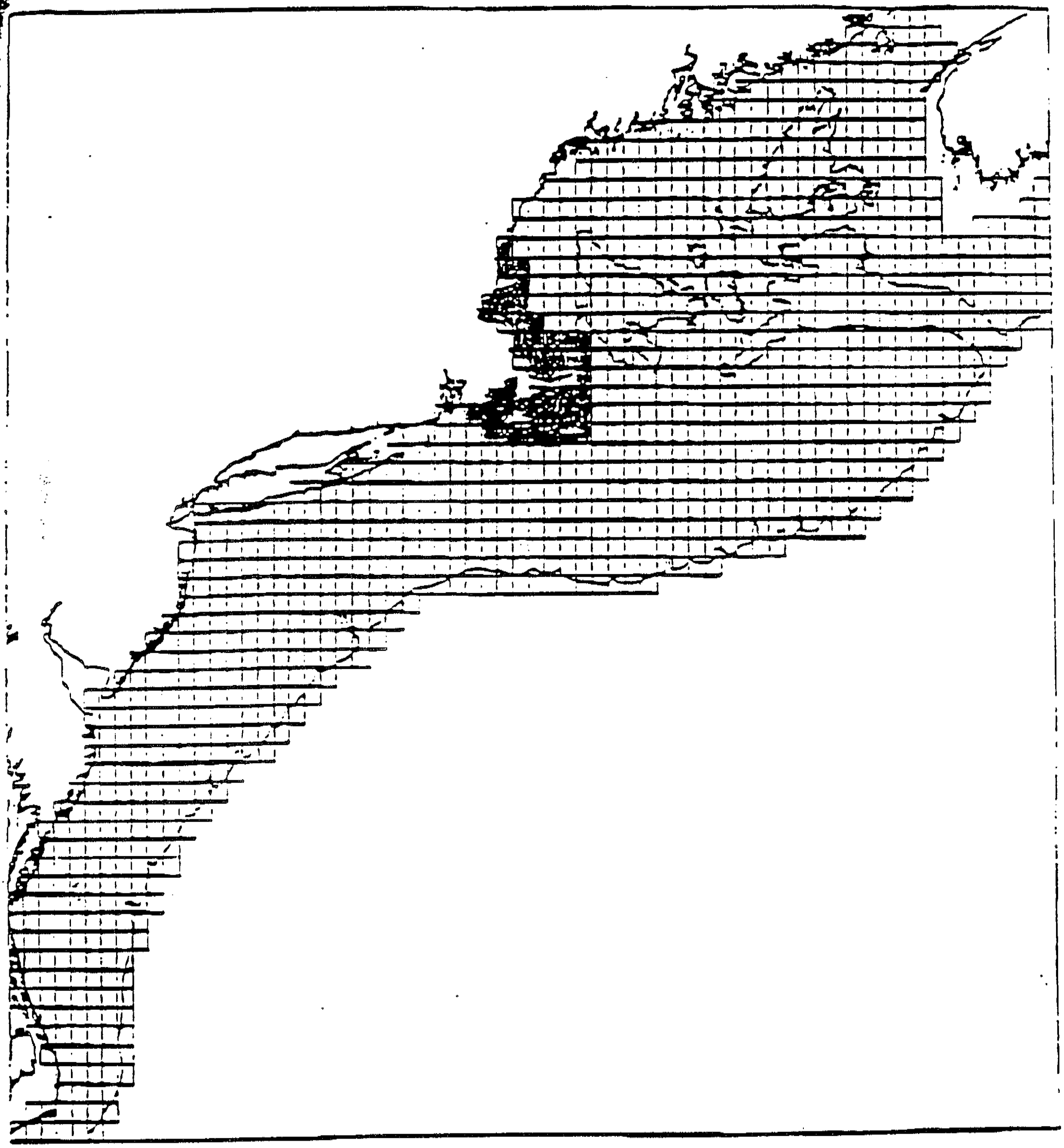

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

ILLEX
PRE-RECRUITS & RECRUITS
(AUTUMN)

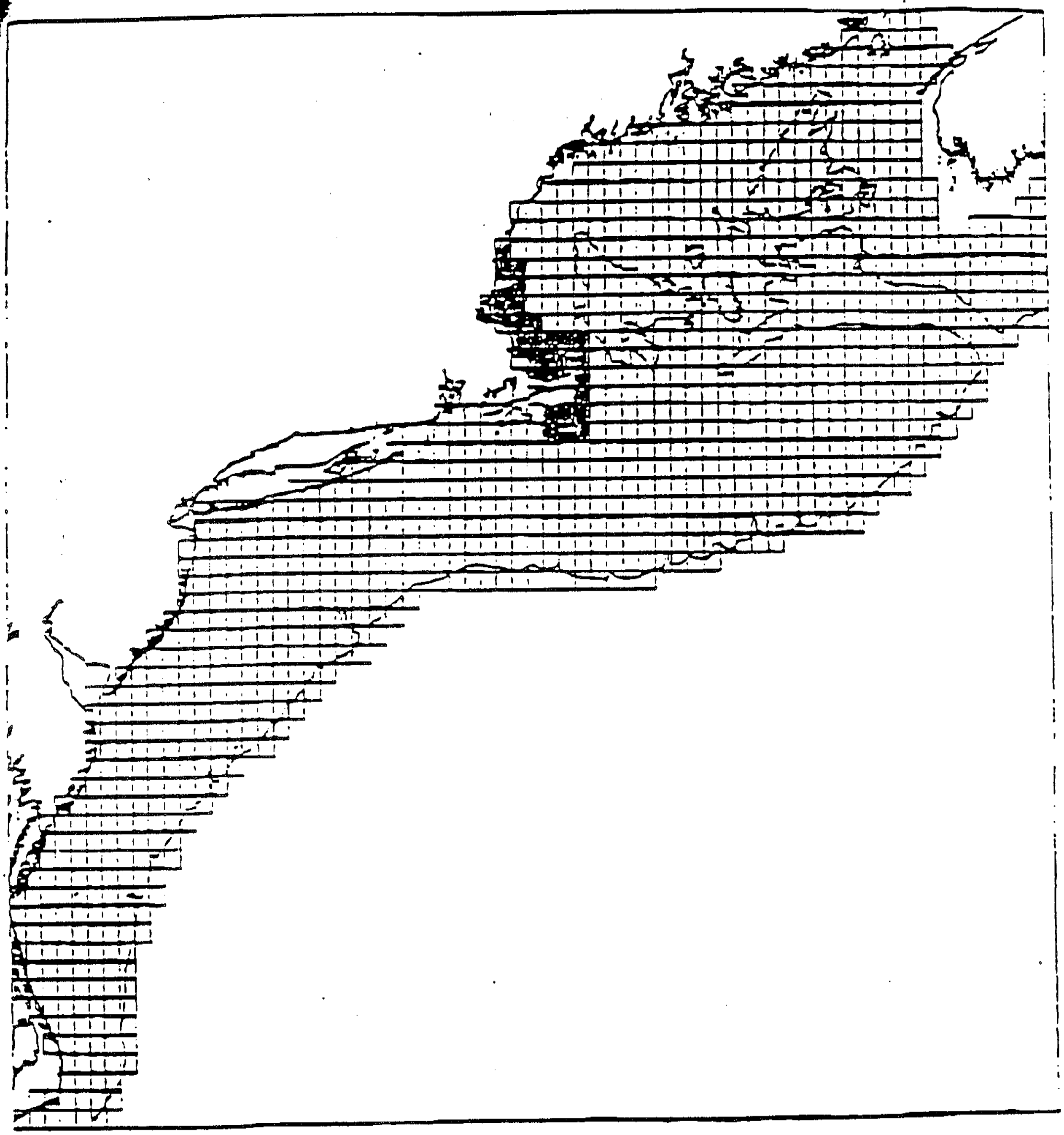

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

BUTTERFISH
EGGS, LARVAE,
JUVENILES, ADULTS

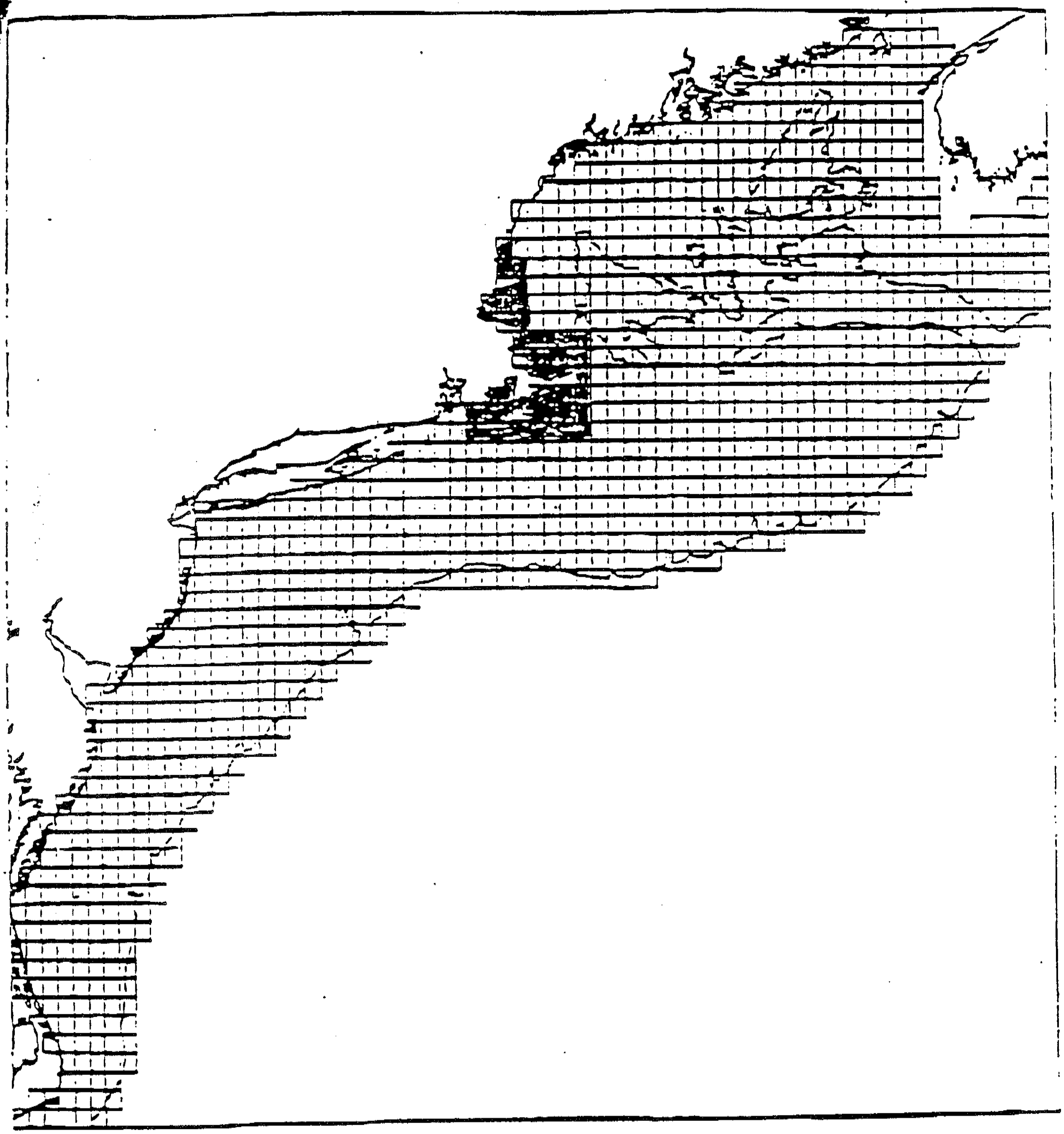

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SPINY DOGFISH
JUVENILES (both sexes)
ADULTS (" ")

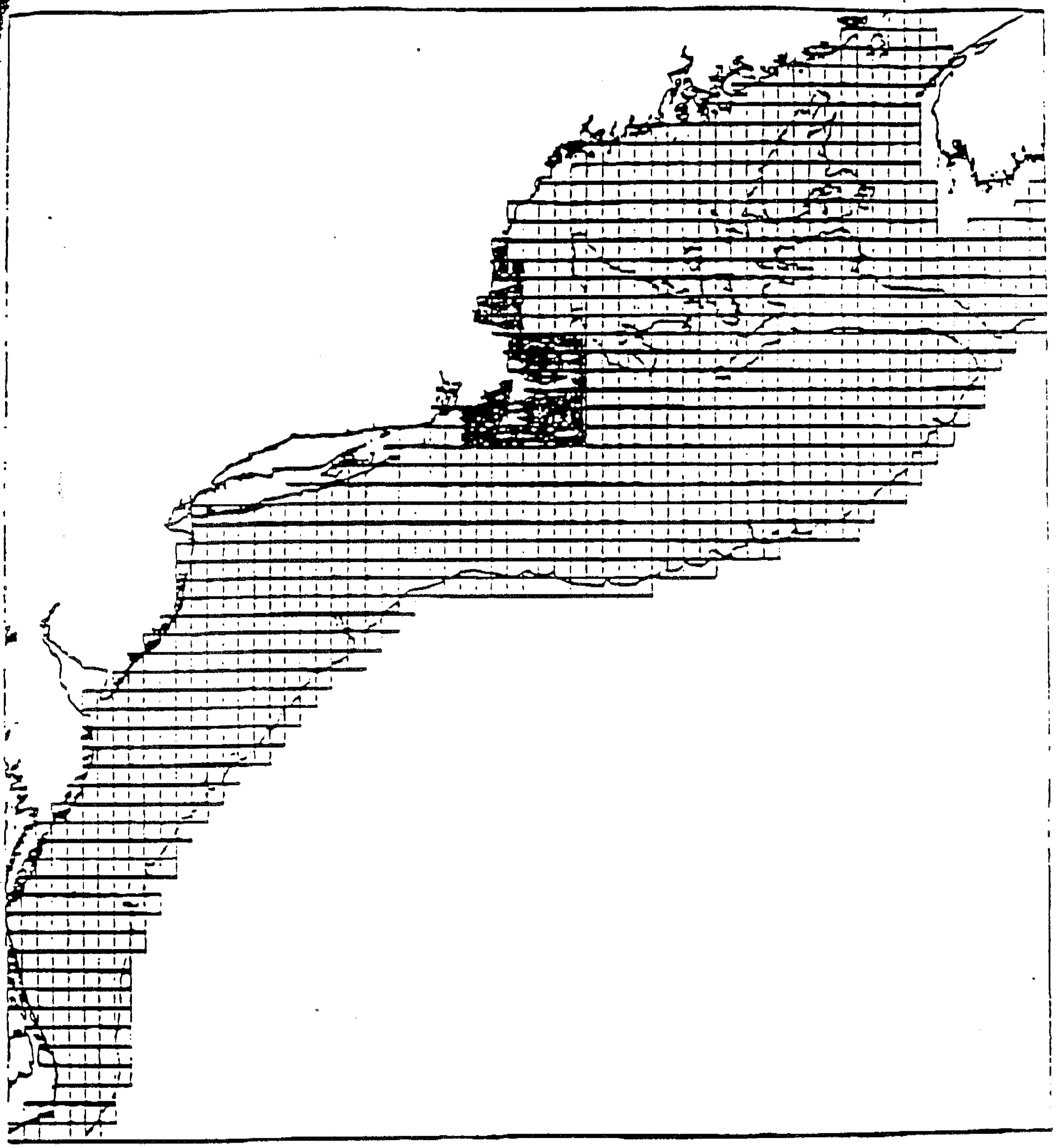

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

SURF CLAM

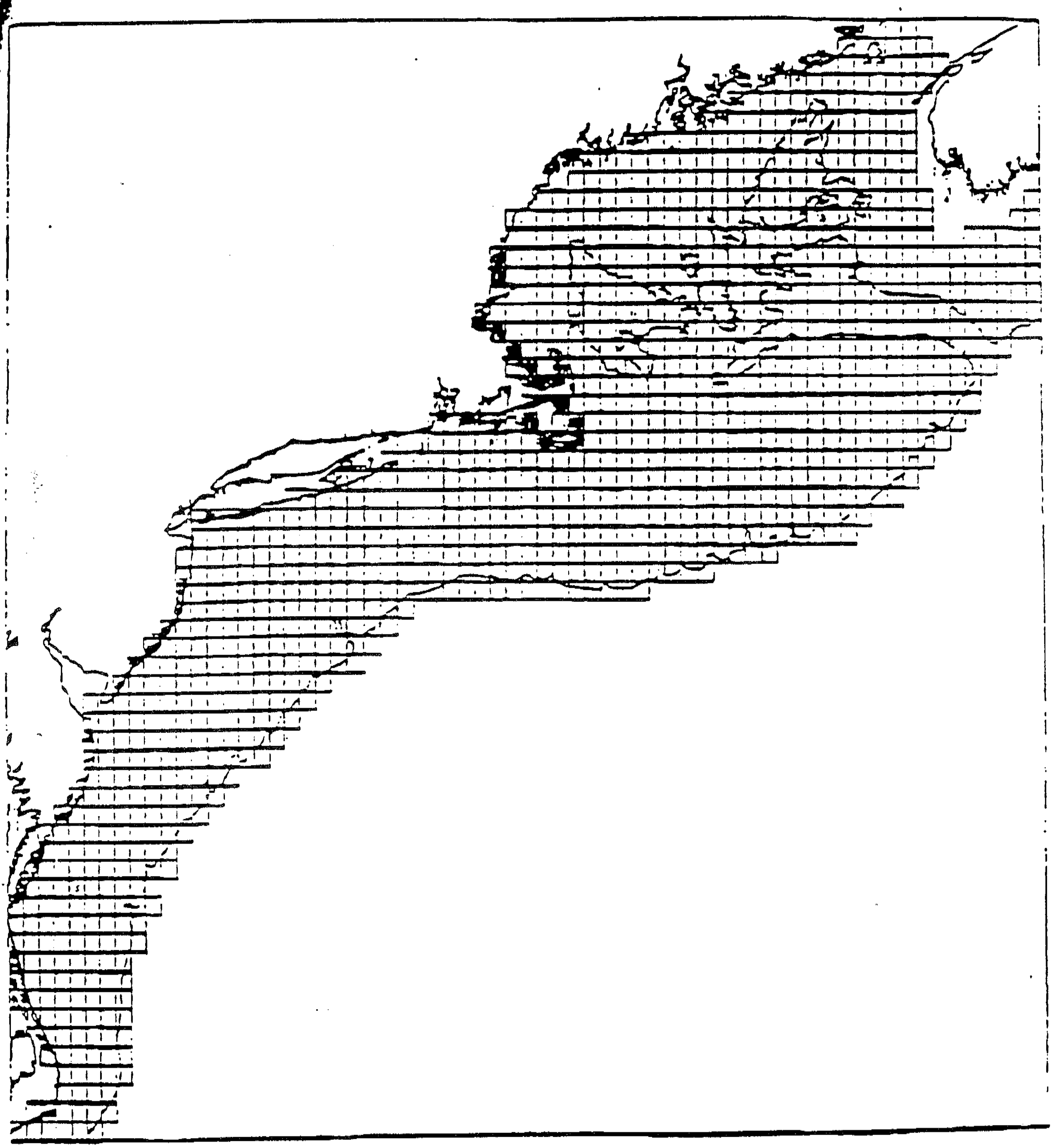

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

OCEAN QUAHOGS

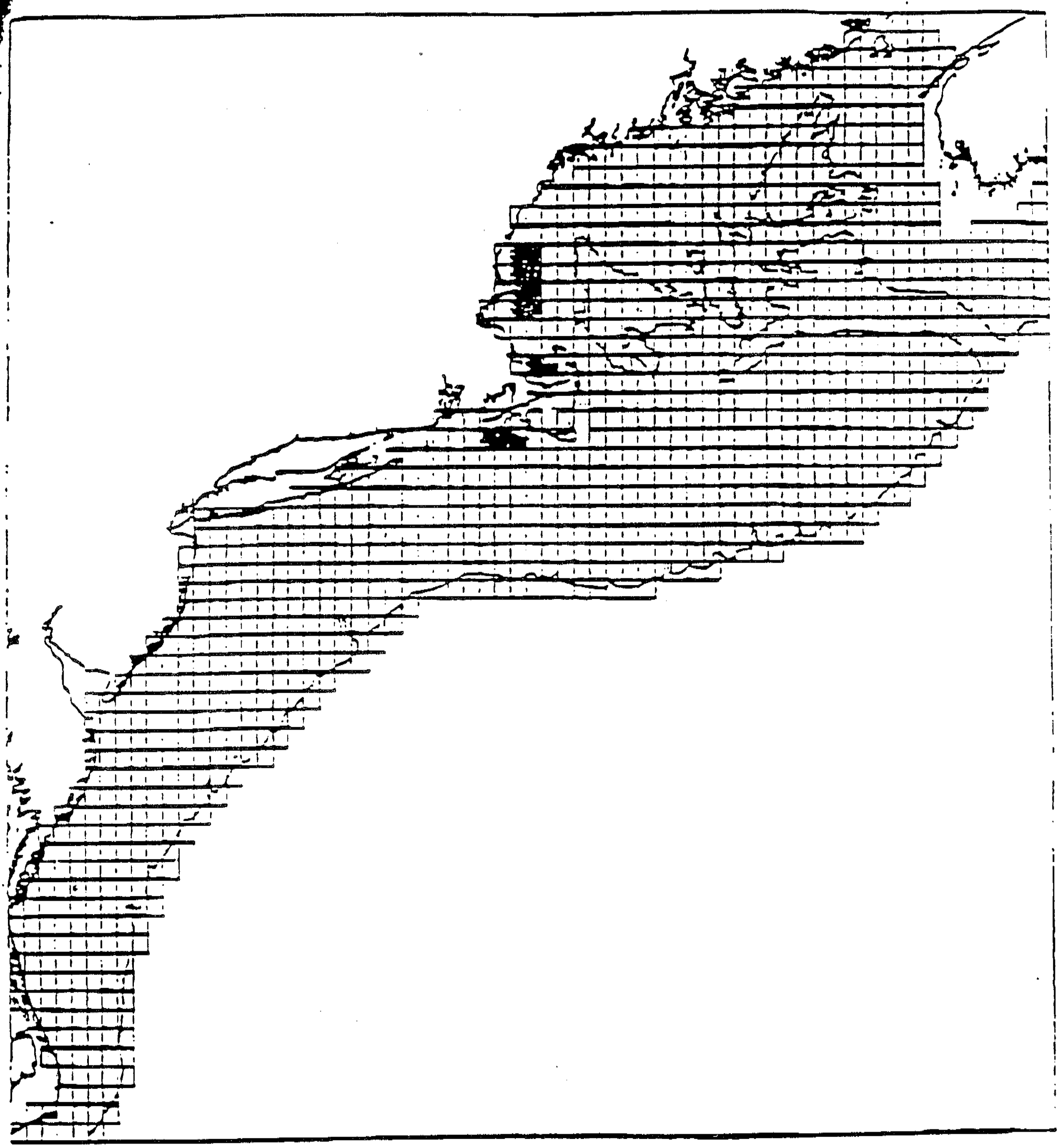

Figure 56. Blank 10 minute grid, north of Cape Hatteras, NC for input by the public on EFH.

AF&PA

AMERICAN FOREST &
PAPER ASSOCIATION

FAX

1111 19th Street, NW Suite 800
Washington, D.C. 20036

Legal Department
FAX: 202/463-2052

TO: Christopher Moore FAX: 302/674-2331 X5399

FROM: Chip Murray PHONE: 202/463-2782

DATE: September 25, 1998 TIME: 3:28pm

NO. PAGES: 6

MESSAGE:

Following are comments on the three FMP amendments due today. Hard copy is in mail.

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.

1111 Nineteenth Street, NW, Suite 800 • Washington, DC 20036 • 202 463-2700 Fax: 202 463-2052

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 Office Building
100 Cambridge Street
Boston, Massachusetts 02202
phone: (617)727-3193
Fax: (617)727-7988

Fax transmittal

to:	Chris
fax:	
from:	David
date:	
re:	
pages:	______ Page(s), including this one

NOTES:

These are our comment on the two amendments.

The Commonwealth of Massachusetts

Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202

PHILIP G. COATES
DIRECTOR

727-3193

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 348,000 lbs. of 3-year old scup 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 no measures (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 $½B_{msy}$? 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

Edward T. Smith Beverly K. Smith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

SEP 21 1998

4EAD/OEA

Christopher M. Moore, Acting Director
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-6790

SUBJECT: Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan, including Draft Environmental Impact Statement and Draft Regulatory Impact Review

Dear Mr. Moore:

The Environmental Protection Agency Region 4 (EPA) has reviewed the referenced draft environmental impact statement (EIS) and management plan in accordance with EPA's responsibilities under Section 309 of the Clean Air Act and Section 102 (2)(C) of NEPA. Amendment 8 revises definition of over fishing for this group, addresses habitat issues, and adds procedures that will allows fishery management councils to add/modify management plans using a streamlined public review process.

Because none of the species in the Atlantic mackerel, squid, and butterfish group are designated as "over fished", no stock rebuilding is necessary. Foreign fisheries for these species were eliminated with the passage of the Magnuson Act in 1977, and the domestic fishery has expanded in a controlled manner with the result that over fishing and overcapitalization have been avoided.

Fishery management plans must now describe options to avoid, minimize, or compensate for adverse effects identified as non-fishing threats, including cumulative impacts. We were pleased to see the new sections in the document that identified impacts of non-fishing activities and associated conservation and enhancement recommendations. At long last habitat is now being recognized as a significant component of the equation in evaluating the status of fish populations. Regulations encourage that each fishery management council may comment on and make recommendations concerning activities undertaken by any state or federal agency that may affect a fishery resource under its authority.

EPA fully supports the Council's position that one of the primary threats to this fishery group, and perhaps all fisheries, are actions that impact estuaries, inshore areas, and water quality. Of these impacts, the physical removal of habitat by dredging and filling as a consequence of coastal development is probably the most egregious. Recognizing estuarine habitats as being critical to the maintenance of many marine species, Section 320 of the Clean Water Act authorized the National Estuary Program (NEP) to restore and conserve estuarine habitats. Currently 28 estuaries are included in the NEP nationally; eight of these are in the Mid-Atlantic states. The NEPs have all identified habitat loss, modification and eutrophication as being major problems affecting estuaries.

EPA supports the streamlining of the public review process, particularly in instances where the fishery has been well-established and all stakeholders have been identified. One streamlining strategy is for the fishery management councils to provide the public with advanced notice of proposed rule/management changes prior to council meetings. This strategy makes sense provided that all the universe of stakeholders is already known. As many of the fishery management plans are in their seventh or eighth amendments, mailing lists of the stakeholders are well-established. However, in fishery management plans where the universe of stakeholders may not be as well known, advance notice may be more problematic. Two recent examples are the Sargasso and Calico Scallop Fishery Management Plans: in less well-defined fisheries it may be difficult to predict who the stakeholders are. Nonetheless, the proposed streamlining of the public hearing process is a laudable goal.

We appreciate the opportunity to review this document and rate it LO, lack of objections, the EPA review has not identified potential environmental impacts requiring substantive changes to the proposal. If you have any questions about this review, please call John Hamilton at 404-652-9617 for more information.

Sincerely,

Heinz J. Mueller, Chief
Office of Environmental Assessment

SEP 21 1998
MID-ATLANTIC FISHERY COUNCIL

Haskin Shellfish Research Laboratory

Reply to: *Eric N. Powell*
6959 Miller Ave.
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eric@hsrl.rutgers.edu

September 16, 1998

Jim Gilford
Executive Director
MAFMC
Rm 2115 - Federal Bldg.
Dover, DE 19904

Dear Mr. Gilford:

I am writing to express my concern over the document sent out for public comment that describes Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. The document establishes fishing and biomass thresholds (F_{msy}, B_{msy}) and target fishing and biomass levels related to these two parameters. These are, as I am sure you know, extremely important parameters that must be adopted after considerable and careful review. Unfortunately, the present draft does not contain sufficient documentation addressing the choice of B_{msy} and F_{msy} for even a sophisticated scientist to adequately comment on the proposals. In fact, the document is nearly entirely wanting in such documentation, as, for example, compared to the analogous document for surf clams and ocean quahogs. Even more serious is the fact that the principle reference substantiating the chosen proxies for F_{msy}, namely Applegate et al. (1998), is, by any stretch, a gray literature document unlikely to be easily obtained by most, even sophisticated, reviewers and the principle document referenced by Applegate et al. (1998) is another gray literature document that is listed as *in press* (Restrepo et al., in press).

Because of these inadequacies in the documentation supporting the chosen values of B_{msy} and proxies and values for F_{msy}, I ask that you table further consideration of this Amendment until the document can be adequately re-enforced with supporting documentation and resubmitted for public review and comment. Independent scientists and lay people should have the opportunity to cogently review these proposals. Very few, perhaps none outside of the stock assessment group at NMFS, could do so from the information provided in this document.

Thank you.

Sincerely,

Eric N. Powell
Director
Haskin Shellfish Research Laboratory

Cc. Jeffrey Reichle
Daniel Cohen
Charlie Bergman
Roger Mann

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Fax to: MAFMC
Fax No: 302.674.5399
Attn: Christopher M Moore Ph.D.

From: Dave Ellenton
Date: Sept. 22, 1998
No. of pages: 4

Chris,

Please accept the following as my written comments regarding the proposed Amendment 8 to the Atlantic mackerel, Squid and Butterfish FMP. I was travelling overseas on the dates of the public hearings and apologize for not being able to attend. My comments are directed at the proposed vessel size limitations only.

I am against restricting access to a fishery that is so greatly underutilized at this time. Government scientists, regulators and virtually the entire industry recognize the strength of the Atlantic mackerel stocks and the fact that they are underutilized. It makes no sense to limit U.S vessels from entering the fishery, particularly when U.S. harvest are in decline – and not because of the stocks, but rather because the small vessel size prevents the operations from achieving the necessary economies of scale to allow the product to be competitive on the world market.

Although the language of the amendment refers only to harvesting, it is unclear as to whether the intent of this amendment is to restrict vessels over a certain size from both harvesting and processing fish, or just to restrict those vessels from catching. It makes no sense to limit vessels of any size from such an underutilized fishery, but it makes even less sense to limit the size of processing vessels. Only recently the Council recommended approval of two mackerel Joint Ventures for 1999, for four freezer trawlers from Estonia and Lithuania. Each one of those vessels exceeds the size limitations that are being proposed for American vessels. The conservation and management impact of a mothership is almost entirely a function of the harvesting of the catcher boats that supply the mothership, not the physical dimensions of the mothership.

The size parameters outlined in the proposed amendment -- 165ft overall length, 750 GRT, or 3,000 shaft horsepower -- are purely arbitrary dimensions. There has never been any analysis to determine the justification for using these dimensions. There is simply no explanation why different thresholds – either larger or smaller – might better serve whatever management and conservation objectives underlie the proposed amendment. There has never been a meeting of industry advisors to discuss the vessel size implications, and even at the Council level, I do not recall any discussion on the justification or rationale for deciding upon these particular dimensions. The Amendment document itself does not include any justification for the specific dimensions.

The following comments are made with reference to the section and sub- section numbers as they appear in the Amendment document:

Section 1.1 Purpose and Need for Action.

There is no explanation regarding the selection of the particular vessel size limitations.

Section 1.2 Proposed Management Measures.

I support the alternative to take no action on the vessel size restrictions.

Section 2.0 Description of the Affected Environment.

In sub section 2.1.4.1 the median bootstrap estimate of MSY determined from recent analysis is 326,000 mt.

In sub section 2.2.1.1.2 the current estimated biomass level is stated to be 3 million mt. Spawning stock biomas (50% of age 2 and 100% age 3 and older) was 2 million mt in 1990 and has remained at or above that level since. The SARC in 1991 determined that the fishery is in an under exploited state

These numbers hardly describe a fishery that requires restricting access, particularly when domestic landings are around 15,000 mt annually.

Section 3.0 Environmental Impacts of the Alternatives.

In sub section 3.1.1 regarding the Framework Adjustment Process (which includes at number 19, restrictions on vessels size etc.) it states that the Council's recommendations to the RA must include supporting rationale. This Amendment does not state any rationale for the specific vessel size parameters. It is not clear what the document is saying, if anything, about the environmental impacts of restricting vessels by size. In fact, smaller vessels -- that do not have to transport a large cold storage facility and numerous staterooms – can take twice as much fish as the large vessel, with the corresponding impact on the environment. Moreover, large vessels that only freeze the product without further processing have the environmental advantage of producing no waste and need no meal plants.

Section 3.3 Alternatives to the Amendment.

Subsection 3.3.1 Take no Action. This section does not say anything about the effect of not taking any action on the vessel size restrictions.

Section 3.4 The Amendment Relative to the National Standards.

I would refer the Committee and the Council to the more detailed comments submitted on this point by American Pelagic Fishing Co. L.P

Section 3.5 Effects on the Environment.

Subsection 3.5.1 This section reiterates the rationale that has been put forward before to support a moratorium on any vessels entering the fishery. The harvest potential described in this section has never come anywhere close to landing sufficient fish to warrant a restriction on entry into the fishery, even as the mackerel prices have increased substantially over recent seasons.

Concerns about the rapid overcapitalization of the mackerel fleet, by the entry of large vessels with significant harvest potential, can be addressed by limiting access to vessels over the size limitations while allowing in only those that had been issued permits that were subsequently determined to be null and void pursuant to Section 616 of Public Law 105-119. Joel MacDonald has confirmed that the vessel, *Atlantic Star* is the only vessel that had its permits declared null and void, and therefore would be the only vessel over the thresholds that would be allowed in under this proposal.

The section says nothing about the effect of restricting vessels by specific size criteria except that there was only one vessel that possessed an Atlantic mackerel permit in 1997 that exceeded the proposed vessel size restrictions. The only vessel that will be effected by this proposed restriction is the *Atlantic Star* which had been issued a mackerel permit and had it revoked in 1997.

The Fishery Management Plan lists 6 objectives. The second objective is **"Promote the growth of the US commercial fishery, including the fishery for export."**

The Amendment Document contains no discussion regarding developing export markets. However the MAFMC has consistently referred to the market situation in its annual Quota Specification document for Atlantic Mackerel, Squid and Butterfish. As recently as August 1998 it stated "In order to compete in the world bulk market (for mackerel), the US industry will have to emulate its foreign competitors which harvest, process and ship mackerel in large quantities to take advantage of economies of scale."

In 1993 the US International Trade Commission published a document entitled Mackerel: Competitiveness of the US Industry in Domestic and Foreign Markets. By implication the document encourages the US industry to follow similar recommendations to those in the Specification document if we are to be competitive in the world bulk markets.

The American Pelagic Fishing Company, with its US vessel the *Atlantic Star*, is the only company to have followed this advice and is now having to address a proposed Amendment to the FMP that will restrict it from putting that advice into action. This is at a time when vessels from Russia, Poland, Estonia, Lithuania and Latvia can participate in the fishery without any concern over their vessel's length.

In my opinion, allowing the *Atlantic Star* to participate in this fishery, would be a major step towards Americanizing the fishery, and at the same time increase the supply of US mackerel into the Export markets at a time when we have a large imbalance of trade in the industry.

If you have any questions please do not hesitate to contact me.

Yours truly,

Dave Ellenton

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 Office Building
300 South New Street
Dover, Delaware 19904-6790

Re. Draft Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan

Dear Dr. Gilford:

We have reviewed Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan[2] that has been developed by the Mid-Atlantic Fishery Management Council (Council) in cooperation with the National Marine Fisheries Service (NMFS), the New England Fishery Management Council (NEFMC) and the South Atlantic Fishery Management Council (SAFMC). It was approved for public release and comment on August 20, 1998. These review comments are provided on behalf of the National Audubon Society, Environmental Defense Fund, Natural Resources Defense Council and Center for Marine Conservation.

Draft Amendment 8 was developed specifically to comply with the new provisions of the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (SFA). The SFA requires that: (1) overfished stocks are rebuilt as soon as is possible to population levels that will support the optimum yield (OY) on a sustainable basis, (2) overfishing is eliminated, (3) essential habitat is identified and protected, and (4) bycatch is avoided to the degree possible and unavoidable bycatch mortality is minimized. Optimum yield is now defined to include consideration of not only food production but also recreational opportunities and ecosystem integrity. Further, the OY population level should be larger than that which would produce the maximum sustainable yield (MSY). Amendment 8 does not address the need to maintain stocks of these prey species at high enough levels to support marine food webs. Moreover, the draft amendment does not address the new bycatch requirements of the SFA. Bycatch of immature scup in these fisheries is a particularly important problem that needs to be addressed in Amendment 8, as well as in the summer flounder, scup and black sea bass plan (Amendment 12). Detailed comments follow.

BYCATCH

Whereas the Magnuson Act was previously silent on this topic, the revised Magnuson-Stevens Act includes a newly established National Standard for bycatch against which all current and existing management programs must be evaluated. In order to adequately comply with the SFA requirement that each FMP be brought in to compliance with National Standard 9), all the Council's FMP amendments must critically and systematically evaluate the level of bycatch and the level of information regarding bycatch in each fishery under the jurisdiction of the MAFMC.

Draft Amendment 8 does not critically and systematically evaluate bycatch for each fishery. The draft amendment fails to identify specific measures that will minimize to the maximum extent practicable, bycatch and discard mortality. Fulfilling the letter and the spirit of the Magnuson Act bycatch provisions require three elements: adequate discard data collection, minimizing bycatch and minimizing bycatch mortality.

In the discussion of the new National Standards requiring minimization of bycatch and bycatch mortality (Amendment 8, p. 121-126), the draft cites a lack of discard data in all the managed fisheries as an obstacle to addressing bycatch problems. (p.126) However, it does not make any suggestions for improving data collection within the fisheries. In fact, the Guidelines require that the Councils improve data collection. (63 Fed. Reg. p. 24235) The Council's FMP amendments all need to add measures for improving the collection of discard data as a first step to fulfilling the bycatch requirements of the Amended Magnuson Act.

Each FMP should include bycatch reporting requirements. For example, there is a need to more carefully document the bycatch of herring in the mackerel fishery so that it can be taken into account in setting the herring TAC. This is clearly required by the SFA. It is also clearly necessary to ensure that bycatch is minimized to the extent practicable, and to ensure that all determinations regarding the extent to which bycatch has been avoided and bycatch mortality minimized are based on adequate data. However, the draft amendment must include considerably more information and analysis than now provided in order to adequately comply with bycatch provisions of the SFA. Amendment 8 and all other FMP amendments developed by the Council should make an explicit determination, on a fishery-by-fishery basis, regarding the status of relevant bycatch minimization. We recommend that the following approach be considered and adopted for all fisheries managed by the Council:

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.

For every analysis, the way "to extent practicable" was utilized in making the determination should be made clear (i.e., technically practicable, economically practicable, etc.).

The Council asserts that since existing state and federal mesh size regulations and the proposed framework approach minimize bycatch, it has fulfilled the bycatch requirements of National Standard 9 to the extent practicable. (see Amendment 8, p.126). While the FMP's efforts to minimize bycatch mortality assist in achieving optimum yield, minimizing bycatch mortality does not address the first priority under the new Magnuson Act - reducing bycatch in the first place. By asserting that bycatch and discards are a necessary part of the management plan to prevent overfishing under National Standard 1. the Council asserts the requirements of National Standard 1 are at odds with National Standard 9is mandate to minimize bycatch. Id. However, the Council has not considered options which reconcile the need to prevent overfishing and minimize bycatch. These measures should be considered to further reduce bycatch below its current levels and ultimately restore the fishery to optimum yield as soon as practicable.

OPTIMUM YIELD

The SFA requires that overfished stocks 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 should 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 3.4.1. (p. 121) and elsewhere throughout the Draft Amendment 8 be revised to reflect the law's new provision. Given their importance in supporting marine food webs in the Mid-Atlantic region, we suggest that a significant portion of MSY be reserved to fulfill the ecosystem support provisions of the amended law.

Thank you for considering our views.

Sincerely,

Sarah Chasis, Senior Attorney
Lisa Speer, Senior Policy Analyst
Natural Resources Defense Council

Doug Rader, Ph.D.
Senior Scientist
Environmental Defense Fund

James R. Chambers
Fisheries Biologist
Living Oceans Program
National Audubon Society

Sonja Fordham
Fisheries Project Manager
Center for Marine Conservation

cc: Jack Dunnigan, Executive Director, ASMFC
Jon Rittgers, Acting Regional Administrator, Northeast Region, NMFS
Joseph Brancaleone, Chairman, NEFMC
Pete Moffitt, Chairman, SAFMC
Susan Fruchter, Director, Office of Policy and Strategic Planning, NOAA

Captain Robert Hempstead
U.S.C.G. Licensed Master / Fisherman
6430 NE 135th Pl.
Kirkland, Wa. 98034

September 19, 1998

Christopher Moore, Ph.D, Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Sir:

The following are my written comments on the " Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP.

As Captain of the F/V Atlantic Star, my future and that of my crew will be directly and adversely effected by the implementation of the now proposed vessel size restriction. The 80+ crewmembers aboard the F/V Atlantic Star consist of licensed mates and engineers, refrigeration engineers, bosons, deck hands, galley personnel, factory engineers, factory managers, foremen, and factory workers. Of all the crew at least 75% have families and depend on this ship and therefore the decision you make. I hope that you carefully research the facts before you make your decision.

Vessel size limits as proposed in Amendment 8 analysis document are "based on the concerns about the rapid overcapitalization of the Mackerel fleet by the entry of large vessels with significant harvest power." Limiting vessels by their size is not the way to restrict the overcapitalization of the Mackerel fleet. By restricting vessel size you are restricting all those factors that make larger vessels safer, more efficient, and able to practice fishing techniques which are better for the stocks and therefore the goals of the Fishery Management council. As stated by NMFS in a letter to Senator Snowe, vessel size by itself is not a measure of harvesting capacity.

Simply put, large vessels are safer working platforms than small vessels. I have seen a vessel of approx. 165' sink and men drown. If not for the ships nearby of the F/V Atlantic Star size class, rescue would not have come in time for the rest of the crew. This is real life and it happens to the U.S. fishing fleet far too often. It's no wonder that fisherman top the list for the most fatalities per capita in America. I have been a fishing captain on large factory trawlers in the North Pacific, Bering Sea, Sea of Okhotsk, and North Atlantic for over 10 years. These are some of the roughest waters in the world and I can sincerely say that a vessel size limitation of any kind could be dangerous to those fishermen participating in the Mackerel fishery during winter in the North Atlantic.

It's a fact that the U.S. Mackerel resource is very healthy, and very underutilized with only 5% being harvested. You have now one small company which saw potential, obtained the necessary permits, and built a quality vessel capable of harvesting a small percentage of the total quota. This created onboard jobs with shore side support opportunities, and there is now proposed legislation to specifically ban this vessel. This is completely irrational and probably illegal. You must respect the fact that the investment made by the owners of the F/V Atlantic Star were done so, based on her eligibility to participate in the Mackerel fishery. The council has a stated policy that says there would not be a control date for possible entry limitation into the fishery until 50% of the ABC was reached. If the law retroactively changes, than you must consider the precedent in fisheries policy and allow for a savings clause for this one vessel.

By allowing large and small sizes of vessels you in effect spread out the fishing effort and this makes for a more sustainable harvest. Because of the mobility of the F/V Atlantic star she has the opportunity to track and select the fish which is most marketable i.e. size, fat content, etc... This is the kind of fishing which should be encouraged. By limiting vessel size you limit seaworthiness, effective use of advanced technologies, and fuel efficiency.

I can clearly find no rational reason for imposing a "Vessel Size Restriction" in the Mackerel fishery. I hope that you consider my comments and act on behalf of the nation as a whole and not on those of a few individuals or states.

Respectfully,

R. Hempstead

Captain Robert Hempstead

Sarah Hazard Uhlen
Fisher & Certified Seafood Quality Control Manager

September 10, 1998

Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Christopher Moore, Ph.D, Acting Executive Director:

Thank you for allowing me to submit my comments on the "Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP.

I have worked in the fishing industry for 13 years. I am one of a very few women in my position or in the industry in general and urge you to only adopt a policy that does not limit participants. When you limit the participants you limit jobs, and this is not justified in a fishery where only 4% of the quota is being taken and the stocks are considered healthy and underutilized. I especially urge you to not limit the size of the vessel. The vessel size has nothing to do with actual harvesting capacity and very good, well paying, safe, career jobs are only available on the "larger" vessels that carry a freezing plant, cold storage, and living quarters with it.

If you don't allow the vessel *Atlantic Star* to enter the fishery as it was legally permitted to do, this country will lose more than 80 good seafaring jobs. These jobs will not be shifted to some other sector of the industry. They will simply be lost. 80+ jobs on board as well as many, many support jobs on shore that pump many dollars into the local economies -- will vanish. This is not the way to rationally develop an underutilized fishery nor does it optimize the benefits to this nation. If you find that you must limit vessel size, which I do not support, then it is only fair and reasonable to come up with some sort of savings clause that allows the *Atlantic Star* to operate; she is the only vessel above the thresholds that invested prior to this Council changing its policy and her rights must not continue to be violated.

Just for a moment, I ask you to put yourself in the shoes of the owners of the one vessel being targeting here or in the shoes of her crew that are career seafarers whose jobs are being put on line for reasons that do not make sense in fisheries management or in the real world. Imagine what it would do to your own life to have your rights violated so harshly and maybe you can see that there is no reason for this to happen in a fishery that is so underutilized and is not threatened in the least by this one vessel.

Thank you in advance for really considering my comments. My livelihood depends on the fairness you give to all participants in this fishery that have played by the rules.

Regards,
Sarah Hazard Uhlen

Sarah Hazard Uhlen
13224 118th Ave. NE
Kirkland, WA 98034

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SEP 22 1998
MID-ATLANTIC FISHERY COUNCIL

Captain Petur Petursson
United States Coast Guard Licensed Master
Fisherman

September 8, 1998

Christopher Moore, Ph.D, Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Sir:

I respectfully submit my written comments on the "Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP. In the Federal Register notice of August 27/98 you are asking for input into this measure. As one of the fishermen directly affected by your actions on this item, I hope you truly consider my comments.

I am the Captain of the vessel *Atlantic Star*. If this vessel is not allowed to participate, you are putting extreme hardship on one vessel that employs a crew of 80+ hardworking, US-tax paying men and women. As the leader of all these crew members who will be out of work, I urge you to make a policy that is sound and assures this vessel's participation.

It has been proven many times over, with the best science available, that the mackerel resource is very strong and remains in an underutilized state. The fishery has been open access forever and yet the harvest remains low at less than 5%. Nothing has changed in the past few years in this fishery except the fact that one company invested millions of dollars in a "large" vessel and followed all the rules to legally enter this fishery and one shore plant upgraded their facility. To retroactively change the policy and punish this one vessel is unjustified and unfair. There is no reason for you to enact policy that stops this one vessel, especially when the policy you are considering allows for an indefinite number of new and historical entrants below the arbitrary thresholds. If you do find you must have some form of limits, then you must recognize this one vessel that invested in the fishery based on this Council's stated policy that there would not be a control date for possible entry limitation into the fishery until 50% of the ABC was reached. The precedent in fisheries management is to grandfather this vessel if you have to change the rules now.

You state in your amendment 8 analysis document that the "vessel size limit is proposed based on concerns about the rapid over-capitilization of the mackerel fleet by the entry of large vessels with significant harvest power". Your analysis is flawed. As confirmed by the NMFS in a letter to Senator Snowe earlier this year, vessel size by itself is not a measure of harvesting capacity. It follows that NMFS must reject any analysis that uses this argument for justification.

Therefore, due to the many factors that challenge the rational behind imposing a vessel size limit in the mackerel fishery: the strong stocks we have, the very low actual harvest rate that is being achieved, that the thresholds proposed are arbitrary and have no rational basis, the fact that foreign vessels continue to take our resources with the blessing of this Council, and that this policy does not begin to follow the national standards of the Magnuson Stevens Act, I do not support any form of vessel size restriction in the mackerel fishery.

As professional fishery managers it is your duty to go beyond the hype and emotions being thrown out by our competitors whose only goal is to keep this national resource for themselves. Thank you for the opportunity to submit my comments.

Sincerely,

Captain Petur M. Petursson
Fisherman for 25 years

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SEP 22 1998
MID-ATLANTIC FISHERY COUNCIL

September 16, 1998

Dr. Christopher Moore
Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Dr. Moore:

Following are my written comments on the "Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP. I am a fisherman that will be adversely affected by Amendment 8 if you limit vessel size in this open access fishery where less that 5% of the potential harvest is being taken.

I am opposed to any vessel size limits because it is inconsistent with management and conservation goals. We are trying to "rationally develop" the underutilized mackerel stocks, not distribute the future harvest to one sector of the industry. I see no rational or legal reason why you can discriminate against any larger vessel or vessels that have invested money to enter this fishery only to have the law changed. The optimum yield to the nation is greater if a larger vessel(s) can contribute from areas typically out of reach of the smaller vessels.

Small and large vessels should co-exist to get the most benefit out of a resource while respecting its long term conservation goals. If we get to a point one day when this fishery is reaching full utilization, we need a combination of large and small vessels to make sure the catch is distributed throughout the range of the resource and not just in the near shore stocks where smaller vessels can logically operate.

I do not support any vessel size restrictions, but if you find that for some far-reaching reason limits can be legally set, then I urge this Council to allow for a savings clause for the vessel Atlantic Star. This is the only vessel that is above these thresholds and had its permits that should, by fairness and fishery precedent set in cases such as this, be allowed an open access mackerel fishing permit. Fishery policy in the United States must meet the goals of the national directives and not just a few individual companies trying to monopolize this fishery.

Thank you for allowing me to submit my comments.

Yours truly,

Shawn Nguyen
Fisherman/Processing Manager
United States Citizen

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SEP 21 1998
MID-ATLANTIC FISHERY COUNCIL

Shawn Nguyen
22104 66th Ave. W
Mount Lake Terrace, WA 98043

September 11, 1998

Mid-Atlantic Fishery Management Council
Federal Building
300 South New Street
Dover, DE 19904-6790

To Whom It May Concern:

I am concerned that the current atmosphere to limit new entrants will only continue to stunt the rational development that we are trying to achieve. Furthermore, some of the options discriminate among fishermen from different states and in different sectors. If you limit serious new entrants and only allow the current players to get bigger and bigger, the resources that should be accessible to all US fishermen, no matter the vessel size, will be lost.

I am against this Council adopting Amendment 8 to the mackerel FMP if it does not allow open fishing access to all, at least in the offshore sector. If we really want to see rational development, then we need to start targeting the offshore stocks, and the only way to do this while respecting human life is with larger vessels, over the arbitrary 165 feet limitation that is being discussed. There is no rational behind this threshold. It is only set at this level because it is designed to allow all interested vessels to participate except one – the Atlantic Star. This is outright discrimination and not allowed under the rules under Magnuson-Stevens.

I don't think that there should be an unlimited number of large vessels, but I think it is fully rational and supportable to allow a small number of them to help us develop the fishery. I urge this Council to, at the very least, allow the one and only large vessel that has already invested real money and hired US tax paying crew members to participate in harvesting the mackerel resource. The *Atlantic Star* should, without question, get her permits back and be part of the rational develop of the US mackerel fishery.

I urge this Council to set policy in which we can all survive and so we can get back to the business we know – fishing.

Sincerely,

Van Le
Commercial Fisherman

Van Hoang Le
13416 40th Ave W #16
Lynnwood, WA 98037

Patricia Seki
1124 N. 92nd Street
Seattle, WA 98103

September 20, 1998

Dr. Christopher Moore
Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

RE: Vessel Size Restrictions under Amendment 8

Dear Dr. Moore:

Following are my written comments on the "Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP. Please note I am currently working at sea so I hope that you accept this faxed copy of my comments.

I believe successful fisheries throughout the world depend on a diversified fleet, so I am oppose the new vessel restriction size. If you allow for an unlimited number of "smaller" vessels, below the arbitrarily set thresholds being discussed, you are promoting the hammering of the near shore stocks. This is not consistent with "management" nor "conservation" goals. Larger vessel(s) would be able to go offshore and harvest where the mackerel stocks are known to be most plentiful. The optimum yield to the nation is greater if a larger vessel(s) can contribute from areas typically out of reach of the smaller vessels. I know that small and large vessels can co-exist to get the most benefit out of a resource while respecting its long term conservation goals.

There has only been 1 vessel above the vessel size limits being discussed that has shown genuine intent to enter this fishery. I support that the one vessel that had its permits revoked in 1997 be allowed an open access mackerel permit. There has been too much effort by industry and members of this Council to stop a vessel than meets the goals of fishery management and can contribute positively to the rational development of this fishery.

Sincerely,

Patricia Seki

RECEIVED
SEP 22 1998
MID-ATLANTIC FISHERY COUNCIL

Michael Love
37 Haskell Road
North Yarmouth, Maine 04097
(207) 829-2754 e-mail love@javanet.com

September 20, 1998

Dr. Christopher Moore
Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Dr. Moore:

Following are my written comments on the "Vessel Size Restrictions" that you are currently considering under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP. I am currently at sea and hope that you accept a faxed copy of my comments as I will not be back in port in time to mail you an original before the short deadline expires.

I am opposed to any vessel size limits. Successful fisheries depend on a diversified fleet. For example in the Lobster fishery there are small vessels appropriate for near shore areas and vessels 3-4 times larger that, for safety and economics fish offshore. If you allow for an unlimited number of vessels below the arbitrarily set thresholds being discussed, you are concentrating effort on the near shore stocks. This is not consistent with management or conservation goals. Larger vessels can operate offshore and harvest where the mackerel stocks are known to be most plentiful. The optimum yield to the nation is greater if a larger vessel can contribute from areas typically out of reach of the smaller vessel. Vessels large & small should co-exist to realize the most benefit from the mackerel resource. This will go a long way to achieving the ideal balance of utilization and conservation that is consistent with your management objectives.

It seems clear to me after reviewing your council's published material, that the proposed length and horsepower regulations are simply about allocating a resource between existing permit holders (Vessels that held permits prior to the most recent control date) vs. speculators trying to manipulate, the management system to keep a large underutilized resource for themselves even though they lack the capacity to use it, and what with the Asian economic problems, will not actually use it.

Why is it then either fair or in the country's best interest to have new 165'/3,000 hp tank boats that were previously not issued a permit, or for that matter thought of, to now come into the fishery as Atlantic Star is kept out? From my vantage point looking across Atlantic Star's deck I am struck by the contradiction of a length & horsepower limit with the council's own fishery specifications which stated essentialy *that to properly develop the fishery U.S. fishermen would have to emulate the Dutch boats and their scale of economies.* If this was not the Council's intent then why was it published?

There are many questions to which the only logical answer is to let any vessel permitted before the control date (including Atlantic Star) in to harvest mackerel. This is simple, fair, and consistent with courses of action in other F.M.P.'s. Thank you for your consideration of my comments. If you have any further questions please feel free to contact me.

Michael Love

Third generation fisherman
U.S.C.G. Captain of Fishing Vessels, Oceans
Past Manager of New England Mackerel and Groundfish vessels

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SEP 22 1998
MID-ATLANTIC FISHERY COUNCIL

Mark L Rose
1st Engineer
F/V Atlantic Star

Dr. Christopher Moore
Acting Executive Director
Mid Atlantic Fishery Management Council
Room 2115, Federal Bldg.
330 S. New Street
Dover, DE 19904

Dear Dr. Moore;

I am writing in regard to the request for public opinion on the Vessel Size Restrictions currently under consideration under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fisheries Management Plan.

I have worked onboard Freezer Trawlers since I was 19 years old. In the past decade I have worked my way up from Processor to Oiler to Unlicensed Engineer to First Engineer, and am now sitting for my Fishing Vessel Chief's license. The Freezer Trawler industry has allowed me the chance to build a career that would otherwise have been impossible to attain on smaller catcher boats.

I accepted the position onboard the Atlantic Star because I looked forward to working in a new U.S. fishery on a U.S. vessel. I am saddened and confused by the decision to impose size restrictions that would keep the Atlantic Star out of this fishery after this company has invested so much time and money with the intent of simply participating legally in what has always been an open access fishery. I also do not understand why, with less than 5% of the total allowable catch being harvested each year, such restrictive measures are needed. Over the years larger vessels like the Atlantic Star have proven to be both safer, and capable of the highest quality product from the underutilized resources available.

If this vessel is kept out of the Atlantic Mackerel fishery, more than 80 tax generating jobs, including mine will be forfieted. They will likely not show up again somewhere else in the fishing industry. They will simply be lost. That is not taking into consideration the shoreside support personnel and the economic impact of having millions of dollars of product offloaded each year through U.S. ports enroute to overseas markets. This is also helpful in boosting our gross national product.

Please consider for just a moment the tremendous amount of money and energy that have been put forth by the vessel owners and her crew. All with the simple goal of legally participating in an open access fishery, fully within the boundaries of the Magunson Act. It is inconceivable that the Mackerel fishery could be threatened by allowing one vessel to participate when the stocks are so underutilized now.

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SEP 22 1998
MID-ATLANTIC FISHERY COUNCIL

Thank you for your time and consideration in allowing me to submit my views. I am sure you will do what is right and fair and allow the Atlantic Star to legally participate in what has always been and open access fishery. If you have questions or comments I would be happy to answer them.

Respectfully;

Mark L. Rose
8253 Bagley Ave. N.
Seattle, WA 908103
(206) 525-6480

September 09, 1998

Arne Uhlen
Fisherman/Factory Manager
13224 118th Ave. NE
Kirkland, WA 98034

Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Sir:

Please let this serve as my written comments on the "Vessel Size Restrictions" under Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP in which you are currently seeking public comment.

I have been following the mackerel fishery closely and do not agree with limiting one sector of the industry. There is room for diversity in the mackerel fishery, especially when the most abundant stocks are offshore where large vessels are safer platforms for harvesting. There is no justification for this Council to limit participants in the mackerel fishery that is healthy and underutilized and is currently seeing less than 5% of the resource being harvested.

The mackerel fishery is healthy and underutilized yet you are suddenly concerned about some type of rapid overcapitilization in this fishery that has been open access for many, many years. With current catch levels below 5%, I find it very hard to believe that you are considering limiting participants and unimaginable that you are not outright respecting the investment made by the owners of the vessel Atlantic Star prior to your sudden reversal in policy. The owners of this vessel followed all the laws and all of your rules. The precedent in fisheries policy is to respect this investment and allow for a savings clause for this one vessel if the law retroactively changes as you are considering doing.

The Council should be considering a policy in which all vessels that had serious intent to participate in this fishery would be allowed to continue to participate in this fishery. In this respect, you can limit the larger vessels if needed after you recognize the one vessel that invested real money based on your stated policies of open access at the time they invested in this fishery.

In reading your justification for a vessel size limit under the National Standards in the amendment 8 document, I find that many of the national standards of Magnusun Stevens are violated: you are discriminating against fishermen from different states and in different sectors of the industry; you are putting undo hardship on just one vessel and its crew; there is no proof that the greatest overall benefit to the nation will be realized if you limit larger vessels (especially when you are taking away our jobs on US-flagged and crewed vessels); you are not promoting the safety of human life at sea when you take away larger vessels that are safer working platforms, especially in the bad weather we face on Georges where the strongest stocks are.

I urge this Council not to adopt any amendment that does not respect the role of the vessel Atlantic Star in the rational development of the mackerel fishery. Thank you for considering my comments. I look forward to the fair treatment of all fishermen in the fishery management process.

Sincerely,
Arne Uhlen
Arne Uhlen

Dear Senators Stevens, Chafee, Snowe, Kerry and the Atlantic Fisheries Council;

My name is Don Cameron and I've been a fisherman for the past 30 years. Fishing out of Gloucester, Boston, Virginia and Alaska. I've been everything from cook to captain. During the past 30 years I've endured storms on Georges Banks that I have been lucky enough to return to port; but many others haven't.

I can recall pulling along side the Capt. Cosmo and calling over to the crew that we were going in and that I would see them in a couple days. No one has ever seen them again! I lost a dozen friends on three different boats that fall. One night last year we had a crew of 7 friends over for supper on the Katie Ann in Seattle. They left to head for Alaska on their big safe boat and the next day the F/T Explorer found one body.

Please take the time to read the books the Perfect Storm, Working on the Edge or Nights of Ice...

Now let me get to the point. I'm a crew member on the Atlantic Star. In the 30 years of fishing I have never felt so totally safe on a vessel. I have made many trips on giant factory trawlers and many times with huge bags of fish on deck. Our stability left a lot to be desired and left a taste of fear in this old sea dogs mouth. I have no problem with the Stevens bill and the exclusion of factory trawlers from our waters. The Atlantic Star is not a factory trawler! We are a little big boat. There are many boats in the mackerel and herring industry that catch and hold more fish than we possibly could. We are a safe working platform. What has horsepower and length got to do with anything in regards to the Atlantic Star. The power pushes a large safe vessel that can only catch and process 250 tons of food quality fish a day.

You limit the size and horsepower to exclude the Atlantic Star and then people will invest in the conversion of round bottom mud boats that catch mackerel and herring offshore. You watch and see boats being lost because greedy skippers will overload their boats and get caught in unpredicted winter storms on Georges Banks. It's going to happen mark my words! And I hope every life that is lost on a boat that would be forced to work under a law like that remains on the conscience of lawmakers and people that support that law the rest of their lives.

I sincerely hope that I have a job along with 50 or more American fishermen and women on the East Coast.

Thank you, Don Cameron

Don Cameron
Atlantic Star

Mr. Christopher M Moore
ATTN. MR. PAUL HOWARD

WE THE UNDERSIGNED ARE AVID SPORTS FISHERMEN AND HAVE PREVIOUSLY BEEN SUPPORTIVE OF THE U.S. GOVERNMENT'S REVOKING OF THE FEDERAL FISHING PERMIT FOR THE VESSEL ATLANTIC STAR.

HOWEVER, AFTER BECOMING EDUCATED ABOUT THE PROJECT WE REALIZE THAT WE CAN COEXIST AND WE URGE YOU TO MAKE SURE THE VESSEL GETS ITS PERMITS AND RIGHTS REINSTATED.

THE ATLANTIC STAR HAS A RIGHT TO BE HERE-THE AMERICAN OWNER HAVING INVESTED MONEY BASED ON US LAW AND POLICY SHOULD BE RECOGNIZED. ITS PLAN TO TARGET TI UNDERUTILIZED OFFSHORE SPECIES OF ATLANTIC MACKEREL AND HERRING WILL NOT HA SPORTS FISHERMEN OR ANY CURRENT COMMERCIAL FISHERS. WHAT THE VESSEL CAN OFFER IS GOOD JOBS, AN INCREASED TAX BASES, AND PROVIDE LOW VALUE, HIGH PROTE FISH PRODUCTS TO COUNTRIES THAT REALLY NEED THIS FOOD.

WE URGE YOU TO ALSO BECOME TRULY EDUCATED ON THE REAL ISSUE HERE. ONCE EDUCATED YOU WILL REALIZE THAT EVERYONE CAN BENEFIT AND WE CAN HAVE A WIN-WIN SITUATION FOR THOSE THAT ENJOY THE SEA FOR PLEASURE AND THOSE THAT RELY ON IT FOR THEIR LIVELIHOOD.

THANK YOU FOR CONSIDERING OUR COMMENTS AND SUPPORTING THE ATLANTIC STAR PROJECT.

The above petition, which was sent via fax during the public comment period, was submitted containing the signatures of 108 individuals. The names of the petitioners are one file and can be obtained from the Mid-Atlantic Fishery Management Council.

To all East Coast Fisheries Council Members;

I have read about the Atlantic and Don Cameron has explained the politics behind the present situation and I personally feel there is no reason that the Atlantic Star shouldn't be allowed to fish on the East Coast of the United States.

The above statement, which was sent via fax during the public comment period, was submitted by 33 different individuals. The names of the petitioners are on file and can be obtained from the Mid-Atlantic Fishery Management Council.

Kjell Arne Husevaag
2147 NW 95th
Seattle, WA 98117

September 21. 1998

Dr. Christopher Moore
Acting Executive Director
Mid-Atlantic Fishery Management Council
Rm. 2115, Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Dr. Moore:

With this letter. I am my submitting my written on the "Vessel Size Restrictions" that you are going to impose under Amendment 8 to the Atlantic Mackerel. Squid and Butterfish FMP.

I have been working in the Fishing industry for the last 30 years and been fishing on Factory Trawler in Alaska for the last 10 years. I am currently one of the crewmembers of the 'Atlantic Star' that this amendment of your seems to be targeting. I gave up my job in Alaska last year to go on the Atlantic Star and work towards building up an safer alternative to the small boats for people in the fishing industry on the East Coast. When we signed on this project we had gotten all the necessary permits and licenses that were needed. The stock were underutilized and the fishery almost none existing.

If you belief that all we fishermen are just out there to ravage the sea, I would like to point out to you that since I chose this as my profession, and I am just as much if not more concerned with the right utilization of the fish stocks. My whole income is based on the continued health of fish stocks. while you will still get paycheck even if everything falters. This is in essence what you have done to me and my crewmates, without us even touching the Mackerel stock.

The size of the vessel is irrelevant in all management schemes since there is a Total Allowable Catch roof, if it is enforced there are no more danger to the fish population regardless of the size of the vessel. The only difference between the smaller vessels and a vessel like the 'Atlantic Star' is that the 'Atlantic Star' is a much safer working environment when you are fishing far off the coast. The Mackerel season is during the winter when the weather is at its worst. If you have ever been out on the Grand Bank and worked on a smaller boat in the wintertime you would most likely understand my point.

Why you are trying to keep this one vessel out of the fishery when you allow another even bigger mothership to enter the fishery (it is arriving this week). You even seem to have a preference for foreign flagged vessels to operate in this fishery, over the 'Atlantic Star' which is a US vessel. I would think that Senator Magnusson did not have that in mind when the Magnusson Act was put together.

Therefore I urge you to not put on any size and horsepower restrictions; they do not have any impact on the fishery. And I would appreciate if you would be so kind and reinstate our permits and Licenses so we, who committed to this project, can go on with our lives and not constantly be put on hold by the governing bodies.

I would very gladly give you the grand tour of the vessel when we arrive home which we hope will be soon.

Best Regards

Kjell Arne Husevaag

K & K Boats
Bristol Bay, Alaska
10816 Rowan Road South
Seattle, WA 98178

September 18, 1998

Executive Director
Mid-Atlantic Fishery Management Council
Room 2115, Federal Bldg.
300 South New Street
Dover, DE 19904-6790

PUBLIC COMMENTS SUBMITTED ON PROPOSED VESSEL SIZE LIMITS
Amendment 8 to Atlantic Mackerel, Squid and Butterfish FMP

Dear Sir:

Thank you for allowing me to submit my comments on your proposed vessel size limits.

I have owned and operated "small" 32-foot fishing vessels for close to 40 years. I have fished in an open access fishery and then was awarded a limited entry permit when full utilization was pending and a controlled access system was needed. I am very aware of the fishery management process and know firsthand that both large and small vessels play important rolls in the rational development of our fisheries.

The intention of the Magnuson-Stevens Act is to Americanize the U.S. fisheries. This past year we have gone backwards – a U.S-flagged and crewed vessel has been denied access to the abundant offshore US herring and mackerel resources. This is at the same time foreign-flagged vessels have been allowed access and many, many more thousands of tons have been transhipped to and from Canada. Both of these practices fall well behind adding the maximum benefit to the US as compared to a US vessel actually harvesting and landing these resources in the US. The priorities of the Magnuson–Stevens Act have been turned upside down. The benefits to our nation have not been realized. I have serious problems with the Constitutionality of how our resources are being managed when a specific sector, a specific vessel, and specific US citizens are discriminated against in a very underexploited fishery such as mackerel.

The owners of the US-flagged vessel *Atlantic Star* invested millions of dollars in the Atlantic mackerel fishery. In fact, this may be the single largest investment in this fishery in recent years. They were encouraged to invest in the development this fishery – by the US government and by this Mid-Atlantic Fishery Management Council. They followed all the rules and were then struck down for no logical or fair reason. This vessel does not threaten the resource. Again, I have serious problems with the Constitutionality of singling out one company and denying access to the mackerel resource for that one company that invested real money in good faith.

This is not an issue of the *Atlantic Star* displacing any other sector of the fishery. It has been open access and still underutilized for many years; it will continue to be underutilized even with the Atlantic Star participating. As it stands today, there is room for both to participate in the orderly development of the mackerel fishery. I therefore urge you to come up with a management plan that includes the vessel *Atlantic Star*.

This is a serious matter with many long-term consequences. If you as fishery managers really want to see an orderly development of this fishery, especially in the offshore areas, then it is only reasonable to develop a plan that includes the vessel *Atlantic Star*. If there is strong concern over too many large vessels entering the fishery, then I would recommend an option that recognizes a savings clause for this one and only large vessel that has played by the rules and has been unfairly targeted.

I therefore support only options for mackerel that allow for the vessel *Atlantic Star* to participate in the fishery as a catcher/processor. I strongly urge you to consider and incorporate my comments into your final amendment.

Sincerely,

Dr. Gary F. Kohlwes

AMERICAN PELAGIC FISHING COMPANY, L.P.

FAX COVER

To : MAFMC Fax #: 302-674-5399
Att. : Christopher Moore, Executive Director
From : Rachel Whitehead
Date : 24.09.98
Cc. :
Re. : Amendment 8, FMP
Pages incl. this : 2

Dear Mr. Moore,

Attached are my comments regarding the Squid, Butterfish, and Mackerel FMP under consideration. Thank you in advance for your attention to this matter.

Regards,

Rachel Whitehead

5470 Shilshole Ave NW, Suite 400 Seattle WA 98107 USA
206-789-5902 Fax: 206-789-6141 E-mail: torgilsa@online.no

AMERICAN PELAGIC FISHING COMPANY, L.P.

September 23, 1998

Christopher Moore
Executive Director
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, DE 19904-6790

Dear Sir,

I am writing to comment on the proposed vessel size restrictions being considered under Amendment 8 of the Atlantic Mackerel, Squid, and Butterfish FMP.

I have just recently been informed of this issue, through working for the owners of the vessel the Atlantic Star. The political issues motivating this debate are intriguing to me. since much of the reasoning behind the vessel size restrictions seems to have no logical or factual basis, but is founded in the desires of the East coast fisherman to drive out competition from other states and keep "their" fishery exclusive.

The facts, as I have come to understand them, are as follows:

1. There is more than enough fish to go around. Currently, the actual catch for herring and mackerel is less than 5% of the allowable catch for these fisheries. There is no lack of resource, nor any danger of it being overcapitalized.
2. The Atlantic Star had its permits and permission to fish on the East Coast before these restrictions were enacted. The owners invested $40 million refitting the vessel in anticipation of entrance into the East Coast fishery. Therefore it is only fair that the Atlantic Star be allowed in.
3. There is a tremendous investment in the American economy involved in this, not only through the employment of US citizens on the boat, but also through the business dealings between the boat and the vendors and suppliers on the coast. Denying the Atlantic Star her permits will be a detriment to the US economy.
4. The Atlantic Star is extremely efficient in its utilization of the resource. It freezes the catch onboard, allowing not only for a fresher and better tasting product. but also providing a resource for other vessels in utilizing their catch.
5. The fact that the vessel freezes its catch right onboard also limits its catching capabilities to 250 m/t daily, which can actually be accomplished by other boats

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under the vessel size limit that are strictly fishing boats. Therefore the size and horsepower don't matter as far as catching capabilities are concerned.

The overabundance of fish, the loss of jobs and a significant investment in the American economy, as well as the fact that limiting size does not accomplish the stated purpose of limiting catch all lead me to believe that this is more of an issue of territory and loyalties than of environmental preservation. Allowing the Atlantic Star access to the East Coast fishery and permits that are rightfully and legally hers, in my opinion, is the most logical and beneficial outcome in this matter.

Thank you for considering my comments on this matter.

Sincerely,

Rachel E. Whitehead

Rachel Whitehead

AMERICAN PELAGIC FISHING COMPANY, L.P.

September 24, 1998

Mr. Christopher Moore, Ph.D.
Acting Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street
Dover, DE 19904

Dear Mr. Moore:

I am an owner of American Pelagic Fishing Company, L.P. American Pelagic owns the *Atlantic Star*, a U.S.-built, U.S. manned freezer trawler that was outfitted last year at a project cost of $40 million for operation in the Atlantic herring and mackerel fisheries. After receiving all necessary fishery permits and federal government rulings to authorize the *Atlantic Star's* operations in these waters, our vessel was kept out of these fisheries by a one-year moratorium contained in a rider to federal appropriations legislation. This legislation was intended to give the New England Fishery Management Council the opportunity to develop a management plan and the Mid-Atlantic Fishery Management Council an opportunity to develop a plan amendment for these fisheries.

I am submitting these comments to Amendment 8 pursuant to 50 C.F.R. 648. The vessel size limitation contained in the proposed Amendment would unfairly exclude our vessel from a vastly underutilized fishery. I hope that upon review of the attached materials, the Council will reassess the provision and alter the Amendment accordingly.

Sincerely,

Lisa Torgersen

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Similarly, as NMFS recently advised the U.S. Senate Commerce Committee:

"NMFS is very confident that the stock assessments for herring and mackerel are correctly indicating the high abundance of these stocks. There is substantial additional data beyond just the landings data for herring and mackerel. The assessments utilize commercial and recreational landings and size composition data as well as research survey data from a 35 year time series of repeated surveys... The mackerel catch specifications are set extremely conservatively."[3]

This is the best scientific information available; it argues against any assertion of a need for curtailing vessel entry into the mackerel fishery through the imposition of vessel size limitations. With landings of mackerel actually *decreasing*, the resource is being underutilized on an ongoing basis.

Under these circumstances it is difficult to understand what has occurred that would warrant a prohibition on new entrants with larger vessels into this fishery. In order to meet the requirements of the Magnuson-Stevens Act, such a proposal needs to achieve the Optimum Yield from the fishery.[4] Having determined that the Initial Optimum Yield for the mackerel fishery this year is 80,000 metric tons and given that U.S. landings this year are in the range of 10,000 metric tons, imposition of the vessel size limitations appears calculated to *frustrate* rather than achieve the Optimum Yield from the fishery.

A recent NMFS analysis indicates that in the very unlikely event that *every single vessel* that landed any Atlantic mackerel in 1997 were to fish *as often as the most active vessels*, they would *still* only land a fraction of the Maximum Sustainable Yield (MSY). Specifically, NMFS concluded that if every one of the 587 vessels that landed mackerel in 1997 fished as often as the *most active* vessels, the projected landings would be only <u>58.000</u> metric tons, or 15% of the ABC and 17.8% of the most conservative MSY of 326,000 tons (or 13.7% of the alternative NMFS estimate for MSY of 423,000 metric tons).[5] Even making this very unrealistic assumption as to the level of projected landings, there still would be no rational basis for imposing a size limitation on new entrants into the mackerel fishery.

This is especially true where this year's 10,000 metric tons of landed mackerel include U.S. catch delivered to *foreign-flag* processing vessels operating in joint ventures with U.S. catcher boats. The fact that the Council allocated, in final specifications published earlier this year, 15,000 metric tons for joint venture processing (JVP) is strong evidence of how inappropriate imposition of a limit on *U.S. flag* vessels is in the mackerel fishery. Nor does there seem to be any indication that these opportunities for foreign vessels will be diminishing in the mackerel fisheries. Earlier

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[3] NMFS Response to Senate Commerce at p. 16.
[4] 16 U.S.C. 1851(a)(1).
[5] See "Follow-up Questions from American Fisheries Act (S.1221) March 26 Hearing – Senate Commerce Subcommittee on Ocean and Fisheries provided by the National Marine Fisheries Service" ("NMFS Response to Senate Commerce") at p. 16.

COMMENTS ON
AMENDMENT 8 TO THE ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERY MANAGEMENT PLAN

Submitted in response to Request for Comments
63 Fed. Reg. 45793 (Aug. 27, 1998)
Due Date: September 25, 1998

The Proposed Vessel Size Limitation in the Atlantic Mackerel Fishery is Arbitrary and Wholly Unjustified

A. The Atlantic Mackerel Fishery Is Under-Exploited

The fundamental problem with the proposed size limitations is that no matter what cutoff date is adopted, there has been no demonstration of the need for a limitation on fishing effort in this fishery. There is, rather, overwhelming evidence of the healthy state of Atlantic mackerel stocks, *particularly* in the offshore areas where vessels exceeding the proposed size thresholds would operate. The best scientific data available demonstrates stock abundance and an enormous opportunity for increased U.S. vessel participation.

At the time that this year's Atlantic mackerel specifications were first published, the Allowable Biological Catch (ABC) was 382,000 metric tons; the National Marine Fisheries Service (NMFS) concluded that "U.S. Atlantic mackerel stock abundance remains high."[1] U.S. landings for 1997 were only 15,000 metric tons, or less than 4% of the ABC. The most recent information from NMFS and the participants in the mackerel fishery indicates total U.S. landings this year of approximately 11,000 metric tons.

In approving this year's specifications, NMFS explained the Council's findings of increased opportunities for *expansion* of the U.S. mackerel industry as follows:

> "*...the Council believes that an expanding mackerel market and uncertainty regarding world supply, due to recent declines in the North Sea mackerel stock, have resulted in increased opportunities for U.S. producers to increase sales to new markets abroad. The U.S. industry has made some progress in capturing an increased market share for mackerel in Japan over the past 2 years, though Canada and Jamaica remain the most important export nations. Several factors indicate that market expansion for U.S. Atlantic mackerel is likely to continue. In addition, U.S. Atlantic mackerel stock abundance remains high. The continued low abundance of several important groundfish stocks in the Gulf of Maine, southern New England, and on Georges Bank and restrictions on fishing for those species also increase the likelihood that harvesters will redirect their efforts to Atlantic mackerel. Atlantic mackerel is considered a prime candidate for innovation in harvesting, processing, and marketing.*" (emphasis added).[2]

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[1] 62 Fed. Reg. 63064, 63065 (Nov. 26, 1997).
[2] 62 Fed. Reg. 63064, 63065 (Nov. 26, 1997).

this year, the Fisheries Subcommittee of the House Committee on Resources held hearings to approve extensions of two more Governing International Fisheries Agreements (GIFAs) with Latvia and Poland which would allow foreign vessels of these nations to participate in the mackerel fishery.[6]

In the face of this, the argument set forth in Amendment 8 is utterly unconvincing. According to the facts as stated in Amendment 8, only 69 vessels harvested an appreciable quantity of mackerel in 1996. Total catch has now substantially *decreased* for two years running (See infra) and there has been "a significant decline in permit holders."[7] In light of these numbers the argument must strain credulity to demonstrate that a size limitation is needed.

The Amendment proposes that: (1) if every single vessel holding a mackerel permit and having the practical capacity to take mackerel suddenly decided to take as much mackerel as each the top 5% of mackerel harvest boats have hitherto; and (2) if every single vessel holding a Northeast Regional Permit having the practical capacity to take mackerel suddenly decided to do the same thing at the same time, and (3) if the existing mackerel fishing fleet harvested the same level of fish as it did in 1996 (despite the decreasing trend since then) at the same time as all these new boats, then overcapitalization would occur.

Only by hypothetically transforming the decreasing number (now under 69) of mackerel boats (taking some 10,000 metric tons of fish this year) into a vast armada of nearly 1,000[8] mackerel starved phantom vessels taking some 230,000 metric tons of mackerel per year, have the authors of the Amendment been able to construct a justification for the proposed size restrictions. A total vessel capacity ceiling, however, is apparently considered unwarranted.

It would be equally true that if every American who had the physical capacity to eat fish did so at the same time, and in the same amounts as Americans who eat the most fish today, there would be a shortage of fish. But there is simply no justification for such strained reasoning. The plain fact is that fewer domestic boats are taking mackerel and that domestic landings, decreasing at the current rate, are soon likely to be under 10,000 metric tons, a classic case for encouraging efficient development of the resource. Thus, the Mid-Atlantic Council between 1994 and 1996 recommended the use of large vessels to further develop the fishery. In its 1994 specifications the Council observed, at page 48,

> *In order to compete in the world market, the U.S. will have to emulate its foreign competitors which harvest, process, and ship mackerel in large quantities so as*

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[6]Hearings before the Subcommittee on Fisheries Conservation, Wildlife and Oceans on H.R. 3460 and H.R. 3461 (May 19, 1998).

[7] Amendment 8 at p. 128.

[8] The Amendment calculates this number by adding the largest number in the range of 300-340 mackerel permitted vessels to the largest number in the range of 518-658 Northeast Regional permitted vessels.

to take advantage of economies of scale. Currently the U.S. East Coast industry does not have the large vessels necessary to participate in this market.

The Council employed similar language in 1995 and 1996:

In order to compete in the world bulk market, the U.S. will have to emulate its foreign competitors which harvest, process and ship mackerel in large quantities so as to take advantage of economies of scale.[9]

In its June 4, 1998 meeting, the Council agreed that the fishery was radically undercapitalized, and many argued that a size limitation on new vessels when an unlimited number of existing vessels could rebuild themselves up to 165 feet in length. was valueless from a conservation standpoint.[10]

In a fishery where the catch levels are at under 4% of the ABC and declining, vessel size limitations are simply not designed to prevent overfishing in any meaningful way. In a fishery where the initial optimum yield (IOY) has been set at 80,000 metric tons, and the most recent annual catch is some 10,000 metric tons, imposition of a size limitations can not be said to achieve the optimum yield. In a fishery where the Council has identified the desirability of pursuing export markets and other *development* initiatives, a *limitation* on the large vessels best suited to develop these markets can hardly be said to result in the greatest possible benefit to the Nation.

B. Size Limitations Are Not A Rational Conservation Tool

Size limitations alone simply are not a rational conservation tool to limit total fishing capacity. As NMFS explained:

"the size of a vessel does not necessarily reflect its fishing capacity. A 150 ft catcher vessel is capable of harvesting as much fish in one tow as a 300 ft factory trawler that has devoted most of its space to processing operations rather than fishing capacity."[11]

Because Amendment 8 fails to limit total entry to the fishery, it does *nothing* to limit fishing capacity. Nowhere is there *any* explanation as to where the proposed 165 foot, 750 gross ton, and 3000 horsepower limitations originated, nor why they are appropriate standards for limiting vessels participating in the fishery. Nothing in the hearing record to date suggests the basis for these particular size thresholds. *The inescapable conclusion is that they are completely arbitrary* or are intended to unfairly advantage vessels in the region at the expense of larger vessels from the West Coast. Ineffective plan provisions are adopted that are purported to advance conservation goals, take the place of other provisions that might actually advance such goals.

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[9] July, 1996 Mid-Atlantic Fishery Management Council Annual Quota Specifications.
[10] June 4, 1998 Mid-Atlantic Fishery Management Council Hearing.
[11] NMFS Response to Senate Commerce at p. 1.

C. The Proposed Size Limit Is Targeted To Exclude A Single Vessel

While it is suggested in the proposed Amendment 8 that a size limit in general may allow diversification of participants into the fishery, the size of vessels in the existing fleet illustrates how unrelated the proposed limit would be to anything other than excluding a *single* vessel from the fishery. Not one vessel in the existing fleet would be restricted by this size limitation, yet at the same time every vessel in the current fleet, no matter how small, would be permitted to be rebuilt into a large vessel, just so long as it did not exceed the new size thresholds. Thus the net increase in capacity could be, and, (according to the Council's June 4, 1998 discussion) is intended to be, substantial.

D. Optimum Yield and the Greatest Benefit to the Nation

Commerce Department regulations define "optimum" with respect to the yield from a fishery, as the amount of fish:

> *(A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and*
> *(B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery, as modified by any relevant economic, social, or ecological factor.* [12]

Vessel size limitations in the mackerel fishery fail to achieve the required optimum yield from the fishery.

1. Food Production

The increased efficient utilization of the resource would substantially enhance the capacity of the fishery to meet nutritional needs domestically and abroad. It is widely recognized that larger vessels with freezing capacity are necessary to achieve the best economies of scale to harvest and process offshore stocks that are far from shorebased processing facilities. Thus, the proposed size limitations will *prevent* the introduction of very vessels most needed to develop the resource.

2. Consumer Satisfaction

Development of a vastly underutilized fishery by larger processing vessels also promotes consumer satisfaction. Because such vessels carry freezing equipment onboard, they are able to produce a fresher higher quality product than vessels that must transport and transfer their catch to processing facilities on shore.

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[12] 16 U.S.C. §1802(18).

3. Development of the Resource and Export Potential

The exceptional economic efficiency and low marginal operating cost of the only vessel excluded from the fishery by the proposed Amendment 8 would enhance the economic viability of the resource. A size limitation designed to keep larger U.S. flag vessels from the fishery cannot further the stated goal of providing for the "orderly development of the offshore and inshore fisheries."

In seeking to accomplish the orderly development of the fishery, it is hard to imagine any regulatory action that is less "orderly" than preventing a vessel that has been completely outfitted for a particular fishery at a cost of $40 million, and that has received all necessary permits, from entering that very fishery because it exceeds size limits that were not adopted until *after* the conversion of the vessel for this fishery was completed. Keeping out a vessel which received all necessary permits and invested $40 million dollars in reliance on its permits *frustrates* the orderly development of this fishery rather than providing for it, for no fishermen will risk the complete loss of his investment in the future under such circumstances.

The economies of scale and potentially higher quality product offered by the *Atlantic Star* are essential for the development of export markets for U.S. mackerel, markets that are currently beyond the reach of smaller scale harvesters and processors due to higher per capita operating costs.

Overall, the arbitrary size limit in the proposed FMP amendment is a significant economic detriment: the *only vessel* that is kept out of the fishery by the size limitation is a U.S. flag vessel that catches and processes mackerel, will create some 80 U.S. jobs, and will generate an estimated annual economic benefit to the Nation approaching $25 million.

4. Ecology

Finally, no ecological factors support a size limitation in this fishery. There is no non-speculative evidence whatsoever that freezer trawlers over 165 feet have a more negative impact on the local ecology that smaller vessels. In fact, many have argued that a small number of larger vessels are far easier to monitor for ecological safety by government observers than many smaller ones. Moreover, larger vessels are able to fish further out, thus reducing the pressure on close in stocks.

E. Targeted Exclusion of the Atlantic Star is an Unfair Allocation

There can be little question that the proposed size limitation is an allocation measure. The term "allocation" is defined as "a direct and deliberate distribution of the opportunity to participate in a fishery among identifiable, discrete user groups or individuals."[13] The manner in which the size limitation is drafted singles out one company and denies it the opportunity to participate in the fishery.

1. Discrimination

It is widely known that the reason for the particular size limitations at issue here was to exclude the *Atlantic Star* from the mackerel fishery. The proposed size limit would discriminate in favor of a vessel with no prior participation in the fishery that only recently applied for a mackerel permit, and against one which was legally permitted over a year ago.[14]

This is exactly the kind of discrimination that NMFS has found to violate the National Standards. In rejecting a moratorium proposal for the groundfish and crab fisheries off Alaska, NMFS concluded:

"...there is no apparent justification for discriminating between two vessels that have no prior participation in a moratorium fishery by allowing one but not the other to enter that fishery...[w]ithout a reasonable justification in the record, approval of the moratorium amendments as proposed...would be arbitrary and capricious in violation of the Administrative Procedure Act (APA)."[15]

Establishing vessel size limits are legally suspect under the circumstances presented here. For example, in Atlantic Prince, Ltd. v. Jorling, 710 F. Supp. 893 (E.D.N.Y. 1989), the Court struck down a New York statute imposing a 90 foot size limitation on squid fishing vessels in New York State as violating the Commerce Clause prohibition against state statutes which discriminate "in practical effect" upon residents of other states. This "dormant" Commerce Clause prohibition is far more limited than the explicit blanket prohibition on discrimination between residents of different states set forth in the Magnuson-Stevens Act. Nevertheless, the Court found that the statute bore

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[13] 50 C.F.R. 600.325 (c)(1).

[14] Amendment 8 states (p. 129): "there was only one vessel [the *Atlantic Star*] which possessed an Atlantic Mackerel permit in 1997 that exceeded the vessel size restrictions proposed in this Amendment. However, this vessel submitted a vessel trip report that indicated that it did not fish in the Atlantic mackerel fishery in 1997." The vessel did not fish for mackerel in 1997 only because of an Act of Congress excluding it pending approval of a Regional Plan Amendment by the Council.

[15] Letter from Steven Pennoyer, Director Alaska Region of NMFS, to Richard B. Lauber, Chairman of the North Pacific Fishery Management Council dated August 8, 1994 (disapproving fishery management plan amendments developed and recommended by the Council to impose a moratorium on the entry of new vessels).

"disproportionately – in fact, almost exclusively – on out-of-state fishers."[16] Because there was only one New York commercial fishing vessel exceeding 90 feet in length and corollary evidence indicated the state's desire to avoid fishing pressure on its residents, the Court held that the statute was discriminatory. Further, in determining that such discrimination was not overcome by any legitimate conservation rationales, the Court found especially persuasive the substantial supply of squid in the fishery and the state's failure to impose limits on the total fishing capacity in the fishery.[17]

The Court's decision in Atlantic Prince is particularly relevant here,[18] where not a single vessel from the entire region will be affected by the proposed size limitation, and abundant extrinsic evidence exists to show that exclusion of a single vessel was the primary purpose behind the provision. It is for this reason that the regulations implementing this National Standard explicitly forbids an FMP from incorporating or relying upon a state statue or regulation that discriminates against residents of another state. These regulations *only* permit management measures that have different effects on persons in various geographic locations if they are valid conservation and management measures.[19]

The proposed size limitations constitute clear discrimination, in purpose and effect, upon fishermen from other regions (in this case, Washington State) for the benefit of fishermen from the local region.

2. Fair and Equitable

For many of the same reasons, the proposed size limit runs counter to any standard of fairness and equitability. Obviously, it is neither fair nor equitable to adopt a measure which prevents a company holding the appropriate permit to enter the mackerel fishery, and one that had made enormous investments in reliance on that permit, from participating in the fishery, when others from the region who have never had a permit, and have not invested so much as a dollar in this fishery are free to enter.

Even if it were determined that there are rational and appropriate reasons for limiting vessel size, *the fair and equitable solution is to allow the vessel that made investments in reliance on existing law to enter the fishery, and prospectively preclude future entrants from coming in.* We are unaware of any fishery management plan developed under the Magnuson-Stevens Act that has

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[16] Atlantic Prince at 896.
[17] Atlantic Prince at 899-900.
[18] The Atlantic Prince case was distinguished by Davrod Corp. v. Coates, 971 F.2d 778 (1st Cir. 1992), where a Court upheld a size limitation in a Massachusetts statutue where far more of the excluded vessels came from the Massachusetts area than from outside the region, significant harvest benefits were realized by fishermen from out of the region and there was no extrinsic evidence to suggest an improper purpose of excluding fishermen from outside the region.
[19] 50 C.F.R. 600.325 (b).

not accommodated projects "in the pipeline" when there has been a change in regulatory direction. The Atlantic mackerel fishery should be no different.

F. Efficiency

It is difficult to imagine a provision better calculated to impede efficiency than a size limitation in an underutilized fishery that excludes the only vessel with sufficient economies of scale to successfully develop domestic and export markets. Such a blanket prohibition ensures excessive investment in harvesting and processing and eventually, the overcrowding of the fishery. The increased total cost to utilize the fishery is a loss to conservation, where that term connotes constitutes wise use of all resources involved in the fishery, not just fish stocks.

G. Bycatch

The arbitrary exclusion of boats over 165 feet successfully effects the exclusion of the most advanced technology available in mid-water trawl fishing. Unlike smaller U.S. vessels, the *Atlantic Star* is equipped with a state-of-the-art sorting device in the vessel's nets that is widely used in other parts of the world to target fish by size and shape and therefore to reduce unwanted bycatch. Such technology permits relatively "clean" fishing; the only vessel excluded by the provision has an exemplary bycatch record compared to other vessels on the East Coast.

H. Safety

The proposed vessel size limitations will necessarily result in vessels of less than 165 feet traveling farther out if they are to pursue the mackerel stocks, since larger vessels will be excluded. The size, stability and modern technology of the only vessel excluded from the mackerel fishery by the proposed size limitations, the *Atlantic Star*, argue strongly against the propose limit, which would likely result in a substantially adverse impact on human safety that is inherent in precluding larger vessels.

I. Advantages to Foreign Vessels

The Council is required to promote the development of underutilized U.S. fisheries and the U.S. fishing industry while preserving the fishery resource. U.S. vessel capacity has first priority for fish within the Exclusive Economic Zone.

The capacity and intention of the fishermen who invested $40 million dollars to outfit the *Atlantic Star* explicitly to fish in the Atlantic mackerel fishery is indisputable. Even now, the Council has permitted 15,000 metric tons for joint venture processing (JVP) with foreign motherships. A Council cannot merely circumvent the intention of the Act by excluding U.S. harvesting and processing vessels while permitting foreign flag vessels of comparable size to operate in the same fishery.

Thus, in the context of the Atlantic mackerel fishery, a size limitation resulting in the idling (and, in fact, bankruptcy) of a U.S. fishing vessel, the loss of 80 jobs and millions of dollars in revenue, for the benefit of foreign fishing interests, is incompatible with the explicit Americanization goals of the Magnuson-Stevens Act and cannot legitimately be part of the FMP.

J. Constitutional Issues

To the extent that the vessel size limitations are targeted at a single vessel for which investments have been made to enter the fishery, and to the extent those limitations would preclude the vessel from any meaningful employment opportunity, there exists a potential Fifth Amendment Constitutional takings claim against the government by that vessel's owners. Where limitations retroactively take out a vessel that was otherwise lawfully in the fishery, these size limitations raise serious due process concerns under the Constitution.

The practical effect of the size limitations on the *Atlantic Star* is to preclude the vessel from operating in the Atlantic mackerel fishery for which the vessel was originally permitted and for which the vessel's conversion was designed. With no sustainable and meaningful employment opportunity, the vessel's worth will be largely destroyed if kept out of the fishery for which it was outfitted. The Fifth Amendment of the U.S. Constitution requires just compensation to be paid for private property that has been taken by governmental action for public use.

A law or regulation that deprives property of all "economically viable use" is a compensable taking as set out in *Lucas v. South Carolina Coastal Comm'n*, 505 U.S. 1003 (1992) (in *Lucas* the challenged regulation, unlike the size limitations here, was designed to "prevent serious public harm"). Moreover, even if the regulation does not deprive the owner of all economically viable use, it may nonetheless constitute a taking under the three-factor test enunciated in *Penn Central Transp Co. v. New York City*, 48 U.S. 124 (1978). The three factors are (1) the economic impact on the claimant, (2) the extent to which the regulation has interfered with distinct investment-backed expectations, and (3) the character of the governmental action.

All three factors point toward a taking under the proposed plan amendment as applied to the only existing mackerel vessel that would be kept out of the fishery. First, the economic impact on the owner of the *Atlantic Star* would be severe. There is no argument that the inability to employ a $40 million vessel would cause a severe hardship on the vessel's owners. Second, there can be little doubt that the owners had distinct, investment-backed expectations – the $40 million was invested in the project solely on the ability to employ the vessel in the herring and mackerel fisheries off the U.S. East coast. Finally, the character of the governmental action here is of the type that supports a takings claim. The application of the Takings Clause to vessels was recently confirmed in *Maritrans v. United States*, 1998 U.S. Claims LEXIS 80.

At the time of the owners' investment in the vessel, there was no limitation whatsoever on this vessel's entry into the mackerel fishery. The *Atlantic Star* received the necessary authorization to enter the fishery and was converted in complete reliance on that eligibility. Adoption of the proposed size limits would now retroactively preclude the vessel from entering the fishery. Such a result raises serious due process concerns under the Constitution. Just recently the U.S. Supreme Court addressed the issue of retroactive application of laws in *Eastern Enterprises v. Apfel*, 118 S. Ct. 2131 (1998). Four justices held that the retroactive allocation of liability to the plaintiff violated the Takings Clause. Justice Kennedy, concurring in the judgment, found that the governing Act violated the Due Process Clause of the Fifth Amendment. Writing for the plurality, Justice Sandra Day O'Connor wrote that legislation may be "unconstitutional if it imposes severe retroactive liability on a limited class of parties that could not have anticipated the liability, and the extent of the liability is substantially disproportionate to the parties' experience."

With respect to the *Atlantic Star*, there is little question that the retroactive imposition of size limitations is "severe" nor can there be any question that the class is limited (a single vessel) or that the liability was unanticipated. Obviously the investment would not have been made had the owners thought that size limitations would be imposed. Justice O'Connor went on to note that "retroactivity is generally disfavored in the law...in accordance with 'fundamental notions of justice' that have been recognized throughout history." *Id.*

Under these circumstances, the imposition of vessel size limitations – targeted at the *Atlantic Star* – raises serious questions as to whether the plan would survive Constitutional scrutiny. Potentially serious Constitutional issues could be addressed simply by including a "savings" or "grandfather" clause to permit the *Atlantic Star* to catch and process mackerel, while prospectively limiting new vessels over the size thresholds. Because the *Atlantic Star* is the only known vessel over the size thresholds that had made investments with the legitimate expectation of entering the fishery, the potential Constitutional infirmities could be solved with the simple addition of a straightforward savings clause.

K. Conclusion

The major purpose behind the Magnuson Stevens Act – rational development of U.S. fisheries for the U.S. fishing fleet – would be directly frustrated by the Mid-Atlantic Council's proposed Amendment 8. In an underutilized fishery, a size limitation that lacks even the rationale of limiting total harvest capacity is at best arbitrary and at worst, discriminatory. The FMP would violate no less than six of the ten National Standards in the interest of excluding a single vessel from the fishery – a vessel whose owners relied in good faith upon the permit process and the purposes of the Magnuson Stevens Act to invest $40 million in the fishery.

Even were the Council and the Secretary of Commerce to determine that there existed some management rationale for such a size limitation, long term practice and tradition mandate grandfathering a vessel already "in the pipeline," certainly one, as in this case, already fitted out and permitted to enter the fishery. It is important to note that in a substantially *underutilized* fishery, the entrance of the *only* vessel kept out of the fishery by the size limitation will not harm existing small fishing communities which are presumably already harvesting the amount of mackerel that is most economically beneficial for them. If existing fishermen could exclude newcomers from an underutilized fishery by arguing that a newcomer might put them out of business, no U.S. fishery could ever be further developed by U.S. vessels.

The proposed size limitations have no management or conservation rationale. They discriminate against fishermen from outside the region and preclude the efficient development of a vastly under-exploited resource. The principles of the Magnuson-Stevens Act are directly contrary to the proposed limit, and consequently the proposed Amendment is vulnerable to legal challenge on a variety of grounds under the Act. Further, the proposed plan would contravene the primary directive of the Administrative Procedures Act. Administrative actions cannot be "arbitrary and capricious" and are required to have some rational nexus to the perceived objectives of the regulatory action. The proposed size limitations fall short under these standards. Finally, the FMP is vulnerable to Constitutional claims for a taking of property without just compensation, as well as related due process and equal protection claims.

L. Suggested Alternatives

Not only are the size limitations unsupported by the best scientific information available in failing to recognize the abundance of the Mackerel stock, the alternatives that it provided itself were too limited. We suggest that the following alternatives be considered by the Council:

(1) No action; the fishery remains an open access fishery

(2) Imposition of a moratorium when domestic landings reach 50% of the ABC.

(3) Create an allocation for at-sea processing when domestic landings reach 50% of the ABC.

(4) Create a cap on the yearly catch for each vessel when the domestic landings reach 50% of ABC.

(5) If a limited entry plan is adopted, the plan should allow vessels having a mackerel permit on the Council adopted control date of September 12, 1997.

APPENDIX 3. PROPOSED REGULATIONS

50 CFR PART 648

Fisheries of the Northeastern United States; Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan

Subpart B--Management Measures for the Atlantic Mackerel, Squid, and Butterfish Fisheries is amended as follows.

§ 648.20 Maximum optimum yield (OYs).

The OYs specified pursuant to Sec. 648.21 during a fishing year may not exceed the following amounts:

(a) Mackerel -- that quantity of mackerel that is less than or equal to the allowable biological catch (ABC) in U.S. waters specified pursuant to Sec. 648.21.

(b) *Loligo*--catch associated with a fishing mortality rate of F_{max}.

(c) *Illex*--catch associated with a fishing mortality rate of F_{msy}.

(d) Butterfish-catch associated with a fishing mortality rate of F_{msy}.

§ 648.21 Procedures for determining initial annual amounts.

(2) *Mackerel.* (i) Mackerel ABC must be calculated from the formula ABC =T - C, where C is the estimated catch of mackerel in Canadian waters for the upcoming fishing year and T is the catch associated with a fishing mortality which is equal to F_{MSY} (F= 0.45) at 890,000 mt SSB (or greater) and decreases linearly to zero at 225,000 mt SSB (1/4 B_{MSY}).

§ 648.4 Vessel Permits

(iv) Atlantic mackerel permit. Any vessel of the United States may obtain a permit to fish for or retain Atlantic mackerel in or from the EEZ. Permitted domestic harvest vessels may not exceed 165 feet in length overall (LOA) and 750 gross registered tons or have shaft horsepower exceeding 3000 hp.

§ 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 Atlantic Mackerel, Squid and Butterfish Fishery Management 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 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 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 (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, any other commercial or recreational management measures, any other management measures currently included in the FMP, set aside quota for scientific research, regional management, and process for in season adjustment to the annual specification.

(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.